

Aspergillus salviicola, a new species from imported spice

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A new species of *Aspergillus*, *A. salviicola*, has been isolated from Turkish sage, an imported spice in Japan. The species, characterized by white to rosy buff conidial heads, pinkish smooth-walled conidiophores, large biseriata aspergilla, globose smooth-walled conidia, absence of sclerotia and thermotolerant growth, is considered to represent an interface species in the subgenus *Circumdati*.

Key Words—*Aspergillus salviicola*; food-borne fungus; hyphomycete; sage; spice.

During a study of contamination of imported spices with mycotoxigenic fungi, an interesting *Aspergillus* species was isolated from a sample of Turkish sage (dried leaves of *Salvia officinalis* L.) in 1993. This isolate is characterized by white to rosy buff, radiate conidial heads, pinkish, smooth-walled conidiophores, large biseriata aspergilla, absence of sclerotia and somewhat thermotolerant growth, and is thus sufficiently different from all described species of *Aspergillus* to warrant its description as a new species (Raper and Fennell, 1965; Samson, 1979; Pitt et al., 1993).

Aspergillus salviicola Udagawa, Kamiya et Tsubouchi, sp. nov. Fig. 1

Coniatae in agaro Czapekii infirme crescentes, floccosae, adpressae, ex mycelio basali albo sparsim constantes; conidiogenesis inconspicua. Coniatae in agaro "Czapek-yeast extract" (CYA) expansae, paulo floccosae, radiatim sulcatae, ex mycelio basali coacto compacto constantes et hyphis aeriis laxae formantes, albae; conidiogenesis moderata, tarde formans; reversum incoloratum vel aurantio-album vel parum salmoneum. Coniatae in agaro maltoso effusae, velutinae, planae, ex mycelio basali coacto tenuiter constantes; conidiogenesis valde abundans, dilute aurantiaca vel roseo-bubalina, deinde rubro-brunnea vel roseo-vinosa; reversum incoloratum vel griseo-aurantiacum. Coniatae in agaro MY20 expansae, floccosae, planae, ex mycelio basali coacto plus minusve compacto constantes, albae; conidiogenesis sparsa; reversum dilute flavum.

Capitula conidica radiantia, primum alba, deinde roseo-bubalina, 250–400 μm diam. Conidiophora ex mycelio basali oriunda; stipites plus minusve sinuosi, saepe subrosei, 800–2500(–4000) \times 14–22.5 μm , leves, parietibus 2.5–3 μm crassis, superne non constricti; vesiculae globosae vel subglobosae, 45–90 μm diam, incrasatae, in toto fertiles. Aspergilla biseriata; metulae elon-

gatae et superne inflatae, cylindricae, 18–40 \times 5–8(–9) μm ; phialides cylindricae, 8–12.5 \times 3–3.5 μm . Conidia hyalina, primum minute echinulata, deinde levia, globosa vel subglobosa, 3–4 μm diam. Aspergilla deminuentia interdum adsunt, plerumque biseriata. Sclerotia absentia.

Ubiquinonum majus: Q-9.

Holotypus NCI 2090, colonia exsiccata in cultura ex *Salvia officinalis*, condimento ex Turcia advecta, 25.iii.1993, a H. Tsubouchi isolata et ea collectione fungorum Musei et Instituti Historiae Naturalis Chiba (CBM) conservata.

Etymology: derived from *Salvia officinalis*=sage, referring to the material, and *-cola*=dweller.

Colonies on Czapek agar growing very poorly, attaining a diameter of 3–4 mm in 7 days at 25°C and 28–33 mm in 14 days at 25°C, floccose, appressed, consisting of a sparse growth of white basal mycelium; conidiogenesis inconspicuous. Colonies on CYA spreading broadly, attaining a diameter of 63–70 mm in 7 days at 25°C, somewhat floccose, radially sulcate, consisting of a compact felt of basal mycelium, with a surface growth of loose aerial hyphae, white in color; conidiogenesis moderate, tardily formed; margins thin, entire; exudate small, clear; odor fermentative; reverse uncolored to Orange White (M. 5A2, after Kornerup and Wanscher, 1978) or somewhat Salmon (Rayner, 1970). Colonies on malt extract agar (MEA) growing rapidly, attaining a diameter of 65–67 mm in 7 days at 25°C, velvety, plane, consisting of a thin basal felt; surface characterized by very abundant conidiogenesis, Pale Orange (M. 6A3) or Rosy Buff (R), becoming Reddish Brown (M. 9D4) or Rosy Vinaceous (R) in age; margins more or less irregular, broad; exudate small, clear; odor not distinctive; reverse uncolored to Greyish Orange (M. 5B4). Colonies on MY20 agar spreading broadly, attaining of a diameter of 70–75 mm in 7 days at 25°C, floccose, plane, consisting of a rather compact mycelial felt, with loose aerial

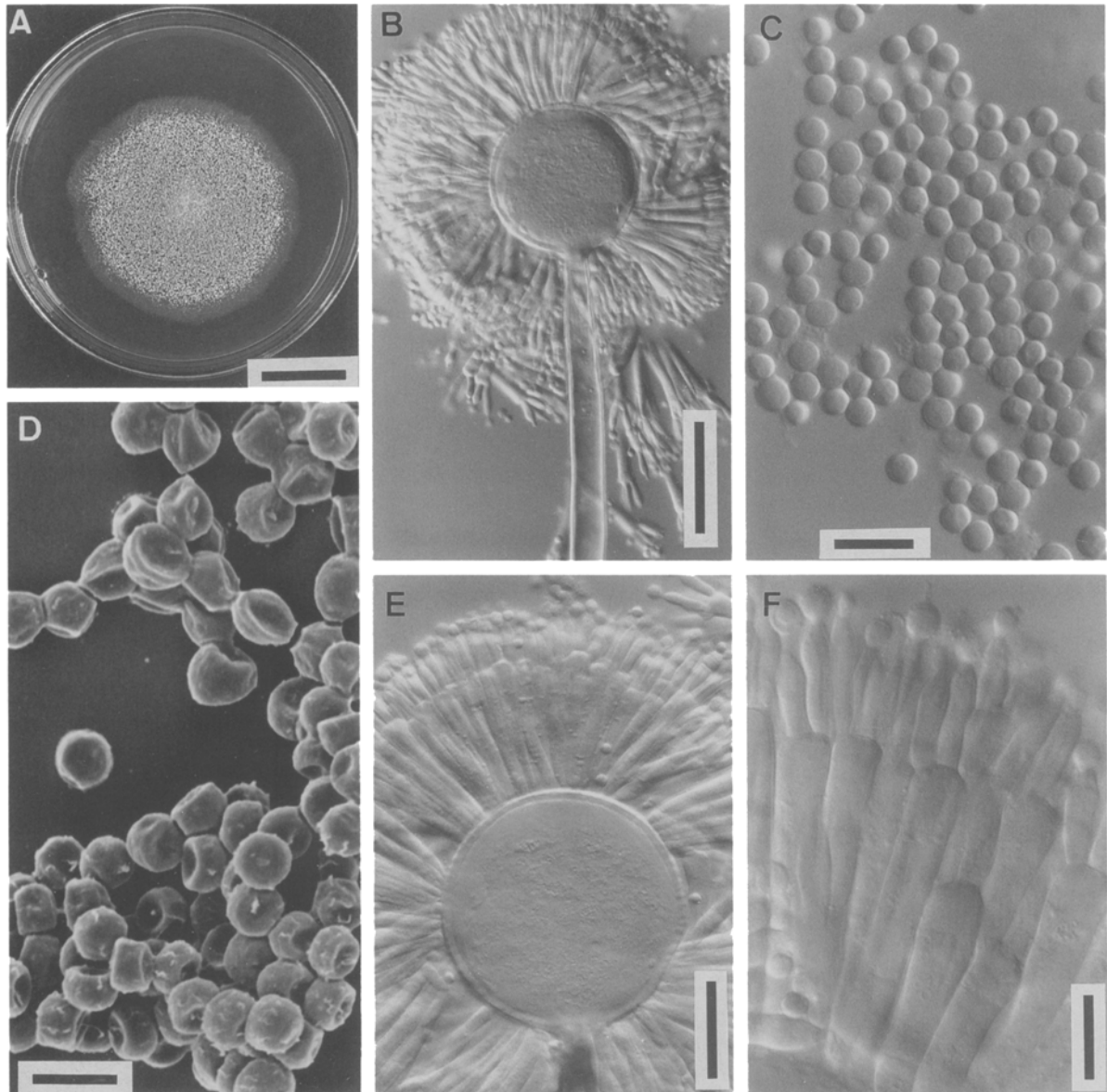


Fig. 1. *Aspergillus salviicola*, NCI 2090.

A. Colony on MEA, 25°C, 7 days. B. Aspergillum. C, D. Conidia (LM and SEM). E, F. Details of metulae and phialides. Scale bars: A=20 mm; B=50 μm ; C=10 μm ; D=5 μm ; E=20 μm ; and F=10 μm .

hyphae and sparse conidial heads, white in color; margins thin, entire; exudate lacking; reverse Light Yellow (M. 4A4).

Conidial heads radiate, splitting into short columns in age, white, then becoming Brownish Orange to Greyish Red (M. 7B-C3) or Rosy Buff (R), 250–400 μm in diam. Conidiophores arising from the basal mycelium; stipes more or less sinuous, often pinkish, 800–2500(–4000) \times 14–22.5 μm , with walls smooth and 2.5–3 μm thick, almost uniform in diam throughout their length (not constricted below the vesicle); vesicles globose to subglobose, 45–90 μm in diam, thick-walled, fertile over the entire surface. Aspergilla biserial, crowded; metulae elongate and swollen above, cylindrical, 18–40 \times 5–8(–9) μm ; phialides cylindrical, 8–12.5 \times 3–3.5 μm . Conidia hya-

line, at first minutely echinulate, then becoming smooth-walled, globose to subglobose, 3–4 μm in diam, often with distinct connectives. Diminutive aspergilla sometimes present, usually biserial. Sclerotia not produced.

Major ubiquinone: Q-9.

At 37°C, growth on Czapek agar is more rapid, attaining a diameter of 62 mm in 7 days, with surface bearing abundant conidial heads.

Temperature relations for 7 days incubation: Growth occurs within the range of 15–45°C (Table 1). Optimum temperature for growth is 30–35°C.

Specimen examined: NCI 2090 (holotype), a dried culture derived from an isolate of sage (leaves of *Salvia officinalis* L.), which was imported from Turkey, 25 March 1993, leg. H. Tsubouchi. The holotype has been

Table 1. Colony diameter (mm) of *Aspergillus salviicola* on three media after 7 days' growth at various temperatures.

Medium*	Temperature (°C)**									
	5	10	15	20	25	30	35	40	45	50
CYA	NG***	NG	NG	3	66	85	90	30	12	NG
MEA	NG	NG	22	47	66	75	67	35	3	NG
PDA	NG	NG	20	42	54	68	64	36	3	NG

* CYA: Czapek yeast extract agar; MEA: malt extract agar; PDA: potato-dextrose agar.

** Data based on averaged growth of triplicate cultures in 90-mm Petri dishes for each set of cultural conditions.

*** No growth.

deposited with the Natural History Museum and Institute, Chiba (CBM), Japan. A representative culture has been deposited at the American Type Culture Collection (ATCC).

The outstanding features of *Aspergillus salviicola* are: (1) restricted growth on Czapek agar at 25°C, (2) white to rosy buff color of its conidial heads, (3) tall, pinkish, smooth-walled conidiophores with large globose vesicles, (4) biseriate aspergilla composed of large metulae and phialides, (5) globose, finally smooth-walled conidia, and (6) absence of sclerotia.

The general characteristics of *A. salviicola* are suggestive of the subgenus *Circumdati* W. Gams et al. in *Aspergillus* (Gams et al., 1985; Klich and Pitt, 1988), particularly the species in three sections (*Circumdati*, *Candidi* and *Cremeri*) of that subgenus. However, the proper placement of *A. salviicola* remains in doubt, as shown in Table 2. Within these sections, *A. salviicola* somewhat resembles *A. dimorphicus* Mehrotra et Prasad and *A. ochraceoroseus* Bartoli et Maggi, which have cinnamon-buff or pinkish tan conidial heads and smooth conidiophores, and which lack sclerotia, but differs from these two species in its larger conidiophore and vesicle dimensions (viz. 225–450(–750) µm long conidiophores and 15–37.5 µm diam vesicles in *A. dimorphicus*, and 800–

1500 µm long conidiophores and 35–50 µm diam vesicles in *A. ochraceoroseus*, respectively), and its spread growth at 37°C versus no growth in the two species (Mehrotra and Prasad, 1969; Bartoli and Maggi, 1978; Christensen, 1982).

Literature cited

Bartoli, A. and Maggi, O. 1978. Four new species of *Aspergillus* from Ivory Coast soil. *Trans. Br. Mycol. Soc.* **71**: 383–394.

Christensen, M. 1982. The *Aspergillus ochraceus* group: Two new species from western soils and a synoptic key. *Mycologia* **74**: 210–225.

Gams, W., Christensen, M., Onions, A. H., Pitt, J. I. and Samson, R. A. 1985. Infrageneric taxa of *Aspergillus*. In: "Advances in *Penicillium* and *Aspergillus* systematics," (ed. by Samson, R. A. and Pitt, J. I.), pp. 55–62. Plenum Press, New York.

Klich, M. A. and Pitt, J. I. 1988. "A laboratory guide to common *Aspergillus* species and their teleomorphs," Commonwealth Scientific and Industrial Research Organization, Division of Food Processing, North Ryde. 116 p.

Kornerup, A. and Wanscher, J. H. 1978. "Methuen handbook of colour, 3rd ed.," Eyre Methuen, London. 252 p.

Kuraishi, H., Itoh, M., Tsuzaki, N., Katayama, Y., Yokoyama, T. and Sugiyama, J. 1990. The ubiquinone system as a taxonomic aid in *Aspergillus* and its teleomorphs. In: "Modern concepts in *Penicillium* and *Aspergillus* classification," (ed. by Samson, R. A. and Pitt, J. I.), pp. 407–421. Plenum Press, New York.

Mehrotra, B. S. and Prasad, R. 1969. *Aspergillus dimorphicus* and *Emericella cleistominuta* spp. nov. from Indian soils. *Trans. Br. Mycol. Soc.* **52**: 331–349.

Pitt, J. I., Samson, R. A., Ahti, T., Farjon, A. and Landolt, E. 1993. "Names in current use in the families Trichocomaceae, Cladoniaceae, Pinaceae and Lemnaceae," International Association for Plant Taxonomy, Koeltz Sci. Books, Königstein. 57 p.

Raper, K. B. and Fennell, D. I. 1965. "The genus *Aspergillus*," Williams and Wilkins, Baltimore. 686 p.

Rayner, R. W. 1970. "A mycological colour chart," Common-

Table 2. Comparison of diagnostic characteristics of some sections in the subgenus *Circumdati* similar to *Aspergillus salviicola*.

Characteristic	<i>A. salviicola</i>	<i>Circumdati</i>	<i>Candidi</i>	<i>Cremeri</i>
Conidial heads	radiate, splitting into columns; white to rosy buff in age	radiate, splitting into columns; yellow, buff or ochre	radiate, splitting into columns; white or nearly white	loosely radiate; pale brown, yellow or blue-green
Conidiophores	pinkish, smooth, not constricted	hyaline to pale brown, smooth to rough, not constricted	hyaline, smooth to rough, not constricted	hyaline, smooth, constricted just below the vesicle
Aspergilla	biseriate	biseriate	biseriate	uniseriate, biseriate or mixed
Conidia	globose, smooth	globose, ovate or ellipsoidal, smooth to rough	globose, smooth	ellipsoidal, rough to echinulate
Sclerotia	not produced	often produced, varying in color	often produced, purple to black	not produced (ascomata produced)
Ubiquinone	Q-9	almost Q-10 (H ₂)*	Q-10 (H ₂)*	Q-9*

* Data from Kuraishi et al. (1990).

wealth Mycological Institute, Kew and British Mycological Society.
Samson, R. A. 1979. "A compilation of the Aspergilli de-

scribed since 1965," Studies in Mycology. No. 18, Centraal bureau voor Schimmelcultures, Baarn. 38 p.