FOUR NEW SPECIES OF PENICILLIUM ISOLATED FROM THE AIR

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Abstract

Four new species of *Penicillium* Link *ex* Fries are described and illustrated. All of them but one have been isolated from the atmosphere in Madrid, Spain. They clearly differ from all species of the genus described so far and are, therefore, described and proposed as new taxa: *Penicillium aurantio-flammiferum* sp. nov., *Penicillium gallaicum* sp. nov., *Penicillium granatense* sp. nov., and *Penicillium ilerdanum* sp. nov.

Introduction

During the course of a survey on microfungus spores in the air of Madrid, Spain, in correlation with seasonal allergies, several thousand of microfungi were isolated. Among them, the following four species of *Penicillium* were found to be sufficiently different from all those previously known in the literature (1–14 and 16–20) to warrant their description as new species: Penicillium *aurantio-flammiferum*, *Penicillium gallaicum*, *Penicillium granatense*, and *Penicillium ilerdanum*.

Penicillium aurantio-flammiferum sp. nov. is a distinctive species characterized by its penicilli of the Biverticillata-Symmetrica type (Raper and Thom, 1949) (12), with phialides typically lanceolate with acuminate ends, growing rather restrictedly upon Czapek's agar medium. It appears most closely related with species classified by Raper and Thom (12) in the *Penicillium herquei* series on account of the brightly coloured encrusted floccose aerial hyphae, covering more or less the colony surface.

Penicillium gallaicum sp. nov. is another distinctive species characterized by its penicilli usually strictly monoverticillate, seldom with an occasional branch bearing a verticil of phialides retaining always its monoverticillate character, growing restrictedly upon most substrata. The correct placement of the species appears to be most satisfactorily assignable to the *P. implicatum* series (Raper and Thom, 1949) (12) on account of the restricted growth on most media and to the *P. decumbens* series on account of the short stipes of the conidiophores, mostly arising directly from a network of trailing aerial hyphae.

Penicillium granatense sp. nov. is a distinctive species characterized by its strongly divaricate penicilli and by its strongly echinulate conidia. The correct placement of the species appears to be most satisfactorily assignable to the *Penicillium nigricans* series (Raper and Thom) (12) on account of the dark-coloured colonies, the rather restricted growth on malt extract agar, and the strongly echinulate conidia.

Penicillium ilerdanum sp. nov. is another distinctive species characterized by its penicilli of the Biverticillata-Symmetrica type (Raper and Thom) (12), with lanceolate phialides, by its restricted growth upon Czapek's agar and by the variety of colours shown in the three different standard media used in the present study. The correct placement of the species appears to be most satisfactorily assignable to the *P. funiculosum* series (Raper and Thom, (12).

Material and methods

Three standard media have been used in the present study: Two of the standard substrata used by Raper and Thom (12): malt extract agar and Czapek's solution agar, plus a third substratum consisting of 0.5 % (Difco)

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Yeast extract additioned to the Czapek's agar medium according to Pitt (8).

Latin diagnosis of Penicillium aurantio-flammiferum su. nov. (Fig. 1)

Coloniae in agaro Czapekii fere lente crescentes, restrictae, post duas hebdomadas ad 25 °C, 25mm in diametro attingunt; cum angusta alba margine inaequaliter; duro denso texto basali coacto mycelio; velutinae, cum superficiebus laxe tecta est hyphys lanosis; prope planae, paucibus radiatibus sulcis; zonis sterilibus aurantio-flammei coloratae alternantis cum zonis fertilibus coeruleo-viridibus coloratae, superficiebus fructificationibus conidialibus abundantibus, coeruleo-viribus fusco circa marginem, aurantio-flammineo in centrali area; exsudatio copioso, incoloro vel succinatio pallido; odor nullum; pigmento succineo in medio diffluentis; reverso aurantio-rubro purpureo obscuro; neque ascomata neque sclerotia visa sunt. Conidiophora erecta, brevia, levia, pleraque minus 100 μm longa per 2. 5–3.0 μm in diametro. Penicilli pleraque biverticillati-symmetrici, aliquando cum ramis secundariis, cum verticillis metularum terminalis, ergo in sectio Biverticillata-Symmetrica; rami numero variabili, 2–3 per verticillum, 10–12 μm longa per 2–3 μm in diametro; metulae tenus 5 per verticillum, 9.0–11.0 μm per 1.5–3.0 μm; phialides lanceolatae acuminatae, plerumque 4–8 per verticillum, 8.0–13.0 μm per 2.0–3.0 μm; conidia glabra, ovoidea vel ellipsoidea, plerumque 3.0–4.0 μm per 2.0–3.0 μm, in densis catenis usque 100 μm longis, flabelliformis.

Coloniae in agaro Czapekii cum extracto levedinis celerior quam in agaro Czapekii crescunt, post duas hebdomadas ad 25 °C, 35–45 mm in diametro attingunt; duro denso texto basali coacto mycelio; velutinae, prominentibus radiatibus sulcis; in centrali area prominentes; superficiebus conidiorum coeruleo-viridibus, ex effusis lanatis aeris hyphis tectae sunt; exsudatio copioso rubro obscuro; odor parum, fungineo; reverso rubro-purpureo obscuro; pigmento succinatio pallido in medio diffluente; neque ascomata neque sclerotia visa sunt.

Coloniae in agaro hordeaceo lente crescentes, post duas hebdomadas ad 25 °C, 30–35mm in diametro attingunt; laxo texto basali coacto mycelio, zonatae, planae, tenua margine e hyphis submersis formatur (3 mm); superficiebus fructificationibus conidialibus abundantibus zonis alternantes cum zonis ex copiosis lanatis hyphis aeriis aurantio-flammineo coloratis; sine odore; exsudatio nullo; pigmento pallido rubro-purpureo diffluente in medio; reverso rubropurpureo obscuro; neque ascomata neque sclerotia visa sunt.

Typus cultura IJFM 7072 ex condimento in anno 1979 isolatus est.

In collectione fungorum Laboratori Mycologiae Instituti 'Jacobus Ferran' Microbiologiae, Matritum Hispaniae et in collectione fungorum Centraalbureau voor Schimmelcultures (CBS), Baarn Batavorum deposita est.

English description of Penicillium aurantio-flammiferum sp. nov. (Fig. 1)

Colonies on Czapek's solution agar growing rather restrictedly, attaining a diameter of 25 mm in 14 days at room temperature (25 °C), velvety in appearance, with white undulating margin, submarginal zone with shallow radial furrows; almost plane, raised in central area, with few radial furrows; sporing abundantly throughout in deep blue-green shades (Séguy, Pl. 30, 446), (15), especially

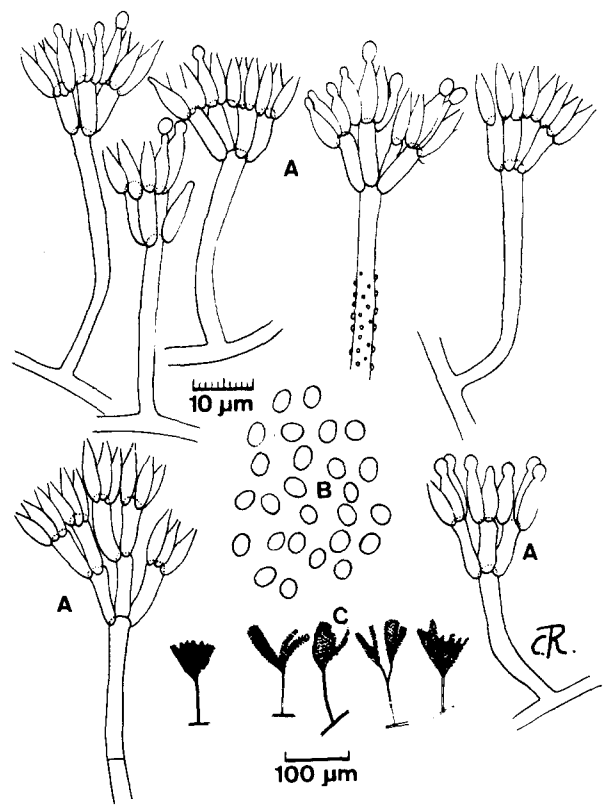

Fig. 1. Camera lucida drawings of *Penicillium aurantio-flammiferum* sp. nov., strain IJFM 7072. A: Different types of penicilli. B: Mature conidia. C: Habit sketches of the penicilli. (A and B are drawn from unstained slide preparations observed with immersion objective).

in subcentral areas; colony surface consisting of a lose-textured basal felt more or less covered by an overgrowth of floccose aerial hyphae forming a dense network, heavily encrusted with brightly coloured saphron-orange crystals influencing greatly the colony appearance, even masking the deep blue-green colour of conidial structures in marginal and central areas; exudate abundantly produced, pale amber to colourless; odour lacking; pale amber pigment diffusing into the surrounding agar; reverse in deep purple-red shades. No ascomata or sclerotia have been observed. Stipes of the conidiophores usually straight, short, smooth-walled or sometimes encrusted with the brightly coloured crystals, arising directly from the substratum or from the network of floccose aerial hyphae, usually less than 100 μm long by 2.5 to 3.0 μm in diameter. Penicilli typically of the Biverticillata-Symmetrica type (Raper and Thom, 1949), (12); sometimes with few branches, two or three per verticil, measuring 10 to 12 μm in length by 2.0 to 3.0 μm in width; metulae in number of two to five per verticil, 9.0 to 11.0 μm in length by 1.5 to 3.0 μm in diameter; phialides typically lanceolate and acuminate, usually four to eight per verticil, measuring 8.0 to 13.0 μm by 2.0 to 3.0 μm; conidia smooth-walled, ovoid to ellipsoidal, usually 3.0 to 4.0 μm by 2.0 to 3.0 μm in diameter, with conidial chains forming compact columns up 100 μm long, typically fan-shaped. Colonies on Czapek's yeast extract agar medium spreading more rapidly than on Czapek's agar, attaining a diameter of 35–40 mm in 14 days at room temperature (25 °C), consisting of a close-textured basal felt, velvety in appearance, deeply radiately furrowed, with centre raised; margin white; saphron-orange floccose aerial encrusted hyphae sparcely produced in dispersed bundles all over the colony surface which is heavily sporulated in deep blue-green shades in marginal areas; exudate abundantly produced, in deep vinaceous shades; odour faint 'mouldy'; reverse in deep purple-red shades; light amber pigment diffusing into the surrounding agar. No ascomata or sclerotia have been observed. Penicilli arising directly from the basal felt.

Colonies on malt extract agar attaining a diameter of 30–35 mm in 14 days at room temperature (25 °C), velvety, loose-textured with white margin surrounded by a fringe of submerged hyphae extending 3mm or more beyond the aerial growth, zonate, plane, with heavily sporing zones alternating with zones covered by the saphron-orange encrusted floccose hyphae, which mask the otherwise heavily sporing deep blue-green conidial structures; aerial hyphae consisting of a loose network of floccose mycelia; odour lacking; exudate not produced; light purple-red pigment diffusing into the surrounding agar. Reverse in deep purple-red shades. No ascomata or sclerotia have been observed. Penicilli typically shaped in a fan-like pattern, due to the compact conidial chains forming more or less divergent columns.

The saphron-orange pigment may be extracted with chloroform, resulting in a deep orange solution reminding a concentrate aqueous solution of potassium dichromate.

Penicillium aurantio-flammiferum appears most closely related with species classified by Raper and Thom (12) within the *P. herquei* series of the Biverticillata-Symmetrica section on account of the brightly coloured encrusted floccose aerial hyphae, covering more or less the colony surface, but detailed investigations failed to match it with any species described so far. Therefore, it is described and proposed as a new species with the specific name of *Penicillium aurantio-flammiferum* sp. nov.

Species diagnosis is based on the type strain IJFM 7072 isolated from a mixture of spices used in the Spanish sausage industry by J. Berenguer in April 1979. It is at present known only from the type locality. A subculture has been deposited with the Centraalbureau voor Schimmelcultures (CBS), Baarn, The Netherlands, and also with the fungus collection of the Laboratory of General and Applied Mycology, Instituto 'Jaime Ferrán' de Microbiología, Madrid, Spain.

Latin diagnosis of Penicillium gallaicum sp. nov. (Fig. 2)

Coloniae in agaro Czapekii fere lente crescentes, post duas hebdomadas ad 25 °C, 30 mm in diametro attingunt, planae et tenues apud marginem, denso texto basali coacto mycelio, inaequaliter prominentes et plicatae in centrali area, velutinae, cum alba margine, subfimbriata, pallido pulla; superficiebus fructificationibus conidialibus parum abundantibus, flavido-albis, granosis; exsudatio abest; odor nullum; sine coloris diffluentis in medio; reverso aurantio pallido ad centrum, albo ad marginem; neque ascomata neque sclerotia visa sunt. Conidiophora brevia, levia, hyalina, plurimum ex substrato vel etiam ex hyphis aeris reptabundis exoriuntur, plerumque minus 50 μm longa per 2.0–3.0 μm in diametro, cum apicibus tenus 5.0 μm inflatibus. Penicilli pleraque monoverticillati; rami rari; phialides parallelae in verticilis compactis, plerumque 6–10 in numero per verticillum, plerumque 7.0–12.0 μm longitudine per 2.5–4.0 μm in diametro, cum brevi collulo. Conidia globosa vel subglobosa,

levia, plerumque 2.0–3.0 μm per 2.5–3.0 μm in diametro, in intricatis catenis brevis usque 150 μm longis. Coloniae in agaro Czapekii cum levedinis celerior quam in agaro Czapekii crescunt, post duas hebdomadas ad 25 °C, 35 mm in diametro attingunt, duro, denso texto basali coacto mycelio, fortiter radiatae sulcatae, prominentes et plicatae in centrali et subcentrali area; cum margine continuo; zonatae, velutinae; superficiebus fructificationibus conidialibus coeruleo-viridibus colorantur; superficies coloniarum sine fructificationibus conidialibus sulphuribus coloratur; odor nullum; exsudatio in minutis guttis glaucis; reverso aurantio-flavido; cum coloris flavido-sulphureo in medio diffluentis; neque ascomata neque sclerotia visa sunt.

Coloniae in agaro hordeaceo lente crescentes, post duas hebdomadas ad 25 °C, 27 mm in diametro attingunt, planae et fimbriatae ad marginem, parum prominentes in centrali area, zonatae et coriaceae durae; fructificationibus conidialibus abundatibus in centrali area, coeruleocinerens colorantur; exsudatio abest; odor nullum; reverso flavido-sulphureo; coloris flavido-sulphureo in medio diffluentis. Neque ascomata neque sclerotia visa sunt.

Typus cultura IJFM 5597 ex aere Matriti Hispaniorum anno 1979 isolatus est. In collectione fungorum Laboratori Mycologyae Instituti 'Jacobus Ferrán' Microbiologiae et in collectione fungorum Centraalbureau voor Schimmelcultures (CBS) Baarn Batavorum deposita est.

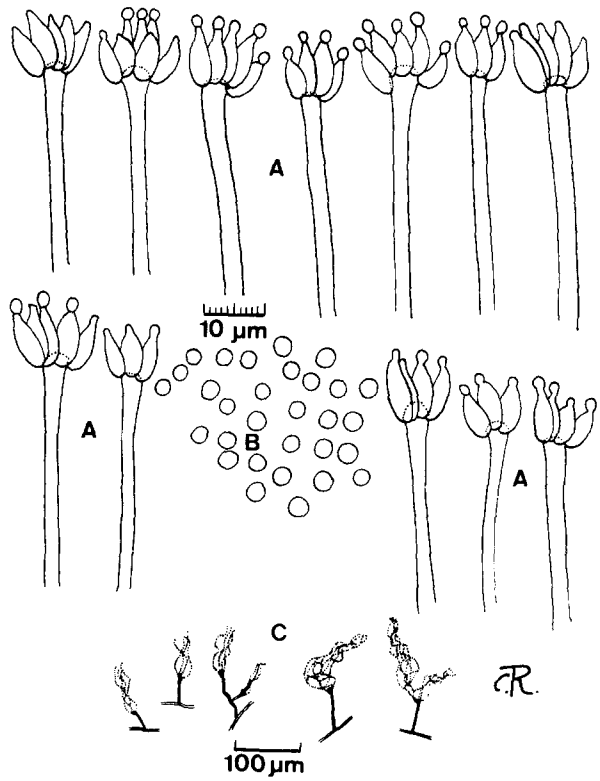

Fig. 2. Camera lucida drawings of *Penicillium gallaicum* sp. nov., strain 5597. A: Different types of penicilli. B: Mature conidia. C: Habit sketches of the penicilli. (A and B are drawn from unstained slide preparations observed with immersion

English description of Penicillium gallaicum sp. nov. (Fig. 2)

Colonies on Czapek's agar growing rather restrictedly, attaining a diameter of 30 mm in 14 days at room temperature (25 °C), consisting of a tough, dense, close-textured basal felt, with marginal area plane, with subcentral en central areas raised and irregularly folded; entire white thin margin, surrounded by a fringe of submerged hyphae extending 2 mm beyond the aerial growth; colony surface velvety, with centre appearing granular, mainly due to the thin network of white aerial hyphae; sparcely sporing in light brown shades in marginal areas and in yellowish shades in submarginal and central areas; exudate lacking; odour absent; reverse in light orange shades at centre and colourless at margin. Stipes of the conidiophores short, usually less than 50 μm long by 2.0 to 3.0 μm in diameter, smooth-walled, colourless, mostly arising either directly from the substratum and as short branches from aerial trailing hyphae, with apices enlarged in a vesicle up to 5 μm in width, giving a mealy or granular appearance to the colony surface, especially in central and subcentral areas. Penicilli usually strictly monoverticillate, seldom with an occasional branch which bears a verticil of phialides retaining always its monoverticillate character; phialides closely packed in parallel clusters, mostly 6 to 10 in number per verticil, ranging from 7.0 to 12 μm in length by 2.5 to 4.0 μm in diameter, with short narrow necks; conidia globose to subglose smooth-walled, measuring 2.0 to 3.0 μm in diameter, forming loose to tangled chains up to 150 μm long. No ascomata or sclerotia have been observed. Colonies on Czapek's yeast extract agar growing restrictedly but more rapidly than on Czapek's agar, attaining a diameter of 35 mm in 14 days at room temperature (25 °C), tough, velvety, zonate, close-textured, strongly and deeply radiately furrowed, with centre raised and irregularly folded in a crater-like pattern, with evenly margin surrounded by a fringe of submerged hyphae extending 2 mm beyond the aerial growth, with heavily sporing zones in blue-green shades (Séguy, Pl. 30, 436), scarcely sporing zones in sulphur yellow shades (Séguy,

Pl. 30, 286), mostly due to the yellow encrusted vegetative hyphae; exudate in small yellow drops; odour lacking; reverse in orange-yellow shades; sulphur-yellow pigment diffusing into the surrounding agar. Penicilli as described above. No ascomata or sclerotia have been observed.

Colonies on malt extract agar growing restrictedly, attaining a diameter of 27 mm in 14 days at room temperature (25 °C), plane with centre slightly raised or depressed, zonate, consisting of a leather-like basal felt formed of yellow encrusted hyphae; thin margin surrounded by a fringe of submerged hyphae extending 3 to 4 mm beyond the aerial growth; heavily sporing in subcentral and central areas in blue-gray shades (Séguy, Pl. 30, 449); no exudate observed; odour lacking; reverse in deep sulphur yellow shades; similarly coloured pigment diffusing into the sourounding agar. Penicillia as described above. No ascomata or sclerotia have been observed.

Penicillium gallaicum appears to be an intermediate species between those classified by Raper and Thom (12) in the *Penicillium implicatum* series and the *P. decumbens* series. It is closely related to the former species, simply on account of its restricted growth on most substrata, and to the latter on account of the short stipes of its conidiophores usually borne as short branches from trailing or interwoven aerial hyphae, but detailed investigations failed to match it with any species described so far. Therefore, it is proposed and described as a new species with the specific name of *Penicillium gallaicum* sp. nov. On account of its intermediate position among species assigned to the *P. implicatum* and *P. decumbens* series, it will have to be placed, for the time being between both series. The specific epithet refers to the North-West region of Spain known as Galicia to which the species has been dedicated.

Species diagnosis is based on the type strain IJFM 5597 isolated from the air of Madrid, Spain. It is at present known only from the type locality. A subculture has been deposited with the Centraalbureau voor Schimmelcultures (CBS), Baarn, The Netherlands, and with the fungus collection of the Laboratory of General and Applied Mycology, Instituto 'Jaime Ferrán' de Microbiología, Madrid, Spain.

Latin diagnosis of Penicillium granatense sp. nov. (Fig. 3)

Coloniae in agaro Czapekii fere celeriter crescunt, post duas hebdomadas ad 25 °C, 30 mm in diametro attingunt, velutinae, margo sinuosus, superficies coloniarum prominentes, fortiter radiatae sulcatae, cum depressione crateriforme in centrali area, zonatae, parum sporulantes, coeruleo-cinerens in superficiebus fructificationibus conidialibus; exsudatio exiguo, perlucido, minutis guttis; odor fungineo; reverso cinnamomeo pallido; sine coloris diffluentis in medio; neque ascomata neque sclerotia visa sunt. Conidiophora erecta, brevia, glabra, plerumque minus quam 100 μm longa per 2.0–2.5 μm in diametro, cum apicibus usque 3 μm inflatibus. Penicilli pleraque fortiter asymmetrici divaricati, ramosi et irregulares, interdum monoverticillati; metulae 8.0–15.0 (25.0) μm per 2.0–2.5 μm, parum in numero; phialides 7.0–9:0 μm per 2.0–3.0 μm, lagaeniformes, ad basem dilatae sunt et ad apicem abrupte angustatae ad tubulum exiguum conidiophorum terminantur; conidia fortiter echinulata, globosa, 3.0–4.0 μm in diametro Conidia columnas laxas formantur.

Coloniae in agaro Czapekii cum extracto levedinis fere celeriter crescunt, post duas hebdomadas ad 25 °C, 45–50 mm in diametro attingunt, in texto basali et caetera persimiles ut in Czapek; exsudatio incoloro; odore nullo; reverso brunneo-cinnamomeo pallido. Neque ascomata neque sclerotia visa sunt.

Coloniae in agaro hordeaceo fere lente crescentes, post duas hebdomadas ad 25 °C, 30–35 mm in diametro attingunt, velutinae, planae, margine sinuoso; fortiter sporulantes, cinereo obscuro; exsudatio abest; odore aromatico; reverso aurantio pallido; sine coloris diffluentis in medio; neque ascomata neque sclerotia visa sunt.

Typus cultura IJFM 5965 ex aere Matriti Hispaniorum isolatus est in anno 1979. In collectione fungorum Instituti 'Jacobus Ferrán' Microbiologiae, Matritum Hispaniorum et in collectione fungorum Centraalbureau voor Schimmelcultures, Baarn Batavorum deposita est.

English description of Penicillium granatense sp. nov. (Fig. 3)

Colonies on Czapek's agar growing moderately, attaining a diameter of 30 mm in 14 days at room temperature (25 °C), appearing velvety, zonate, with undulating margin, raised towards the centre of the colony, which is depressed in a crater-like pattern, moderately sporing in blue-green to blue-gray shades (Séguy, Pl. 29, 424, and Pl. 30, 449); exudate crystal clear in small colourless drops; odour 'mouldy'; reverse in light cinnamon shades; no diffusing pigment produced. Stipes of the conidiophores straight, short, usually less than 100 μm in length by 2.0 to 2.5 μm in diameter, smooth-walled, with apices somewhat enlarged in a vesicle up to 3 μm in diameter, arising as short branches from trailing hyphae. Penicilli mostly

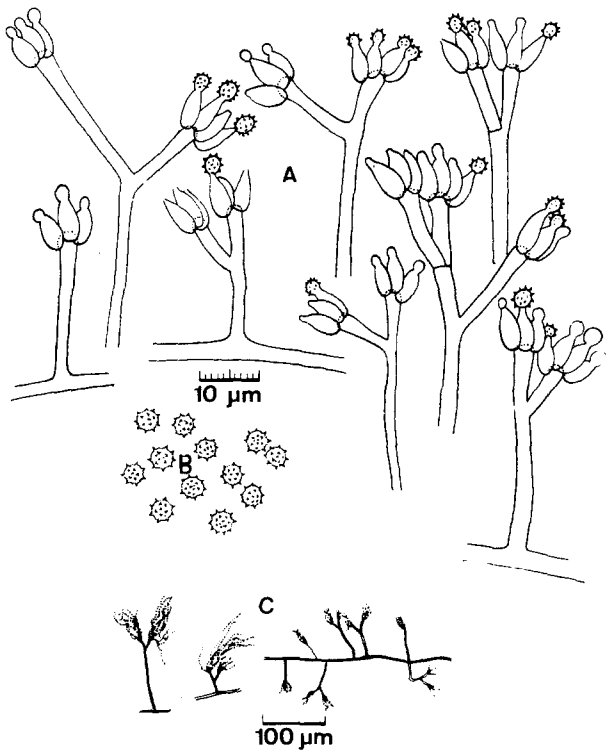

Fig. 3. Camera lucida drawings of *Penicillium granatense* sp. nov., strain IJFM 5965. A: Different types of penicilli. B: Mature conidia. C: Habitat sketches of the penicilli. conidia. C: Habit sketches of the penicilli. (A and B are drawn from slide preparations observed with immesion objective).

strongly divaricate asymmetrical, irregularly branched, sometimes monoverticillate; metulae 8.0 to 15.0 (25.0) µm by 2.0 to 2.5 µm, few in the verticil; phialides 7.0 to 9.0 µm by 2.0 to 3.0 µm, terminating in a very short narrowed neck; conidia strongly echinulate, globose 3.0 to 4.0 µm in diameter, forming loose columns. No ascomata or sclerotia have been observed.

Colonies on Czapek's yeast extract agar spreading more rapidly than on Czapek's agar, attaining a diameter of 45–50 mm in 14 days at room temperature (25 °C), white margin with a very narrow fringe of submerged hyphae, less than 1 mm wide; similar in texture to the above described colonies, but less raised and with numerous radial furrows; sporing abundantly in blue-gray shades (Séguy, Pl. 30, 449) especially in marginal areas; colony surface covered by an overgrowth of white aerial hyphae influencing the colony appearance; exudate colourless; odour faint or lacking; reverse in light cinnamon shades; no diffusing pigment produced. No ascomata or sclerotia have been observed.

Colonies on malt extract agar growing restrictedly, attaining a diameter of 30 to 35 mm in 14 days at room temperature (25 °C), plane, appearing velvety, margin irregularly dissected with a fringe of submerged hyphae extending 2 mm beyond the aerial growth; heavily sporing throughout in dark brown-gray shades; no exudate observed; odor aromatic; reverse in light orange shades; no diffusing pigment produced. Penicilli as described above; conidial chains tangled. No ascomata or sclerotia have been observed.

Penicillium granatense appears most closely related with species classified by Raper and Thom (12) in the *Penicillium nigricans* series of the Divaricata asymmetrica sub-section on account of dark brown colours of the colonies, the rather restricted growth on malt extract agar, and the conspicuously echinulate conidia, but detailed investigations failed to match it with any species described so far. Therefore, it is proposed as a new species with the specific name of *Penicillium granatense* sp. nov. The specific epithet refers to the Andalousian city of Granada (Spain), to which the species has been dedicated.

Species diagnosis is based on the type strain IJFM 5965 isolated from the air in Madrid, Spain, in 1979. It is at present known only from the type locality. A subculture has been deposited with the Centraalbureau voor Schimmelcultures (CBS) Baarn, The Netherlands, and with the fungus collection of the Laboratory of General and Applied Mycology, Instituto 'Jaime Ferrán' de Microbiología, Madrid, Spain.

Latin diagnosis of Penicillium ilerdanum sp. nov. (Fig. 4)

Coloniae in agaro Czapekii lente crescentes, post duas hebdomadas ad 25 °C, 20 mm in diametro attingunt, denso texto basali coacto mycelio, margine sinuoso, planae, velutinae vel funiculosae, superficiebus fructificationibus conidialibus pallido virido-flavis in marginalibus areis et virido-flavis in centrali area; odore levi, indeterminato; exsudatio abest; sine coloris in medio diffluentis; reverso Sienna fusco obscuro vel fusco-viride; neque ascomata neque sclerotia visa sunt. Conidiophora brevia, pleraque minus 60 µm longa, septata, glabra, 3.0–4.0 µm in diametro, pleraque ex substrato et ex reptabundis hyphis vel funiculis exoriuntur; penicilli biverticillati-symmetrici, plerumque sine ramis; metulae 3–6 in numero per verticillum, parallelae 5.0–12.0 µm per 2.0–3.0 µm; phialides lanceolatae, 2–3 in numero per metulam, parallelae, 6.0–11.0 µm per 1.5–3.0 µm; conidia globosa vel subglobosa, levia, 2.0–2.0 µm per 2.0–3.0 µm in diametro, in catenulis flabelliformis.

Coloniae in agaro Czapekii cum extracto levedinis celerior quam in agaro Czapekii crescunt, post duas hebdomadas ad 25 °C, 40 mm attingunt, denso texto basali coacto mycelio, fortiter prominentes et radiatae sulcatae, crateriformae in centrali area; exsudatio abundante, magnae guttae succineo obscurae; odore levi, indeterminato; coloris succineo in medio diffluentis; reverso Sienna fusco. Neque ascomata neque sclerotia visa sunt. Coloniae in agaro hordeaceo, celerior quam in agaro Czapekii crescunt, post duas hebdomadas ad 25 °C, 40 mm in diametro attingunt; laxo texto basali coacto mycelio, velutinae, parum prominentes ad centrum, fortiter sporulantes, superficiebus fructificationibus conidialibus flavoviride colorantur; exsudatio limitato; odore aromatico; sine coloris in medio diffluentis; reverso aurantio tenus viride pallido. Conidiophora brevia, pleraque ex reptabundis aeris hyphis exoriuntur; conidia in catenulis compactis similiter *Cupressus sempervirens*.

Typus cultura IJFM 5596 ex aere urbis Matriti Hispaniorum in anno 1979 isolatus. In collectione fungorum Laboratori Mycologiae Instituti 'Jacobus Ferran Microbiologiae, Matritum Hispaniae et in collectione fungorum Centraalbureau voor Schimmelcultures (CBS) Baarn Batavorum deposita est.

English description of Penicillium ilerdanum sp nov. (Fig. 4)

Colonies on Czapek's agar growing restrictedly, attaining a diameter of 20 mm in 14 days at room temperature (25 °C), plane, velvety in appearance, somewhat funiculose, with some ropes of aerial hyphae, undulating margin surrounded by a narrow fringe of submerged hyphae extending 1 mm beyond the aerial growth; sporing abundantly in yellow-green shades (Séguy, Pl. 24, 357); exudate not observed; odour faint, indefinite; reverse in brownish green shades; diffusing pigment not produced. Stipes of the conidiophores short, smooth-walled, septate, usually less than 60 μm long by 3.0 to 4.0 μM in diameter, mostly arising as short branches from a network of aerial hyphae or from ropes of hyphae, sometimes directly from the substratum; penicilli typically of the Biverticilliata-Symmetrica type, seldom branched; metulae in number of 3 to 6 in the verticil, in parallel clusters, 5.0 to 12.0 μm by 2.0 to 3.0 μm; phialides typically lanceolate, in number of 2 to 3 per verticil, in parallel clusters, 6.0 to 11.0 μm by 1.5 to 3.0 μm; conidia globose to subglobose, smooth-walled, 2.0 to 2.0 μm by 2.0 to 3.0 μm in diameter, forming chains in a fan-like pattern. Colonies on Czapek's yeast extract agar growing more rapidly than above,

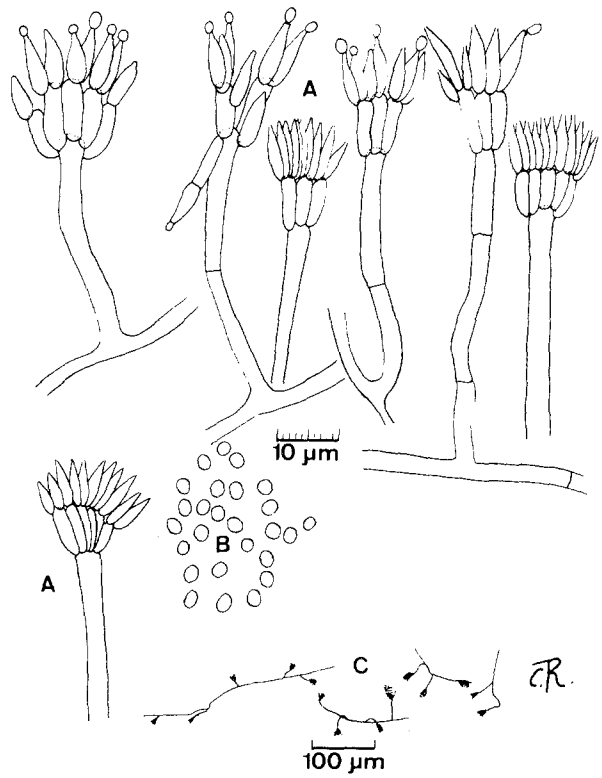

Fig. 4. Camera lucida drawings of *Penicillium ilerdanum* sp. nov., strain IJFM 5596. A: Different types of penicilli. B: Mature conidia. C: habit sketches of the penicilli. (A and B are drawn from unstained slide preparations observed with immersion objective).

attaining a diameter of 40 mm in 14 days at room temperature (25 °C), close-textured, velvety in appearance, raised up to 3 mm deep in colony centre, deeply radiately furrowed, with centre depressed in a crater-like pattern, surface of the colonies in orange shades; strongly pulling the medium apart; exudate abundant, in large dark amber drops, influencing greatly the colony appearance and colour; odour faint, indefinite; reverse in dark burnt Sienna brown shades; amber pigment diffusing into the surrounding agar. Penicilli as above. No ascomata or sclerotia have been observed.

Colonies on malt agar attaining a diameter of 40 mm in 14 days at room temperature (25 °C), loose-textured in marginal areas, which are surrounded by a fringe of submerged hyphae extending 3 mm or more beyond the aerial growth, velvety in appearance, somewhat powdery, gradually raised towards the colony centre up to 1 mm deep; heavily sporing throughout in pale yellow-green shades (Séguy, Pl. 22, 324); exudate limited in

amount; odour aromatic; reverse in orange and green shades; diffusing pigment not produced. Stipes of the conidiophores short, usually arising from a loose network of aerial hyphae and from ropes of hyphae; conidial chains in short and compact columns suggesting cypress trees. No ascomata or sclerotia have been observed.

Penicillium ilerdanum appears most closely related with species classified by Raper and Thom (12) in the *Penicillium funiculosum* series of the Biverticillata-Symmetrica section in view of the fact that the phialides are of the lanceolate-acuminate type and on account of the presence of ropes of hyphae, and that stipes of the conidiophores arise usually from aerial hyphae and ropes of hyphae, but detailed investigations failed to match it with any species described so far. Therefore, it is described an proposed as a new species with the specific name of *Penicillium ilerdanum* sp. nov. The specific epithet refers to the Catalonian city of Lérida (Spain) to which the species has been dedicated.

Species diagnosis is based on the type strain IJFM 5596 isolated from the air in Madrid, Spain, in 1979. It is at present known only from the type locality. A subculture has been deposited with the Centraalbureau voor Schimmelcultures (CBS) Baarn, The Netherlands, and with the fungus collection of the Laboratory of General and Applied Mycology, Instituto 'Jaime Ferrán' de Microbiología, Madrid, Spain.

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