

An overview of *Penicillium* (Hyphomycetes) and associated teleomorphs in southern Africa

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ABSTRACT

Literature on the hyphomycete genus *Penicillium* Link and its teleomorphs, *Eupenicillium* Ludwig and *Talaromyces* C.R. Benjamin, is surveyed in the Republic of South Africa, Lesotho, Mozambique, Namibia, Swaziland and Transkei up to 1990. References are grouped under the headings, general mycology, plant pathology, industrial application, medical importance, mycotoxins and chemical work. An alphabetical list of the species recorded in southern Africa as well as the host and/or substrate from which each species has been reported is presented with relevant literature references; specimens in various culture collections are also incorporated. Although most of the known *Penicillium* species have already been reported from southern Africa, in-depth work is still required in all fields of research concerning this genus.

UITTREKSEL

Literatuur aangaande die hifomiseetgenus *Penicillium* Link en sy teleomorwe *Eupenicillium* Ludwig en *Talaromyces* C.R. Benjamin in die Republiek van Suid-Afrika, Lesotho, Mosambiek, Namibië, Swaziland en Transkei is nagegaan tot 1990. Die verwysings word gegroepeer onder die opskrifte mikologie, plantpatologie, industriële toepassing, mediese belang, mikotoksiene en chemiese werk. 'n Alfabetiese lys van die spesies wat in suidelike Afrika aangeteken is, asook die gasheer en/of substraat waarop elke spesie aangemeld is, word met die toepaslike verwysings gegee; eksemplare in verskeie fungusversamelings word ook ingesluit. Alhoewel die meeste van die bekende *Penicillium*-spesies reeds in suidelike Afrika aangeteken is, is diepgaande werk op alle navorsingsgebiede rondom hierdie genus steeds nodig.

INTRODUCTION

'Species of *Penicillium* are so abundant and so conspicuous in all sorts of stale or decaying organic matter that they constitute a part of the common conception of mould, and are loosely referred to as 'blue' or 'green' mould' (Raper & Thom 1949). Representatives of this multi-faceted genus are of ecological importance because they are abundant and widespread in the environment; they are fruit deteriorators and contribute greatly to post-harvest decay; they have industrial applications such as in cheese-making; and they produce secondary metabolites and mycotoxins, including the indispensable antibiotics.

The generic name *Penicillium* (Latin, *penicillus* = little brush) was first introduced in 1809 by Link who very briefly described the genus with three species, namely *P. candidum* Link, *P. expansum* Link and *P. glaucum* Link. The true identity of these fungi has been difficult to determine, but an apple-rotting fungus was linked to *P. expansum* by Thom (1910). Although the validity of the generic name has been questioned over the years, Hawksworth (1985) concluded that *Penicillium* Link should be considered correct and indicated that he had previously designated a neotype of *P. expansum* Link as the type species of the genus.

Succeeding the works of Thom (1910, 1930), the manual by Raper & Thom (1949) has been the standard work on *Penicillium* for nearly 30 years. Subsequently, a new era in *Penicillium* identification was heralded by Pitt (1973), who used the ability of isolates to grow at reduced water

activity, correlated with penicillus types, as well as growth rates at 5°C and 37°C, as differential criteria. This concept was later fully developed in a monograph (Pitt 1979). Shortly afterwards, a well-illustrated atlas of penicillia by Ramirez (1982) was published. However, the value of Pitt's (1979) guide to the taxonomy of *Penicillium* was confirmed at the First international *Penicillium* and *Aspergillus* workshop (Samson & Pitt 1985), when Pitt's species concept and methods were incorporated in the recommendations for future taxonomic practice in this genus.

Previously, the name *Penicillium* was applied to both the hyphomycetous and ascomycetous states. However, separation of the teleomorphic states of *Penicillium* from the anamorph, as implemented by Pitt (1979), is in accordance with Art. 59 of the International Code of Botanical Nomenclature and is of practical value for the taxonomist. Stolk & Scott (1967) re-introduced the use of the teleomorph name *Eupenicillium* Ludwig for a portion of the genus *Penicillium*. Monographic contributions to the genus *Eupenicillium* were made by Scott (1968a, b) and Stolk & Samson (1983). The teleomorphic genus *Talaromyces* C.R. Benjamin is separated from *Eupenicillium* on the basis of ascocarp morphology. The former genus is characterised by the production of gymnothecia composed of loosely intertwined hyphae, as opposed to cleistothecia. Stolk & Samson (1972) as well as Pitt (1979) have contributed to the taxonomy of this group.

A multidisciplinary approach to the identification of *Penicillium* is becoming more prevalent (Bridge *et al.* 1985). Protein electrophoresis (Bent 1967), the API ZYM testing system (Bridge & Hawksworth 1984), pyrolysis gas chromatography (Söderström & Frisvad 1984), physiological and biochemical methods (Bridge 1985), enzyme electrophoresis (Cruickshank & Pitt 1987), studies on

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thermal denaturation of DNA (Paterson *et al.* 1990), electron microscopy (Ramirez 1982; Kozakiewicz 1989) and the production of secondary metabolites and mycotoxins (Frisvad & Filtenborg 1983; Frisvad *et al.* 1990) have recently been used to supplement traditional methods of identification.

Members of this genus identified at the Mycology Unit in recent years were often found to differ somewhat from the descriptions given by Pitt (1979). This raised the question of whether these variations are consistent for all South African isolates. In addition, preliminary investigations indicated that *Penicillium* species are frequently only briefly mentioned in publications or included in lists of fungi from surveys. It was therefore considered advantageous to gather this scattered information in order to compile a list of *Penicillium* species recorded in southern Africa, to bring this information in line with modern taxonomic systems, and to indicate areas requiring further research.

This paper is an overview of publications dealing with all aspects of the *Penicillium* species reported in South Africa, Lesotho, Mozambique, Namibia, Swaziland and Transkei up to 1990. Literature is grouped according to various fields of research and presented in chronological order. The National Collection of Fungi, including the dried collection and the culture collection, collections donated to the Mycology Unit, the collection of the Medical Research Council as well as catalogues of international culture collections, served as additional sources of information. Foreign isolates used for chemical work, have been mentioned but not listed. No attempt has been made to verify published data, the identity of *Penicillium* isolates, or any other information.

OVERVIEW OF LITERATURE

General mycology

The first published record of the genus *Penicillium* in southern Africa appears to be that of *P. digitatum* (Pers. ex Fr.) Sacc. on citrus (Pole Evans 1911). In this publication Pole Evans mentioned that in 1903, the Government Entomologist for Natal reported great losses to the orange crop, due to a mould. He noted that he had collected the causative fungus, *P. digitatum*, from fallen oranges in the Northern Transvaal five years before (i.e. in 1906). Doidge (1950) listed all *Penicillium* species recorded up to 1945, including specimens in the Collection of the Timber Research Laboratories, Chamber of Mines, Johannesburg, as well as those mentioned by Thom (1930).

The *Penicillium* specimen accessioned in the National Collection of Fungi first was '*P. armeniacum* Berk' (PREM 187—see checklist), recorded by the Government Laboratories Johannesburg, on *Zea mays* on 12 September 1906. This fungus was not a *Penicillium*, however, but probably belongs in *Monilia* (Thom 1930).

The second *Penicillium* entry, '*P. gratioti* Sartory' (PREM 5587—see checklist), was recorded by P.A. van der Bijl from the City Deep Mine in Johannesburg, on 7 December 1912. Thom (1930) provided more data about this isolate, recording its optimum temperature and utilization of various sugars. Its true identity is not clear,

however, as the name is no longer in use and Raper & Thom (1949) referred to *P. gratioti* only as: 'apparently some member of the *P. janthinellum* series'.

Numerous penicillia have been reported subsequently in general surveys of fungi on various substrates. Cohen (1950) conducted the first survey of soil fungi in South Africa, comparing the effect of different burning and grazing treatments, and he recorded nine *Penicillium* species. Scott (1968a) described eight new *Eupenicillium* species from soil and included these in a more extensive monograph of the genus (Scott 1968b). *Penicillium* was found to be the genus of Fungi Imperfecti with the largest number of species represented in Zululand soil (Eicker 1969). The same locality yielded *P. olsonii* Bain. & Sartory throughout the soil profile, whereas *P. javanicum* Van Beyma showed a marked decrease with increasing soil depth (Eicker 1970). Eicker (1973) found the penicillia to have an even distribution in different litter layers of *Eucalyptus maculata* Hook. f. and later found the genus to be common on *Panicum coloratum* L. litter (Eicker 1976). *P. cyclopium* Westling was isolated from angora goat dung, but Mitchel (1970) indicated that it was probably an aerial contaminant.

High quality stored maize obtained from six localities, studied by Van der Westhuizen & Bredell (1972) was found to have a high percentage of *Penicillium* spp., with *P. oxalicum* Currie & Thom often comprising 30% of the fungi recorded. On stored lucerne seed, species of this genus did not increase during an increased period of storage (Marasas & Bredell 1973). The composition and distribution of soil fungi in the western Transvaal was studied by Papendorf (1976) and one of his isolates, described as the new species *P. striatosporum* Stolk (Stolk 1969), was later re-identified by Pitt (1979) as *P. restrictum* Gilman & Abbott. *Penicillium* spp. were found to be scarce on leaves and litter of *Cenchrus ciliaris* L. (Bezuidenhout 1977), in aerospora of an *Eragrostis curvula* (Schrad.) Nees pasture (Van der Merwe *et al.* 1979) and in the soil of Kaokoland, Namibia (Eicker *et al.* 1982). Many of the above-mentioned species are included in the checklist and bibliography of South African fungi compiled by Gorter (1979) for the period 1947–1977.

Allsop *et al.* (1987) found a more varied fungal flora present in the rhizosphere than in the non-rhizosphere area of a fynbos site; several *Penicillium* species were reported, including *P. novae-zeelandiae* Van Beyma and *Eupenicillium pinetorum* Stolk, reported in South Africa for the first time. McLean & Berjak (1987) studied the mycoflora of maize and indicated *P. variabile* Sopp as the most frequent internal contaminant of maize seed, while *P. brevicompactum* Dierckx was isolated from 15% of the seedlings. Wittaker *et al.* (1989) reported a decline in *Penicillium* species after hot water treatment of stored maize seed. penicillia were found to be present on *Eucalyptus* (Lundquist & Baxter 1985), *Pinus* in the Transvaal (Lundquist 1986), *Pinus* in the Cape (Lundquist 1987) and common on stored seed of indigenous plants (Isaacs & Benic 1990). *P. crustosum* Thom and *P. purpurescens* (Sopp) Biourge have been indicated as endophytes of grass species (De Villiers 1989). Ramirez (1990) based the description of *P. krugeri* Ramirez on 26 isolates collected from soil at different localities in the Kruger National Park in 1987.

Apparently the type material of this fungus has been lost (C. Ramirez pers. comm.).

Additional reports of South African isolates may be found in the monographs on *Penicillium* by Thom (1930), Raper & Thom (1949), Pitt (1979) and Stolk & Samson (1983), as well as in catalogues of international culture collections.

Plant pathology

During the early 1900's the deteriorators, *P. digitatum*, *P. expansum* Link and *P. italicum* Wehmer, became a major problem for the fruit producing industry by hampering exports to Europe (Pole Evans 1920). Most of the South African isolates mentioned by Thom (1930) had been sent to the USA for identification by V.A. Putterill. Putterill was in charge of a mycological laboratory in Cape Town in 1918, and later worked at the fruit inspection service (Doidge 1950). These first South African *Penicillium* records probably concerned fruit rot, although they are listed as having an undetermined host.

P. digitatum on citrus was reported by Pole Evans (1911) who stressed the importance of good sanitation in orchards to combat this fungus. To determine the presence of pathogenic fungal spores at the Cape harbour, Pole Evans (1920) exposed agar plates in the railway trucks and in cold storage rooms on the docks and on the ships.

These pathogens were later listed by Verwoerd (1929). Doidge & Van der Plank (1936) subsequently conducted a survey on the fungi causing rot of oranges and lemons, indicating *P. digitatum* as the most important, with *P. italicum* and *P. verrucosum* Dierckx also present. They (Doidge & Van der Plank 1936) remarked that although a large number of additional *Penicillium* spp. were isolated during the survey, no attempt was made to identify these species which were apparently saprophytic and growing on decaying tissues. Van der Plank (1945) did experimental work with hypochlorous acid as a bleach and disinfectant of citrus fruit, finding it effective against *P. digitatum* conidia. Martin (1960) listed seven saprophytic *Penicillium* species in citrus soil and found five species in adjacent virgin soil. Other *Penicillium* species of plant pathological interest were mentioned by Doidge *et al.* (1953), Roth (1967), Wager (1972) and Gorter (1977). The bulb pathogen *P. corymbiferum* Westling, isolated by Wager, was deposited in the IMI culture collection where it was examined by Pitt (1979).

Matthee (1968) studied *P. expansum*, the pathogen and deteriorator of stored pome fruits, and indicated that older or bruised fruit was more susceptible. Holtzhausen & Knox-Davies (1974) used this fungus as an experimental organism in chemical seed treatments. Combrink *et al.* (1980) found that a longer exposure time of apples to a sodium hypochlorite solution had a better fungicidal effect on *P. expansum* conidia than a stronger solution. *P. funiculosum* Thom reportedly caused a core rot of apples and formed a moist infection (Combrink *et al.* 1985). Members of the genus were also isolated from litchi fruit (Roth 1963), bananas (Roth & Loest 1965) and mangoes (Wehner *et al.* 1981). *P. pinophilum* Hedgcock apparently enhances disease symptoms of groundnut pods in the presence of *Chalara elegans* Nag Raj & Kendrick (Baard

1988). This fungus was able to decompose filter paper as well as detached groundnut pods. Surface disinfected roots of *Medicago* spp. yielded eight different *Penicillium* spp. (Lamprecht *et al.* 1988). *P. spinulosum* Thom was found to be pathogenic on onions (Naudé & Jooste 1989) and *P. hirsutum* Dierckx on bulbs of flowering plants (Schutte 1990).

Unidentified members of the genus were reported on Japanese radish seed (Holtzhausen 1978), groundnuts (Ferreira & Lutchman 1989), recalcitrant seed (Berjak *et al.* 1989; Mycock & Berjak 1990), barley seed (Lübben *et al.* 1989) and maize cultivars (Rheeder *et al.* 1990).

Industrial applications

Penicillia encountered in industry were first reported by Van der Bijl (1920) in his study of the deterioration of cane sugar crystals and solutions in storage. This record is also of taxonomic interest as two of these *Penicillium* isolates had been sent to Thom, whose comments accompanying the identifications are included. One of these isolates was deposited in PREM: 14262 *P. luteum-purpurogenum* group.

Davel & Neethling (1930) dealt with fungi in dairies and mentioned the use of *P. camembertii* Thom, *P. glaucum* and *P. roquefortii* Thom in cheese factories, indicating that members of this group can be troublesome in these surroundings. Coles (1925) recorded *P. glaucum* on Stilton and Wenslydale cheese and Radmore (1986) did a microbiological study of air in dairies. Other work done on penicillia in the dairy industry is discussed under the heading 'Mycotoxins'.

An interesting use for *Penicillium* was found in reducing the stickiness of molasses meal (Roth 1968), for which *P. notatum* Westling was used on a commercial scale. Although photographs of eight different *Penicillium* spp. are included, only the series to which they belong are given. The wine industry noted various identified and unidentified *Penicillium* spp. on grapes (Le Roux *et al.* 1973), their incidence on healthy grapes being 60% and on *Botrytis* infected fruit 70%.

Heat resistant fungi posing problems for apple juice canners, turned out to be teleomorphs of *P. vermiculatum* Dangeard and *P. brefeldianum* Dodge (Van der Spuy *et al.* 1975). This work is referred to world-wide in connection with heat resistance of fungal spores. The thermophilic *Talaromyces dupontii* Griffen & Maublanc, was isolated during a study of fungi in mushroom compost (Eicker 1977). *Penicillium* species encountered later when various casings for mushroom production were tested, were indicated as potentially harmful (Smit 1984). Martin & Keen (1978) found *P. crustosum* to be common in home-made beer as well as on sorghum malt used for brewing. A low incidence of *Penicillium* spp. on commercial and industrial sorghum malt was reported by Rabie & Lübben (1984).

Medical importance

Although members of the genus are known to cause allergies and to produce mycotoxins, *Penicillium* is mentioned infrequently in literature on medical mycology.

Fungal allergy was the motivation for three five-year surveys of aerospora, two done in Johannesburg (Ordman & Etter 1956; Ordman 1963) and one in Windhoek (Ordman 1970). *Penicillium* made up about 10% of the fungi isolated and showed no seasonal prevalence. Fungal contamination of food was investigated by Gilman (1972), in an attempt to correlate diet and liver cancer in man and a variety of identified penicillia were listed. Antimycotic and antibacterial activity of soil fungi was studied by Eicker (1975) who found positive effects against both organisms, by *P. chrysogenum* and *P. cyclopium*. Horwitz & Wehner (1977) warned that the presence of antibiotics produced by *P. chrysogenum* Thom used in salami curing may pose a health hazard for persons sensitive to penicillin. *Penicillium* was also amongst the fungi present on corn believed to be the cause of oesophageal cancer in Transkei and in the high rate area of the disease, 43% of the samples were infected with this organism (Marasas *et al.* 1981). Marasas & Van Rensburg (1986) found this genus most prevalent on crops in the area where Mseleni joint disease occurs in Kwazulu. Some of the work mentioned under the heading 'Mycotoxins' also has a medical application.

Mycotoxins

The discovery in the 1960's of aflatoxin and its carcinogenic effects created renewed interest in fungal contamination. In the search for members of the aflatoxin-producing *Aspergillus flavus* group, numerous species of the closely related genus *Penicillium* were also encountered and details of their distribution recorded. Scott (1965), the first South African to test fungi for toxicity by feeding day old ducklings with infected meal, found *P. islandicum* Sopp, *P. oxalicum*, *P. rubrum* Stoll and *P. urticae* to be acutely toxic, whereas *P. piceum* Raper & Fennell had a less severe effect. This paper subsequently became a citation classic. The fungal flora of stock feeds, and the incidence of toxicity, was investigated by Van Warmelo (1967), who found that *Penicillium* had a low incidence on these substrates. Wehner & Rabie (1970) did toxicity tests with micro-organisms from nuts and dried fruit, including *P. frequentans* Westling, *P. notatum* and three unidentified *Penicillium* spp., none of which turned out to be toxic.

Martin (1974) compiled a table of all information available on mycotoxin-producing fungi, dividing them into field and storage fungi. Mutagenicity of *Penicillium* mycotoxins to *Salmonella typhimurium* was studied by Wehner *et al.* (1978) and negative results were reported for griseofulvin, patulin and penicillic acid. In a similar study, the mycotoxin emodin, produced by *P. rugulosum* Thom, was found to be a frameshift mutagen (Wehner *et al.* 1979). As no local isolates were mentioned in the above-mentioned work, the species concerned have not been included in the appended list.

The presence of mycotoxin-producing fungi on cheese was investigated by Lück *et al.* (1976) and unidentified *Penicillium* spp. were isolated from 33 out of 43 cheese samples. Some of the isolates tested had a toxic effect on ducklings. Seven isolates of *P. roquefortii*, isolated from blue cheese showed a variation in toxicity, whereas the four isolates of *P. camembertii* tested had a less pronounced effect (Lück *et al.* 1978). A noteworthy finding of Lück & Wehner (1979) was that *Penicillium* isolates grown on maize were more toxic to ducklings than those grown on

milk curd. Kriek & Wehner (1981) proved the toxicity of *P. italicum*, isolated from an orange, to laboratory animals. The effect of maize meal infected with this fungus was not as detrimental to ducklings as to rats. The nature of the lesions observed in rats was similar to those caused by the toxic *P. islandicum*. Dutton & Westlake (1985) found the incidence of *Penicillium* spp. as well as contamination by its mycotoxins to be low on cereal and animal feedstuffs. Kellerman *et al.* (1988) implicated *Penicillium* as a mycotoxin producer but gave no examples. The Medical Research Council tested various isolates of 30 *Penicillium* spp. for toxicity to ducklings and found most to have a detrimental effect (C.J. Rabie pers. comm.). All isolates were identified by J.I. Pitt and are listed under the abbreviation MRC. These authors all studied the relationship between fungi and mycotoxins, but the mycotoxins themselves called for more detailed chemical studies.

Chemical work

A variety of *Penicillium* mycotoxins have been extracted and characterized in South Africa. Steyn (1969) described a new, rapid and sensitive system for the separation and detection of eleven different mycotoxins, followed by work on secalonic acid D, a toxic metabolite of *P. oxalicum* (Steyn 1970). The isolation of viridicatum toxin from *P. viridicatum* Westling was reported by Hutchison *et al.* (1973). Nagel *et al.* (1972) reported on the production of the highly toxic citreoviridin and made a study of the morphological characteristics of various isolates of its producer, *P. pulvillorum* Turfitt. Steyn *et al.* (1982) studied the biosynthesis of the above-mentioned citreoviridin.

Holzappel (1968), Steyn *et al.* (1975), McGrath *et al.* (1976) and Neethling & McGrath (1977) studied various aspects of cyclopiazonic acid (e.g. biosynthesis, structure and production), a toxic metabolite of *P. cyclopium*. However, Frisvad (1989) stated that the isolate used for all the above-mentioned cyclopiazonic acid work, namely CSIR 1085, was not *P. cyclopium* but *P. griseofulvum* Dierckx. Pitt came to the same conclusion as indicated by De Jesus *et al.* (1981). Frisvad (1989) stated that *P. viridicatum* (CSIR 1029) used by Hutchison *et al.* (1973) had also been misidentified.

Various mycotoxins other than the above-mentioned were studied locally. Oxalin produced by *P. oxalicum* received attention from Nagel *et al.* (1976), Vleggaar & Wessels (1980) and Steyn & Vleggaar (1983), while PR toxin produced by *P. roquefortii* was studied by Gorst-Allman & Steyn (1982). Certain isolates of *P. crustosum* are able to produce tremorgenic mycotoxins and these were examined in detail by Maes *et al.* (1982) and De Jesus *et al.* (1983a, b, c). *P. janthinellum* Biourge, associated with rye grass staggers was found to produce janthitrems, tremorgenic mycotoxins studied by De Jesus *et al.* (1984). For most of these investigations the authors obtained authenticated isolates or had their fungal cultures verified, mostly by Pitt.

In 1985, South Africa hosted the IUPAC Symposium on mycotoxins and phycotoxins (Steyn & Vleggaar 1986) where a paper concerning synthesis of the *Penicillium* mycotoxins cyclopiazonic acid and viridamine was presented by Holzappel (1986).

DISCUSSION

The large number of undetermined *Penicillium* species in the literature cited is an indication that scientists in South Africa have a history of not attempting to identify members of this genus. Other than that done by Scott (1968a, b), work published on *Penicillium* in South Africa is clearly fragmentary and many of the isolates obtained early this century were identified overseas. The use of correctly identified *Penicillium* isolates in any scientific research must be stressed. Mistaken identities have been reported for South African studies (Frisvad 1989); voucher specimens deposited in recognized culture collections will assist in overcoming this problem and will also make isolates available to other scientists.

With the exception of *P. hordei* Stolk, *P. olivicolor* Pitt and *Talaromyces stipitatus* (Thom) C. R. Benjamin, all the *Penicillium* species listed by Samson & Pitt (1985) as common, have been recorded in southern Africa. However, teleomorphic penicillia have been reported infrequently as they require special isolation techniques (Scott 1968b). Synnematos members of the genus appear to be scarce and most representatives in the National Collection of Fungi, PREM and PPRI are recent acquisitions.

The role that penicillia play in the ecology of natural ecosystems as well as in cultivated areas, has not been investigated in this country. Certain *Penicillium* species have antimycotic as well as antibacterial activities (Eicker 1975). Others are strongly antagonistic to soil-borne plant pathogens such as *Gaeumannomyces*, *Pythium* and *Rhizoctonia*, whereas some members of *Talaromyces* have antifungal as well as antiprotozoal capacities (Domsch *et al.* 1980). Biological control of plant pathogens by *Penicillium* species deserves attention, as it may well be of economic importance.

The successful use in *Penicillium* taxonomy of physiological and various biochemical methods, mycotoxin profiles and electron microscopy, has been indicated. However, these techniques have not yet been applied to this genus in South Africa and may be of value in determining relationships between species and groups as well as indicating new species.

Much meaningful work on *Penicillium*, one of the more common and economically important genera of fungi, is therefore still to be done in the fields of taxonomy, ecology, biological control and chemotaxonomy.

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CHECKLIST OF *PENICILLIUM*, *EUPENICILLIUM* AND *TALAROMYCES* SPECIES RECORDED IN SOUTHERN AFRICA

Penicillium species recorded in southern Africa up to 1990 are arranged alphabetically and the host and/or substrate from which each species has been recorded is given with the relevant literature reference. Species names are listed as cited in the original publication in roman type, with a cross reference to the epithet currently accepted by Pitt (1979) in bold, except in the case of *Eupenicillium*, where the revision proposed by Stolk & Samson (1983) has been followed, or where older epithets have been traced (Seifert & Samson 1985). In the past, ascospore fungi were included in the genus *Penicillium*, posing nomenclatural problems (≠) in designating the anamorph-teleomorph relationship. Consequently, species known to produce a teleomorphic state have been listed under *Penicillium* with a cross reference to either *Eupenicillium* or *Talaromyces*, which are listed separately.

The following abbreviations are used in the list:

CBS, South African isolates listed in the 1990 List of Cultures of the Centraalbureau voor Schimmelcultures, Baarn, The Netherlands.
 IMI, cultures in the 1988 Catalogue of the Culture Collection of CAB International Mycological Institute, Kew, United Kingdom.
 MRC, isolates in the Culture Collection of the Medical Research Council, all identified by Pitt (C.J. Rabie pers. comm.).
 PPRI, isolates in the Culture Collection of the National Collection of Fungi. Several of these have been identified or verified by Pitt.
 PREM, isolates deposited in the National Collection of Fungi as dried material.

The National Collection of Fungi recently acquired three additional fungal culture collections. Most of these cultures were no longer viable and had scant accompanying data, but local isolates are listed with numbers under their appropriate abbreviations:

CSIR, isolates listed in a collection obtained from the Council for Scientific and Industrial Research, which included some isolates of Scott (1968a, b).
 MCP, the collection of Papendorf (1976), received from the University of Potchefstroom for C.H.E. These isolates are listed under the substrate soil, but some isolates could have been isolated from *Acacia karroo* litter.

UCT, a collection obtained from the University of Cape Town which contained isolates of Allsopp *et al.* (1987).

GENUS *PENICILLIUM*

acidiferum (see ***P. canescens***)

aculeatum Raper & Fennell
 cereal and legume products: Scott (1965)
 soil: CSIR 348

adametzii Zaleski
Allium cepa: PREM 44729
 soil: Papendorf (1976); Allsopp *et al.* (1987); MCP 35, 221, 222, 1159
 ventilation tubing: Doidge (1950)
Zea mays: Van der Westhuizen & Bredell (1972)

adametzioides Abe ex G. Smith
Zea mays: McLean & Berjak (1987); PREM 47619

alutaceum (see ***E. terrenum***)

arenicola Chalabuda
 mushroom casing: Smit (1984)

asperum (see ***E. crustaceum***)

atramentosum Thom
 chicken feathers and droppings: PPRI 4086; PREM 48602
 dung: PPRI 3703, 4049; PREM 49878, 50682

atrovenetum (see ***P. melinii***)

armeniicum Berk (*Monilia*, Thom 1930)
Zea mays: PREM 187

aurantiobrunneum (see ***P. glabrum***)

aurantiocandidum (see ***P. aurantiogriseum***)

aurantiogriseum Dierckx
Arachis hypogaea: MRC 330
Aristea major: PPRI 4302
 cheese: PREM 49040, 49042
Hordeum vulgare: MRC 2670
Panicum miliaceum: MRC 245
Vigna subterranea: MRC 284
Zea mays: McLean & Berjak (1987); PREM 47622
 = *aurantiocandidum* Dierckx

soil: Eicker (1969, 1973)
 = *cyclopium* Westling
Allium cepa: PREM 44737
Arachis hypogaea: Gilman (1972)
 cereal and legume products: Scott (1965)
 cheese: Lück & Wehner (1979)
 dung: Mitchell (1970)
 natural gum: Roth (1968)
 soil: Eicker (1975); CSIR 409; MCP 378
Sorghum caffrorum: CSIR 519, 534, 542, 543
Vitis vinifera: Doidge (1950, *et al.* 1953)
Zea mays: Van der Westhuizen & Bredell (1972) CSIR 258, 303, 358, 403, 461, 462, 543, 659, 719; PREM 43751, 44302, 44303
 = *johannioli* Zaleski
 undetermined host: Thom (1930)
 = *lanosocoeruleum* Thom
Medicago spp.: Van Warmelo (1967)
Vitis spp.: Le Roux *et al.* (1973)
 = *martensii* Biourge
Arachis hypogaea: Gilman (1972)
Zea mays: Gilman (1972); Van der Westhuizen & Bredell (1972); CSIR 660
 = *solitum* Westling
 material: Doidge (1950)

biforme (see ***P. camembertii***)

brefeldianum (see ***E. javanicum*** var. ***javanicum***)

brevicompactum Dierckx
 aerospora: Roth (1968)
 apple puree: MRC 3137
Avena sativa: MRC 2824
 brattice cloth: Doidge (1950)
 cereal and legume products: Scott (1965)
 compost: PPRI 3186
 debris: PPRI 4068
 fodder: PPRI 3631
Medicago sativa: PREM 44475, 44477, 44519
 natural gum: Roth (1968)
Prunus persica var. *nucipersica*: PPRI 3597
 soil: Eicker (1975); CSIR 327; MCP 371

- Sorghum caffrorum*: CSIR 531, 547
Vitis spp.: Le Roux *et al.* (1973)
Zea mays: McLean & Berjak (1987); Pitt (1979); Van der Westhuizen & Bredell (1972); CSIR 81, 95, 219, 330, 378, 459, 593, 623, 665, 675; PPRI 3630; PREM 43741, 43742, 47537, 47831
 undetermined host: CBS 287.53 (albino mutant)
 = *stoloniferum* Thom
 soil: Cohen (1950)
Zea mays: Van der Westhuizen & Bredell (1972); CSIR 238
- camembertii** Thom
 cheese: Davel & Neethling (1930); Lück *et al.* (1978); PPRI 3122; PREM 47740
 = *biforme* Thom
Arachis hypogaea: Van Warmelo (1967)
Medicago spp.: Van Warmelo (1967)
- canescens** Sopp
Barleria obtusa: PPRI 3808
 flannel: PREM 33287
Protea cynaroides: PPRI 3786
 soil: Papendorf (1976)
Zea mays: Van der Westhuizen & Bredell (1972)
 = *acidiferum* Sopp (near *P. canescens*, Raper & Thom 1949)
Citrus sinensis: Doidge (1950)
 = *kapuscinskii* Zaleski
 soil: MCP 384
 swine meal: Van Warmelo (1967)
- capsulatum** Raper & Fennell
 dried fish: Pitt (1979); IMI 140 284
Medicago sativa: PREM 44469
Zea mays: CSIR 181
- casei** (see *P. roquefortii*)
- charlesii** (see *P. fellutanum*)
- chermesinum** Biourge
 soil: Martin (1960)
- chrysogenum** Thom
 aerospora: Roth (1968)
Arachis hypogaea: Van Warmelo (1967); PPRI 3658; PREM 48261
 cereal and legume products: Scott (1965)
 fishmoth gut: PREM 49016, 49017
 grass: PPRI 4277
Hordeum vulgare: MRC 2807
Medicago spp.: Lamprecht (1988); PREM 48321
 molasses meal: Roth (1968)
 mushroom casing: Smit (1984)
 natural gum: Roth (1968)
 nuts and dried fruit: Wehner & Rabie (1970)
 soil: Eicker (1975); Martin (1960); PREM 48767
Sorghum caffrorum: CSIR 427; MRC 1682
Zea mays: Gilman (1972); McLean & Berjak (1987); Van der Westhuizen & Bredell (1972); Van Warmelo (1967); CSIR 436, 453, 477
 = *notatum* Westling
 aerospora: Roth (1968)
Allium cepa: PREM 44738
Cenchrus ciliaris: Bezuidenhout (1977)
 cereal and legume products: Scott (1965)
Medicago sativa: PREM 44466, 44552
 molasses meal: Roth (1968)
 natural gum: Roth (1968)
 nuts and dried fruit: Wehner & Rabie (1970)
 soil: CSIR 317, 318
Sorghum caffrorum: CSIR 285, 286
Vitis spp. Le Roux *et al.* (1973)
Zea mays: Van der Westhuizen & Bredell (1972); CSIR 265, 302, 328, 428, 434, 644
 undetermined host: Doidge (1950)
- citreonigrum** Dierckx
 mushroom casing: Smit (1984)
 = *citreoiviride* Biourge
Zea mays: Van der Westhuizen & Bredell (1972); CBS 239.65; CSIR 138, 505, 568, 590
- citreoiviride** (see *P. citreonigrum*)
- citrinum** Thom
 aerospora: Roth (1968)
- Allium cepa*: PREM 44777
Arachis hypogaea: Gilman (1972); MRC 241, 263, 283, 294, 2109
Avicennia spp.: PREM 47616, 47617
 cereal and legume products: Scott (1965)
 dried leaves: MRC 320, 333, 334
 fruit: Doidge (1950); Thom (1930)
Ipomoea batatas: PPRI 3571
Manihot esculenta: MRC 212, 232, 249
Medicago spp.: Lamprecht (1988); PREM 48312
 natural gum: Roth (1968)
Phaseolus spp.: MRC 178, 210, 222, 304, 313
 soil: Allsopp *et al.* (1987); Cohen (1950); Eicker (1969, 1970); Papendorf (1976); CSIR 370, 372, 373, 374
Sorghum caffrorum: MRC 2332
Vigna subterranea: MRC 224, 280
Zea mays: Gilman (1972); McLean & Berjak (1987); Van der Westhuizen & Bredell (1972); CSIR 152, 352, 393, 394, 549, 661, 708; MRC 257, 258, 262, 266, 293, 294, 307, 437, 444; PREM 44304, 44305, 47620, 47621
 = *steckii* Zaleski
Arachis hypogaea: Van Warmelo (1967)
 cereal and legume products: Scott (1965)
 soil: Eicker (1969, 1970); CSIR 346, 381, 382, 384, 385, 387
Zea mays: Van der Westhuizen & Bredell (1972); Van Warmelo (1967); CSIR 341, 383, 426, 444, 454, 595, 670; PREM 43752
- claviforme (see *P. vulpinum*)
- commune (see *P. puberulum*)
- concentricum (see *P. coprophilum*)
- coprophilum** (Berk. & Curt.) Seifert & Samson
 cubed dogfood: PPRI 3700
 debris: PPRI 3725, 3902, 3903; PREM 49881
 dung: PPRI 3726, 4107, 4128; PREM 49863, 50683, 50714
 grass roots: PREM 47700
Zea mays: CBS 473.75
 soil: PPRI 3611, 4280; PREM 47700, 47701
 = *concentricum* Samson, Stolk & Hadlock
Zea mays: Seifert & Samson (1985)
- coralligerum (see *P. herquelii*)
- corylophilum** Dierckx
 aerospora: Doidge (1950); Thom (1930)
Asparagus virgatus: PPRI 3785
 contaminant: PREM 48560
 lime juice: PPRI 4303
Medicago spp.: Lamprecht (1988); PREM 48316
 soil: PPRI 4304
Zea mays: PREM 44307
- corymbiferum (see *P. hirsutum*)
- crustosum** Thom
Arachis hypogaea: PREM 48018
 cheese: PPRI 3892
 dried fish: MRC 316
 fishmoth gut: PREM 49015
Manihot esculenta: MRC 247
 meat pie: MRC 1271
Oryza sativa: MRC 285
Phaseolus spp.: MRC 228
Prunus armeniaca: MRC 3015
Prunus persica: PPRI 3587
 soil: Eicker (1975)
Sorghum caffrorum: Martin & Keen (1978)
Stipagrostis uniplumis: De Villiers (1989); PPRI 3457
Zea mays: Gilman (1972); Van der Westhuizen & Bredell (1972); PREM 47864
- cyclopium (see *P. aurantiogriseum*)
- dangeardii (see *T. flavus*)
- decumbens** Thom
Dalbergia obovata: PPRI 3721; PREM 49888
 mushroom casing: Smit (1984)
 soil: Martin (1960)
Zea mays: Van der Westhuizen & Bredell (1972); CSIR 2
 undetermined host: Thom (1930)
- dendriticum** Pitt
 contaminant: PPRI 4002; PREM 48605

- debris: PPRI 3782
 fodder: PPRI 3887, 4225
Protea scolopendriifolia: PPRI 4014; PREM 47704
Watsonia marginata: PPRI 3724
- digitatum** (Pers. ex Fr.) Sacc.
 aerospora: Pole Evans (1920)
Carica papaya: Doidge (1950, *et al.* 1953)
Citrus aurantium: Doidge *et al.* (1953)
 citrus fruit: Pole Evans (1911); Roth (1967)
Citrus limonia: Doidge (1950, *et al.* 1953); CSIR 562, 563; PPRI 3740
Citrus nobilis var. *deliciosa*: Doidge (1950, *et al.* 1953)
Citrus paradisi: PPRI 3319; PREM 48908
Citrus sinensis: Doidge (1950, *et al.* 1953); Doidge & Van der Plank (1936); Van der Plank (1945); Verwoerd (1929); CSIR 558, 561; PPRI 3737
 soil: Eicker (1969, 1973)
 = *digitatum* Sacc. var. *californicum* Thom
Physalis peruviana: Doidge *et al.* (1953)
Citrus sinensis: Doidge (1950); Doidge & Van der Plank (1936); PREM 30659
- digitatum var. *californicum* (see **P. digitatum**)
- divaricatum** Thom (*Scopulariopsis*, Raper & Thom 1949)
 sugar: Van der Bijl (1920)
- diversum** Raper & Fennell
Eucalyptus cloeziana: PPRI 3731; PREM 49865
Medicago sativa: PREM 44517
- duclauxii** Delacr.
 aerospora: Roth (1968)
Asparagus officinalis: PPRI 4083
 grass roots: PPRI 3130; PREM 47754
 mine timber: Doidge (1950); Pitt (1979); Raper & Thom (1949); IMI 200 309
 molasses meal: Roth (1968)
 natural gum: Roth (1968)
 soil: PPRI 3983, 4305; PREM 48938
- dupontii (see **T. thermophilus**)
- echinulatum** Raper & Thom ex Fassatiová
 granadilla juice: PPRI 3585
- elongatum (see **P. expansum**)
- erubescens (see **E. terrenum**)
- expansum** Link
 aerospora: Pole Evans (1920)
Arachis hypogaea: Pitt (1979); MRC 199; PREM 48381
 cereal and legume products: Scott (1965)
 granadilla juice: PPRI 3584; PREM 49415
Malus sylvestris: Combrink *et al.* (1980); Doidge (1950, *et al.* 1953); PPRI 4215
 molasses meal: Roth (1968)
 natural gum: Roth (1968)
 pome fruit: Matthee (1968)
Psidium guajava: PREM 48383
Strelitzia reginae: PPRI 4278
 soil: CSIR 398, 410; PPRI 4279
Vigna subterranea: MRC 174
Vitis vinifera: Doidge (1950, *et al.* 1953); Le Roux *et al.* (1973); MRC 1131
Zea mays: Van der Westhuizen & Bredell (1972); CSIR 15, 71, 226, 326, 404, 443, 483, 527, 659, 717; MRC 177; PREM 47512
 undetermined host: Holtzhausen & Knox-Davies (1974)
 = *elongatum* Dierckx
Vitis vinifera: Doidge (1950, *et al.* 1953)
- fellutanum** Biourge
 face cream: PPRI 4306
Protea spp.: PPRI 3980
 soil: MCP 390, 391
Zea mays: Pitt (1979); CBS 268.65; IMI 162 083, 162 114; CSIR 284
 = *charlesii* G. Smith
 cereal and legume products: Scott (1965)
 soil: Papendorf (1976); MCP 48, 117
Zea mays: Gilman (1972); Van der Westhuizen & Bredell (1972); CSIR 284, 389, 401, 476
- flavidorsum (see **P. glabrum**)
- frequentans (see **P. glabrum**)
- funiculosum** Thom
Ananas comosus: Doidge (1950, *et al.* 1953); PPRI 4307
Arachis hypogaea: Baard (1988); Gilman (1972); Pitt (1979); PPRI 3634; PREM 48015
 cereal and legume products: Scott (1965)
Cyperaceae spp.: PPRI 3632; PREM 48604
Eucalyptus maculata: Eicker (1973)
Malus sylvestris: Combrink *et al.* (1985)
Medicago sativa: PREM 44513
Phaseolus spp.: MRC 281
 soil: Allsopp *et al.* (1987); Doidge (1950); Eicker (1969, 1973) Martin (1960); Papendorf (1976); CSIR 141, 362, 365, 367, 368, 369; MCP 189, 336; PPRI 3504; UCT
Zea mays: Gilman (1972); McLean & Berjak (1987); Van der Westhuizen & Bredell (1972); CSIR 23, 82, 83, 92, 93, 221, 242, 300, 613; PPRI 3633; PREM 43754, 43755, 43756, 43757, 47637
 undetermined host: Thom (1930); Raper & Thom (1949)
 = *varians* G. Smith
Zea mays: Van Warmelo (1967)
- fuscum** (Sopp) Biourge (application uncertain, Pitt 1979)
Medicago sativa: PREM 44401
- glabrum** (Wehmer) Westling
 dung: PPRI 4308
Medicago sativa: PREM 44535, 44550
Melianthus comosus: PPRI 3807
 soil: Allsopp *et al.* (1987)
 wine bottle cork: PPRI 3637; PREM 48406
 = *aurantiobrunneum* Dierckx
 soil: Cohen (1950)
 = *flavidorsum* Biourge
 soil: Cohen (1950)
 = *frequentans* Westling
Allium cepa: PREM 44767
Arachis hypogaea: Gilman (1972)
 cereal and legume products: Scott (1965)
 nuts and dried fruit: Wehner & Rabie (1970)
 soil: Papendorf (1976); MCP 122, 185, 190
Sorghum caffrorum: CSIR 546
Zea mays: Gilman (1972); Van der Westhuizen & Bredell (1972); Van Warmelo (1967); PREM 44300
- gladioli (see **E. crustaceum**)
- glandicola** (Oud.) Seifert & Samson
 debris: PPRI 3705; PREM 49879
 fodder: PREM 48588
 grass roots: PPRI 3123
 = *granulatum* Bain.
 aerospora: Roth (1968)
 molasses meal: Roth (1968)
Triticum aestivum: MRC 1135
Zea mays: Van der Westhuizen & Bredell (1972); PREM 43750
- glaucum** Link (nomen confusum, Pitt 1979)
 cheese: Coles (1925); Davel & Neethling (1930)
Corylus avellana: PREM 23651
 nuts: Doidge (1950)
- granulatum (see **P. glandicola**)
- gratioti** Sartory (indeterminate, Pitt 1979)
 underground, gold mine: Doidge (1950); PREM 5587
- griseofulvum** Dierckx
 birdseed: PPRI 3701
 cereal and legume products: Scott (1965)
 cubed dogfood: PPRI 3306, 3679
Dalbergia obovata: PPRI 3702; PREM 49887
 fishmoth gut: PPRI 3123
Manihot esculenta: Pitt (1979); MRC 270, 273
Medicago spp.: Lamprecht (1988); PREM 48317, 48318
 silage: CBS 315.63
 soil: De Jesus *et al.* (1981); Cohen (1950); PPRI 4281
Vigna subterranea: MRC 312
Watsonia marginata: PPRI 3809
Zea mays: MRC 214
 = *urticae* Bain.
 cereal and legume products: Scott (1965)
 soil: CSIR 391

- Zea mays*: PREM 44308
- griseoroseum** Dierckx
= *roseocitreum* Biourge
aerospora: Doidge (1950); Thom (1930)
- herquei** Bain & Sartory
cereal and legume products: Scott (1965)
debris: PPRI 3904
soil: Eicker (1975); CSIR 359, 360, 361, 363; PPRI 4218; PREM 48559
Zea mays: Gilman (1972); Van der Westhuizen & Bredell (1972); Van Warmelo (1967); CSIR 364, 402, 474, 538, 731
= *coralligerum* Nicot & Pionnat
soil: CSIR 1072
- hirayamae** (see *E. euglaucum*)
- hirsutum** Dierckx
Allium sativum: PPRI 3792; PREM 47862
Asparagus officinalis: PPRI 4219
Ornithogalum spp.: Pitt (1979); Schutte (1990); CBS 502.75; PPRI 3795
Gladiolus spp.: PPRI 3598, 3600, 3601, 3602; PREM 49414
= *corymbiferum* Westling
Ornithogalum spp.: Wager (1972); IMI 068 414
- humuli** Van Beyma
soil: Eicker (1969, 1973)
Eucalyptus maculata: Eicker (1973)
- implicatum** Biourge
Allium cepa: PREM 44779
Arachis hypogaea: Van Warmelo (1967)
cereal and legume products: Scott (1965)
Zea mays: Van der Westhuizen & Bredell (1972); CSIR 139, 355, 506
- inflatum** Stolk & Malla
soil: PPRI 3206; PREM 49071
- intricatum** (see *P. jensenii*)
- inusitatum** (see *E. inusitatum*)
- islandicum** Sopp
Arachis hypogaea: Gilman (1972)
cereal and legume products: Scott (1965)
contaminant: PPRI 3124, 3714; PREM 47753, 49869
Sorghum caffrorum: Rabie & Lübben (1984)
Zea mays: Gilman (1972); Van der Westhuizen & Bredell (1972)
undetermined host: Raper & Thom (1949); Thom (1930); CBS 176.68
- italicum** Wehmer
aerospora: Pole Evans (1920)
Citrus sinensis: Doidge *et al.* (1953); Doidge & Van der Plank (1936); Verwoerd (1929)
Citrus limonia: Doidge (1950, *et al.* 1953)
Citrus maxima: Doidge (1950, *et al.* 1953)
Citrus nobilis var. *deliciosa*: Doidge (1950); PPRI 3723; PREM 48607
Citrus sinensis: Doidge (1950); Kriek & Wehner (1981); IMI 78 681; PPRI 4309; PREM 48606
fodder: PREM 48386, 48389
mushroom casing: Smit (1984)
Prunus persica: Doidge (1950)
Prunus salicina: Doidge (1950)
- janczewskii** Zaleski
Barleria obtusa: PREM 49890
contaminant: PREM 47702
Encephalartos laevifolius: PPRI 3179
Medicago spp.: Lamprecht (1988); PREM 48320
Pinus elliottii: PREM 48907
soil: Allsopp *et al.* (1987); Eicker (1969); PPRI 3586
undetermined host: CBS 384.67
= *nigricans* Bain.
cereal and legume products: Scott (1965)
Medicago sativa: PREM 44523
soil: Martin (1960); CSIR 325
Sorghum caffrorum: MRC 1552
Zea mays: Van der Westhuizen & Bredell (1972); Van Warmelo (1967)
- janthinellum** Biourge
Arachis hypogaea: PREM 48262
brattice cloth: Doidge (1950)
cereal and legume products: Scott (1965)
Medicago spp.: Lamprecht (1988); PREM 48319
- soil: CSIR 319, 320, 321, 322, 340, 342; MCP 365; PREM 48013, 48014, 48905
Zea mays: McLean & Berjak (1987); Van der Westhuizen & Bredell (1972); PREM 47545
- javanicum** (see *E. javanicum* var. *javanicum*)
- jensenii** Zaleski
Allium cepa: PREM 44761
mushroom casing : Smit (1984)
soil: Eicker (1969, 1970); PREM 44256
Zea mays: Van der Westhuizen & Bredell (1972), PREM 43740, 43753
= *intricatum* Thom
soil: Cohen (1950)
flannel: Doidge (1950)
- johannioli** (see *P. aurantiogriseum*)
- kapuscinskii** (see *P. canescens*)
- krugeri** Ramirez
soil: Ramirez (1990)
- lanosocoeruleum** (see *P. aurantiogriseum*)
- lanosum** (see *P. puberulum*)
- lapidosum** (see *E. lapidosum*)
- lilacinum** Thom (*Paecilomyces lilacinus*, Pitt 1979)
soil: Martin (1960); Papendorf (1976)
swine meal: Van Warmelo (1967)
Zea mays: Van der Westhuizen & Bredell (1972)
- lividum** Westling
debris: PPRI 3707; PREM 49886
soil: PPRI 4043
- luteum** (see *T. luteus*)
- luteoviride** Biourge (indeterminate, Pitt 1979)
aerospora: Doidge (1950); Thom (1930)
- martensii** (see *P. aurantiogriseum*)
- megasporum** Orput & Fennell
Encephalartos laevifolius: PREM 49069
- melinii** Thom
debris: PREM 47699
Encephalartos laevifolius: PPRI 3178; PREM 49070
mouse nest material: PPRI 4223
mushroom casing: Smit (1984)
soil: Allsopp *et al.* (1987); Pitt (1979); PPRI 4042; PREM 47699
= *atrovenetum* G. Smith
Arachis hypogaea: CBS 240.65
Zea mays: Van der Westhuizen & Bredell (1972); CSIR 323, 324
- meridianum** (See *E. meridianum*)
- miczynskii** Zaleski
debris: PPRI 3710; PREM 49882
soil: Allsopp *et al.* (1987); PPRI 4040
Zea mays: MRC 426
undetermined host: Pitt (1979)
= *pedemontanum* Mosca & Fontana
soil: Papendorf (1976); MCP 127
Zea mays: PREM 44301
= *soppii* Zaleski
Eucalyptus maculata: Eicker (1973)
soil: Eicker (1969, 1970, 1973); PREM 44281
undetermined host: CSIR 1398
- minioluteum** Dierckx
Dianthus caryophyllus: PPRI 3982
Hordeum vulgare: MRC 1756
paper: PPRI 3659; PREM 49874
soil: PREM 48586, 48587
Zea mays: McLean & Berjak (1987); PPRI 3984, 4020; PREM 47533, 47538, 47539, 47544, 47618
- montanense** Christensen & Bakus
soil: PPRI 4041
- multicolor** (see *P. sclerotiorum*)
- nigricans** (see *P. janczewskii*)

- notatum (see **P. chrysogenum**)
- novae-zeelandiae** Van Beyma
Protea spp.: PPRI 3978
 soil: Allsopp *et al.* (1987); PPRI 4222
- ochrochloron** Biourge
 soil: Eicker (1969)
- ochrosalmoneum (see **E. ochrosalmoneum**)
- olivinoviride (see **P. viridicatum**)
- olsonii** Bain. & Sartory
 debris: PPRI 4038
Eucalyptus maculata: Eicker (1973)
Gloxinia spp. PPRI 3706
 mushroom casing: Smit (1984)
 soil: Eicker (1969, 1970, 1973)
Tribulus terrestris: PPRI 3308; PREM 49207
Zea mays: PREM 47861, 47863
- oxalicum** Currie & Thom
Aloe asperifolia: MCP 351
Arachis hypogaea: PREM 48260, 48567
 cereal and legume products: Scott (1965)
 debris: PPRI 4039
 dried fish: MRC 322
 face cream: PPRI 3272
 fodder: PREM 48584, 48585
 soil: CSIR 331, 332, 333, 335, 338
Sorghum caffrorum: CSIR 296, 522, 523
Zea mays: Doidge (1950); McLean & Berjak (1987); Nagel *et al.* (1976); Steyn (1970); Van der Westhuizen & Bredell (1972); CSIR 210, 293, 368, 504, 555, 589, 615, 620, 643, 650, 676; PREM 47542
- palitans (see **P. viridicatum**)
- paraherquei (see **P. simplicissimum**)
- paxilli** Bain.
Encephalartos laevifolius: PPRI 3183, 3184
 mouse nest material: PPRI 4220
- pedemontanum (see **P. miczynskii**)
- petchii** Sartory & Bain. (indeterminate, Pitt 1979)
Ananas comosus: Doidge (1950)
- piceum** Raper & Fennell
 cereal and legume products: Scott (1965)
 debris: PPRI 4019; PREM 49864
 soil: CSIR 345
- pinetorum (see **E. pinetorum**)
- pinophilum** Hedcock
Ananas comosus: Doidge (1950)
Arachis hypogaea: Baard (1988); PPRI 3661; PREM 48033, 48384, 48385
 compost: PPRI 3166; PREM 49030
Ehretia rigida: PPRI 4310
Sorghum caffrorum: MRC 1587
Zea mays: PREM 47638
 undetermined host: Thom (1930)
 = **purpuregenum** var. **rubisclerotium** Thom
 cereal and legume products: Scott (1965)
Zea mays: CSIR 72, 90, 100, 207, 233, 277, 329, 366, 524
- pisarium (see **P. simplicissimum**)
- primulinum** Pitt
Eucalyptus cloeziana: PPRI 3730; PREM 49866
- puberulum** Bain.
Allium cepa: PREM 44765
Arachis hypogaea: Pitt (1979); MRC 335
Encephalartos laevifolius: PPRI 3205
 soil: PPRI 3204
Zea mays: Van der Westhuizen & Bredell (1972)
 = **commune** Thom
 aerospora: Roth (1968)
Cenchrus ciliaris: Bezuidenhout (1977)
 flannel: PREM 33289
 molasses meal: Roth (1968)
Zea mays: Van der Westhuizen & Bredell (1972)
- = **lanosum** Westling
 brattice cloth: Doidge (1950)
 cheese: Lück & Wehner (1979)
 soil: Papendorf (1976); MCP 163
Zea mays: Gilman (1972)
- pulvillorum (see **P. simplicissimum**)
- purpurescens** (Sopp) Biourge
Fingerhuthia africana: De Villiers (1989); PREM 49278
 mushroom casing: Smit (1984)
Protea spp.: PPRI 4284
 stored foods: IMI 141 658
Vitis vinifera: PPRI 3574
- purpuregenum** Stoll
 aerospora: Roth (1968)
Agave sisalana: PREM 48893
Allium cepa: PPRI 4224; PREM 44773
Arachis hypogaea: Gilman (1972); CSIR 13
Manihot esculenta: Pitt (1979); MRC 181
 molasses meal: Roth (1968)
 natural gum: Roth (1968)
 nuts and dried fruit: Wehner & Rabie (1970)
Phaseolus spp.: MRC 182
 soil: Allsopp *et al.* (1987); CSIR 350, 351
Sorghum caffrorum: MRC 2501
 sugar: Doidge (1950); Van der Bijl (1920)
Vitis spp.: Le Roux *et al.* (1973)
Zea mays: Gilman (1972); Van der Westhuizen & Bredell (1972); MRC 315; PPRI 3120, 3783; PREM 49018
 = **rubrum** Stoll
Arachis hypogaea: CSIR 13
 cereal and legume products: Scott (1965)
 cheese: Lück & Wehner (1979)
Medicago sativa: PREM 44370
Zea mays: Gilman (1972); Van der Westhuizen & Bredell (1972); PREM 43747
- purpuregenum var. **rubisclerotium** (see **P. pinophilum**)
- pusillum (see **E. cinnamopurpureum**)
- putterillii** Thom (*Geosmithia putterillii*, Pitt 1979)
 aerospora: Doidge (1950); Thom (1930)
- raciborskii** Zaleski
 aerospora: PPRI 3712; PREM 49885
Arachis hypogaea: PPRI 3664
 soil: Stolk & Samson (1983); PPRI 4217
Watsonia marginata: PPRI 3722
 = **raistrickii** G. Smith
Arachis hypogaea: Pitt (1979); MRC 197
 cereal and legume products: Scott (1965)
 mushroom casing: Smit (1984)
 soil: Allsopp *et al.* (1987); CSIR 388
Sorghum caffrorum: CSIR 526, 528, 529, 545
Zea mays: McLean & Berjak (1987); Van der Westhuizen & Bredell (1972); CSIR 4; PREM 47636
- raistrickii (see **P. raciborskii**)
- restrictum** Gilman & Abbott
Acacia karroo: Pitt (1979)
Helianthus annuus: PREM 47856
 soil: Allsopp *et al.* (1987); Papendorf (1976); MCP 23
 = **striatisporum** Stolk
Acacia karroo: Stolk (1969); IMI 151 749
 soil: Stolk (1969); Papendorf (1976); MCP 116, 213
- roquefortii** Thom
 cheese: Davel & Neethling (1930); Doidge (1950); Lück *et al.* (1978); CSIR 390, 392, 423, 447, 450, 455, 493, 497, 498, 499, 502, 503, 507, 509, 510, 512; PREM 49041, 49050; PPRI 3167, 3190, 3889; UCT
Medicago spp.: Lamprecht (1988); PPRI 3125; PREM 48315
Vitis spp.: Le Roux *et al.* (1973)
Zea mays: Van der Westhuizen & Bredell (1972); Van Warmelo (1967)
 = **casei** Staub
 soil: Eicker (1969, 1970, 1973); PREM 44280
- roseocitream (see **P. griseoroseum**)
- roseopurpureum** Dierckx
 soil: Papendorf (1976)

- Zea mays*: CSIR 400
- rubrum (see **P. purpureogenum**)
- rugulosum** Thom
aerospora: Roth (1968)
Allium cepa: PREM 44775
Arachis hypogaea: PREM 48388
coconut matting: Doidge (1950)
Gladiolus spp.: PPRI 3596; PREM 49413
natural gum: Roth (1968)
Zea mays: Van der Westhuizen & Bredell (1972); PREM 43739
= *tardum* Thom
aerospora: Doidge (1950); Thom (1930)
Arachis hypogaea: Gilman (1972)
soil: CSIR 344; MCP 372
timber: Doidge (1950)
Zea mays: Gilman (1972); Van der Westhuizen & Bredell (1972)
- sclerotiorum** Van Beyma
fodder: PREM 48876
Kniphofia spp.: PREM 48877
soil: Pitt (1979); Raper & Thom (1949); PREM 48571; PPRI 3901, 4069, 4139
Zea mays: Stolk & Samson (1983); MRC 425
= *multicolor* Grigoriova-Manoilova & Poradielova (application uncertain, Pitt 1979)
cereal and legume products: Scott (1965)
Eucalyptus maculata: Eicker (1973)
soil: Eicker (1969, 1973, 1975); Papendorf (1976)
Zea mays: Van der Westhuizen & Bredell (1972); CSIR 208, 397; MCP, PREM 43748
- senticosum (see **E. senticosum**)
- simplicissimum** (Oudem.) Thom
Arachis hypogaea: PREM 48032, 48564
cereal and legume products: Scott (1965)
dung: PPRI 3214; PREM 49084
flannel bag: Raper & Thom (1949); Pitt (1979); IMI 039 816
Medicago spp.: Lamprecht *et al.* (1988); PREM 48313, 48314
soil: Eicker (1969); Papendorf (1976); CSIR 339; MCP 178, 179; PPRI 4067; PREM 48902, 48903, 48904
Sorghum caffrorum: MRC 2206
ventilation tubing: Doidge (1950)
Zea mays: Van der Westhuizen & Bredell (1972); CSIR 77
= *paraherqueti* Abe
soil: Papendorf (1976); MCP 39, 105, 188
= *piscarium* Westling
soil: Papendorf (1976); MCP 187
= *pulvillorum* Turfitt
cereal and legume products: Scott (1965)
Eucalyptus maculata: Eicker (1973)
soil: Eicker (1969, 1973); PREM 44287
Zea mays: Nagel & Steyn (1972); CSIR 1405, 1406
- solitum (see **P. aurantiogriseum**)
- soppii (see **P. miczynskii**)
- spiculisporum (see **T. trachyspermus**)
- spinulosum** Thom
Allium cepa: Naude & Jooste (1989); PREM 48012, 48561, 48871, 48872, 48873
Pinus spp.: PPRI 3505
soil: Cohen (1950); Papendorf (1976); MCP 165; UCT
Zea mays: Van der Westhuizen & Bredell (1972); CSIR 200; PREM 43749
undetermined host: Thom (1930)
= *terlikowskii* Zaleski
Zea mays: CSIR 411, 412, 475, 684, 685
= *trzebinskii* Zaleski
soil: Cohen (1950)
- steckii (see **P. citrinum**)
- stolkiae (see **E. stolkiae**)
- stoloniferum (see **P. hrevicompectum**)
- striatisporum (see **P. restrictum**)
- sublateritium** Biourge
soil: Cohen (1950)
- tardum (see **P. rugulosum**)
- terlikowskii (see **P. spinulosum**)
- terrenum (see **E. terrenum**)
- terrestre** Raper & Thom (application uncertain, Pitt 1979)
Zea mays: Van der Westhuizen & Bredell (1972)
- thomii** Maire
aerospora: Roth (1968)
cereal and legume products: Scott (1965)
Cussonia paniculata: PPRI 3784
molasses meal: Roth (1968)
soil: Eicker (1975); Papendorf (1976); CSIR 752; MCP 38; PPRI 3237, 4044; UCT
Zea mays: Van der Westhuizen & Bredell (1972)
- trzebinskii (see **P. spinulosum**)
- urticae (see **P. griseofulvum**)
- variabile** Sopp
Allium cepa: PREM 44757, 44764
Arachis hypogaea: Gilman (1972)
cereal and legume products: Scott (1965)
coconut matting: Raper & Thom (1949); IMI 040 040
Hordeum vulgare: MRC 1755
leaves: MRC 319
Medicago sativa: PREM 44547, 44548
paper: PPRI 3657; PREM 49876
soil: CSIR 206, 353, 356, 467
Vitis spp.: Le Roux *et al.* (1973)
Zea mays: Gilman (1972); McLean & Berjak (1987); Van der Westhuizen & Bredell (1972); Van Warmelo (1967); CSIR 70, 73, 232, 269, 296, 395, 464, 472, 548; PREM 43743, 43744, 43745, 43746, 47540, 47541, 47543
- varians (see **P. funiculosum**)
- velutinum** Van Beyma
Eucalyptus maculata: Eicker (1973)
Medicago sativa: PREM 44522, 44549
soil: Eicker (1969, 1970, 1973); PREM 44260
Zea mays: Van der Westhuizen & Bredell (1972) PREM 44306, 47514
- vermiculatum (see **T. flavus**)
- verrucosum** Dierckx
cheddar cheese: Pitt (1979)
Citrus sinensis: Doidge (1950, *et al.* 1953); Doidge & Van der Plank (1936)
debris: PPRI 3121
Phaseolus spp.: MRC 220
soil: PPRI 3575
- verruculosum** Peyronel
Casuarina spp.: PREM 47707
Eucalyptus maculata: Eicker (1973)
Oryza sativa: MRC 171
soil: Allsopp *et al.* (1987); Eicker (1969, 1970, 1973); CSIR 347; PPRI 3501; PREM 44265, 48017; UCT
Zea mays: PPRI 3837
- viridicatum** Westling
aerospora: Thom (1930); Doidge (1950)
Arachis hypogaea: MRC 292
birdseed: PREM 4221
cereal and legume products: Scott (1965)
cheese: MRC 1132
Hordeum vulgare: MRC 1761, 2669, 2830
material: Doidge (1950)
natural gum: Roth (1968)
soil: CSIR 15, 405, 407; PREM 48906
Zea mays: Hutchison *et al.* (1973); Pitt (1979); Van der Westhuizen & Bredell (1972); CSIR 255, 349, 354, 396, 413, 425, 430, 460, 570, 663, 724; MRC 422
= *olivinoviride* Biourge
Allium cepa: PREM 44769
= *palitans* Westling
Allium cepa: PREM 44758
flannel: Doidge (1950)
Zea mays: Van der Westhuizen & Bredell (1972)
- vulpinum** (Cooke & Massee) Siefert & Samson
dung: PPRI 3727; PREM 49880
= *claviforme* Bain.

molasses meal: Roth (1968)
soil: CSIR 1088, 1089

waksmanii Zaleski

Barleria obtusa: PPRI 3704; PREM 49884
Encephalartos spp.: PPRI 4283
Medicago sativa: PREM 44474
mushroom casing: Smit (1984)
soil: Eicker (1975); Papendorf (1976); MCP 40
Zea mays: Van der Westhuizen & Bredell (1972); MRC 203

wortmannii (see **T. wortmannii**)

Penicillium species undetermined

aerospora: Ordman (1963, 1970); Ordman & Etter (1956); Radmore (1986); Van der Merwe *et al.* (1979)
Arachis hypogaea: Ferreira & Lutchman (1989); Marasas & Van Rensburg (1986); Van Warmelo (1967)
Cenchrus ciliaris: Bezuidenhout (1977)
cheese: Lück *et al.* (1976); Lück & Wehner (1979)
Citrus sinensis: Doidge (1950); Doidge & Van der Plank (1936); Roth (1967); Verwoerd (1929)
Crucifera spp.: Holtzhausen & Knox-Davies (1974)
Cucumis melo: Doidge *et al.* (1953)
Eucalyptus spp.: Lundquist & Baxter (1985)
fodder: Dutton & Westlake (1985)
foodstuff: Martin & Keen (1978)
Hordeum vulgare: Lübben & Rabie (1989)
indigenous seed: Isaacs & Benic (1990)
Iris spp.: Doidge *et al.* (1953)
Litchi chinensis: Doidge *et al.* (1953); Roth (1963)
Lupinus spp.: Van Warmelo (1967)
Mangifera indica: Wehner *et al.* (1981)
Malus sylvestris: Doidge *et al.* (1953); Verwoerd (1929)
Medicago sativa: Lamprecht (1988); Marasas & Bredell (1973); Van Warmelo (1967); PREM 44530, 44551, 44554
molasses meal: Roth (1968)
Musa spp.: Roth & Loest (1965)
mushroom casing: Smit (1984)
Narcissus spp.: Doidge *et al.* (1953)
nuts and dried fruit: Wehner & Rabie (1970)
Panicum coloratum: Eicker (1976)
Pinus spp.: Lundquist (1987)
Prunus persica: Doidge *et al.* (1953)
Prunus salicina: Doidge *et al.* (1953)
recalcitrant seed: Berjak *et al.* (1989); Mycock & Berjak (1990)
Raphanus sativus var. *longipinnatus*: Holtzhausen (1978)
Saccharum officinarum: Doidge (1950)
smoked shrimps: Gilman (1972)
soil: Allsopp *et al.* (1987); Cohen (1950); Eicker (1975, *et al.* 1982); Papendorf (1976); CSIR 312
Sorghum caffrorum: Rabie & Lübben (1984); CSIR 316, 521, 533
Tulipa spp.: Doidge *et al.* (1953)
Vitis spp.: Le Roux *et al.* (1973); Verwoerd (1929)
Zea mays: Gilman (1972); Marasas *et al.* (1981); Marasas & Van Rensburg (1986); McLean & Berjak (1987); Van Warmelo (1967); Wittaker *et al.* (1989); CSIR 218, 264, 414, 415

GENUS EUPENICILLIUM

alucateum (see **E. terrenum**)

anatolicum (see **E. euglaucum**)

baarnense (Van Beyma) Stolk & Scott

Acacia mollesjuna: CBS 339.61
soil: Scott (1968b), CSIR 1059, 1070, 1071, 1090, 1106, 1107, 1130; PPRI 3259

brefeldianum (see **E. javanicum** var. **javanicum**)

catenatum Scott

soil: Scott (1968a); Stolk & Samson (1983); CBS 325.67; CSIR 1097; PREM 48556

cinnamopurpureum Scott & Stolk

Pinus spp.: CBS 492.66; CSIR 946
soil: Scott (1968b); Stolk & Samson (1983); CBS 490.66, 491.66; CSIR 942, 943, 945, 946, 1126; PREM 48558

Zea mays: Stolk & Samson (1983)

undetermined host: Stolk & Samson (1983)
≠ *P. pusillum* G. Smith

Zea mays: CSIR 606

crustaceum Ludwig

soil: Scott (1968b), CBS 214.71, 215.71, 216.71; CSIR 1026, 1027, 1057, 1102, 1105, 1124; PREM 48551
≠ *P. asperum* (Shear) Raper & Thom
Eucalyptus maculata: Eicker (1973)
soil: Eicker (1969, 1970, 1973); PREM 44264
≠ *P. gladioli* McCulloch & Thom
Gladiolus spp.: Doidge (1950, *et al.* 1953); PREM 30706

ehrllichii (see **E. javanicum** var. **javanicum**)

erubescens (see **E. terrenum**)

euglaucum (Van Beyma) Stolk & Samson

soil: Stolk & Samson (1983); CBS 467.67
Zea mays: Stolk & Samson (1983); CBS 238.65

= *anatolicum* Stolk

soil: Scott (1968b); Stolk & Samson (1983) CSIR 1095, 1113

= *hirayamae* Scott & Stolk

soil: Allsopp *et al.* (1987); Scott (1968b); CSIR 1112; PPRI 3264; PREM 49212

Zea mays: CBS 238.65; CSIR 445

≠ *P. hirayamae* Scott & Stolk

Zea mays: CSIR 487, 554; IMI 136 205

hirayamae (see **E. euglaucum**)

inositatum Scott

soil: Scott (1968a); Stolk & Samson (1983); CBS 351.67; CSIR 1096; PREM 48570

≠ *P. inositatum* Scott

soil: IMI 136 214

javanicum (Van Beyma) Stolk & Scott var. **javanicum**

apple juice: Stolk & Samson (1983)

soil: Stolk & Samson (1983); CBS 211.71

undetermined host: Stolk & Samson (1983)

= *brefeldianum* (B. Dodge) Stolk & Scott

apple juice: CBS 291.62

soil: Scott (1968b); Stolk & Samson (1984), CBS, CSIR 1002, 1010, 1011, 1012, 1013; 1028, 1029, 1030, 1068, 1069, 1108, 1109; PPRI 3260; PREM 48555

undetermined host: Stolk & Samson (1983)

≠ *P. brefeldianum* B. Dodge

apple juice: Van der Spuy *et al.* (1975)

= *ehrllichii* (Klebahn) Stolk & Scott

soil: Scott (1968b), CSIR 1025, 1026, 1027; MCP, ; PPRI 3262, 3695; PREM 49195, 49362

= *javanicum* (Van Beyma) Stolk & Scott

Arachis hypogaea: CSIR 416, 417, 419, 420, 421, 424; PREM 48259
soil: Scott (1968b), CSIR 1004, 1005, 1006, 1007, 1008, 1009, 1015, 1018, 1019, 1025, 1026, 1027, 1110; 48382, 48550;

≠ *P. javanicum* Van Beyma

soil: Eicker (1969, 1970, 1973); Martin (1960); Papendorf (1976); MCP 123

Zea mays: Van der Westhuizen & Bredell (1972)

lapidosum Scott & Stolk

soil: Scott (1968b); CBS 318.66, CSIR 1035; PREM 48880

Zea mays: CSIR 1093

unrecorded host: Stolk & Samson (1983)

≠ *P. lapidosum* Raper & Fennell

soil: IMI 113 748; PREM 48880; UCT

meridianum Scott

soil: Scott (1968a, b); Stolk & Samson (1983); CBS 314.67, 217.71, 219.71; CSIR 1052, 1037, 1036, 1103; PREM 48884

≠ *P. meridianum* Scott

soil: IMI 136 209

ochrosalmoneum Scott & Stolk

soil: Scott (1968b), Stolk & Samson (1983); CBS 515.67; CSIR 1094; PREM 48886

Zea mays: Stolk & Samson (1983); CBS 489.66; CSIR 145

≠ *P. ochrosalmoneum* Udagawa

Zea mays: IMI 116 248

parvum (Raper & Fennell) Stolk & Scott

soil: Scott (1968b), CSIR 973, 1054, 1058; MCP, PPRI 3263; PREM 48557, 48881, 48887, 49194

pinetorum Stolk

soil: Allsopp *et al.* (1987); Scott (1968b); CBS 328.71; CSIR 1092, 1125; PPRI 3490; PREM 48883; UCT

- ≠ *P. pinetorum* Stolk
soil: CSIR 1092
- senticosum** Scott
soil: Scott (1968a, b); Stolk & Samson (1983); CBS 313.67, 329.71; CSIR 1042, 1104; IMI 216 905; PREM 48882
≠ *P. senticosum* Scott
soil: IMI 216 905
- shearii** Stolk & Scott
Medicago spp.: Lamprecht (1988); PPRI 4017; PREM 48322
soil: Scott (1968b); CSIR 1003, 1016, 1017; PREM 48549
Zea mays: CSIR 722
- stolkiae** Scott
soil: Scott (1968a, b); Stolk & Samson (1983); CBS 315.67, 330.71, 331.71; CSIR 1003, 1041, 1074; PREM 48552
≠ *P. stolkiae* Scott
soil: IMI 136 210
- terrenum** Scott
soil: Scott (1968a, b), Stolk & Samson (1983); CBS 313.67, 212.71, 213.71, 220.71, 327.71; CSIR 972, 1020, 1021, 1022, 1023, 1024; PPRI 3266
= *alutaceum* Scott
soil: Scott (1968a); Stolk & Samson (1983); CBS 317.67; CSIR 1039, 1056, 1091, 1100, 1101; PPRI 3488; PREM 48885
= *erubescens* Scott
soil: Scott (1968a, b); Stolk & Samson (1983); CBS 318.67, 319.67; CSIR 944, 974, 1040, 1032, 1034, 1038, 1040, 1061; PPRI 3261; PREM 48554, 49199
≠ *P. alutaceum* Scott
soil: IMI 136 243
≠ *P. erubescens* Scott
soil: IMI 136 404
≠ *P. terrenum* Scott
soil: IMI 136 208
- Eupenicillium* species undetermined
mushroom casing: Smit (1984)
soil: CSIR 1127, 1128, 1129; PPRI; UCT
- GENUS TALAROMYCES
- avellaneus** (Thom & Turesson) C.R. Benjamin (anamorph: *Merimbla ingelheimense*, Pitt 1979)
soil: CSIR 958, 959
- bacillosporus** (Swift) C.R. Benjamin (anamorph: *Geosmithia swiftii*, Pitt 1979)
soil: CSIR 961
- flavus** (Klöcker) Stolk & Samson
apple juice: Pitt (1979)
contaminant: PPRI 3790; PREM 48577
Encephalartos laevifolius: PPRI 3213; PREM 49074
wine bottle cork: MCP 27
= *flavus* var. *macrosporus* Stolk & Samson
fruit: Stolk & Samson (1972); CBS 317.63; IMI 197 487
soil: Stolk & Samson (1972); CBS 226.72; PPRI 3791
= *vermiculatus* (Dang.) C.R. Benjamin
soil: CSIR 960, 962, 963
≠ *P. dangeardii* Pitt
apple juice: IMI 197 478
≠ *P. vermiculatum* Dang.
apple juice: Van der Spuy *et al.* (1975)
soil: Eicker (1969, 1973)
- luteus** (Zukal) C.R. Benjamin
≠ *P. luteum* Zukal
aerospora: Roth (1968)
Citrus sinensis: Doidge (1950)
flannel: Doidge (1950); PREM 33288
molasses meal: Roth (1968)
natural gum: Roth (1968)
- spiculisorus (see **T. trachyspermus**)
- thermophilus** Stolk
Celtis africana litter: Pitt (1979); Stolk & Samson (1972); CBS 116.72
≠ *P. dupontii* Griffin & Maubl.
apple juice: Van der Spuy *et al.* (1975)
compost: IMI 197 483
mushroom compost: Eicker (1977)
- trachyspermus** (Shear) Stolk & Samson
Manihot esculenta: Pitt (1979); MRC 724
contaminant: PPRI 3885
= *spiculisorus* (Lehman) C.R. Benjamin
soil: CSIR 955, 956
≠ *P. spiculisorum* Lehman
undetermined host: MCP 1125
- vermiculatus (see **T. flavus**)
- wortmannii** (Klöcker) C.R. Benjamin
Arachis hypogaea: MRC 332
Oryza sativa: Pitt (1979)
soil: Allsopp *et al.* (1987); MCP 1134; Stolk & Samson (1972); CBS 293.53; CSIR 954, 957, 964, 965
Watsonia marginata: PPRI 3675
≠ *P. wortmannii* Klöcker
Oryza sativa: MRC 243