

## *Fennellia flavipes* and *Neosartorya stramenia*, two new records from Japan

Takashi Yaguchi<sup>1)</sup>, Ayako Someya<sup>1)</sup> and Shun-ichi Udagawa<sup>2)</sup>

<sup>1)</sup> Pharmaceutical Research Center, Meiji Seika Kaisha, Ltd., 760 Morooka-cho, Kohoku-ku, Yokohama 222, Japan

<sup>2)</sup> Nodai Research Institute, Tokyo University of Agriculture, 1-1, Sakuragaoka 1-Chome, Setagaya-ku, Tokyo 156, Japan

Accepted for publication 24 March 1994

**Two interesting species of cleistothecial Ascomycetes with *Aspergillus* anamorphs are described: *Fennellia flavipes* and *Neosartorya stramenia*. Both species were isolated from soil samples collected in 1992 as a new record to Japan.**

**Key Words**—Ascomycetes; *Aspergillus flavipes*; *Aspergillus paleaceus*; *Fennellia flavipes*; Japan; *Neosartorya stramenia*; soil fungi; Trichocomaceae.

During our continuous survey of soil-borne microfungi in Japan, two interesting cleistothecial Ascomycetes with *Aspergillus* anamorphs (Trichocomaceae, Eurotiales) were isolated. These were identified as *Fennellia flavipes* Wiley et Simmons and *Neosartorya stramenia* (Novak et Raper) Malloch et Cain. Because of their rarity world-wide, these two noteworthy fungi are here described as a new Japanese record. Color nomenclatures are from the Kornerup and Wanscher (1978) color handbook and the Rayner (1970) color chart, and are referred to with the letters M and R, respectively.

*Fennellia flavipes* Wiley et Simmons, Mycologia 65: 937, 1973. Fig. 1

Anam.: *Aspergillus flavipes* (Bain. et Sart.) Thom et Church, The Aspergilli: 155, 1926.

Basynonym: *Sterigmatocystis flavipes* Bain. et Sart., Bull. Soc. Mycol. France 27: 90–96, 1911.

Colonies on Czapek agar (CzA) growing rather rapidly, attaining a diam of 26 mm in 7 days and 50–55 mm in 14 days at 25°C, deeply floccose, loose-textured, Yellowish White (M. 3A2–4A2) or Straw (R); ascostromata lacking; conidiogenesis sparse; reverse Pale Yellow (M. 3A3) or Primrose (R). Colonies on Czapek yeast extract agar (CYA) growing rapidly, attaining a diam of 33–35 mm in 7 days and 60–65 mm in 14 days at 25°C, velvety to floccose, radially furrowed, consisting of a thick basal felt, White to Pale Yellow (M. 1A3) or Suphur Yellow (R); ascostromata slowly developing and not affecting the colony appearance within 14 days; conidiogenesis lacking or very inconspicuous; reverse Greyish Yellow (M. 4B6) with a Light Brown (M. 7D4) tint or Ochreous (R) with a Fawn (R) tint. Colonies on malt extract agar (MEA) growing restrictedly, attaining a diam of 15–20 mm in 7 days and 25–30 mm in 14 days at 25°C, floccose, irregularly wrinkled, consisting of a thin basal

felt, Light Yellow (M. 3A5) or Pure Yellow (R); ascostromata abundantly produced on the felt, loosely covered by aerial hyphae and conidial heads; conidiogenesis moderate but not affecting the colony appearance; reverse Greyish Orange (M. 5B5) or Ochreous (R). Colonies on oatmeal agar (OA) growing rather rapidly, attaining a diam of 21–23 mm in 7 days and 37–45 mm in 14 days at 25°C, floccose, plane, consisting of a thin basal mycelium, Light Yellow to Yellow (M. 2A5–3A8) or Pure Yellow (R); ascostromata abundantly produced on the vegetative mycelium and intermixed with conidial heads; conidiogenesis profuse, Reddish Grey (M. 9B2) or Pale Vinaceous (R); reverse Pale Yellow (M. 2A3–3A3) or Straw (R).

Ascostromata scattered on the basal mycelium, yellow, globose to elongate, 600–800 µm in diam, enveloped by masses of hülle cells, containing 1–8(–15) ascospores; hülle cells rounded to elongate, hyaline to yellow, thick-walled, often curved, 10–32 × 2.5–6 µm. Ascospores Pure Yellow (R), non-ostiolate, globose to subglobose, 70–120 µm in diam, with walls consisting of several layers of thin-walled hypha-like cells, maturing within 50–60 days at 25°C. Asci irregularly disposed, singly borne from croziers, 4–8-spored, subglobose to pyriform, 12–16 × 10–14 µm, evanescent at maturity. Ascospores hyaline to pale yellow, globose to broadly ovoid, 6–8 × 4.5–6 µm, smooth-walled.

Conidial heads radiate to loosely columnar, white to Pale Vinaceous (R). Conidiophores arising from the basal mycelium or aerial hyphae; stipes straight, 300–1120 × 4–8 µm, smooth-walled or partially finely roughened, thick-walled, often pale yellowish, remotely septate; vesicles spathulate to subglobose, 13–18 µm in diam. Aspergilla biseriolate; metulae 5.5–8 × 2.5–3.5 µm, covering the upper two-thirds of the vesicle; phialides 5.5–8 × 2–3 µm. Conidia hyaline, globose to subglobose, 2–3 µm in diam, smooth-walled.

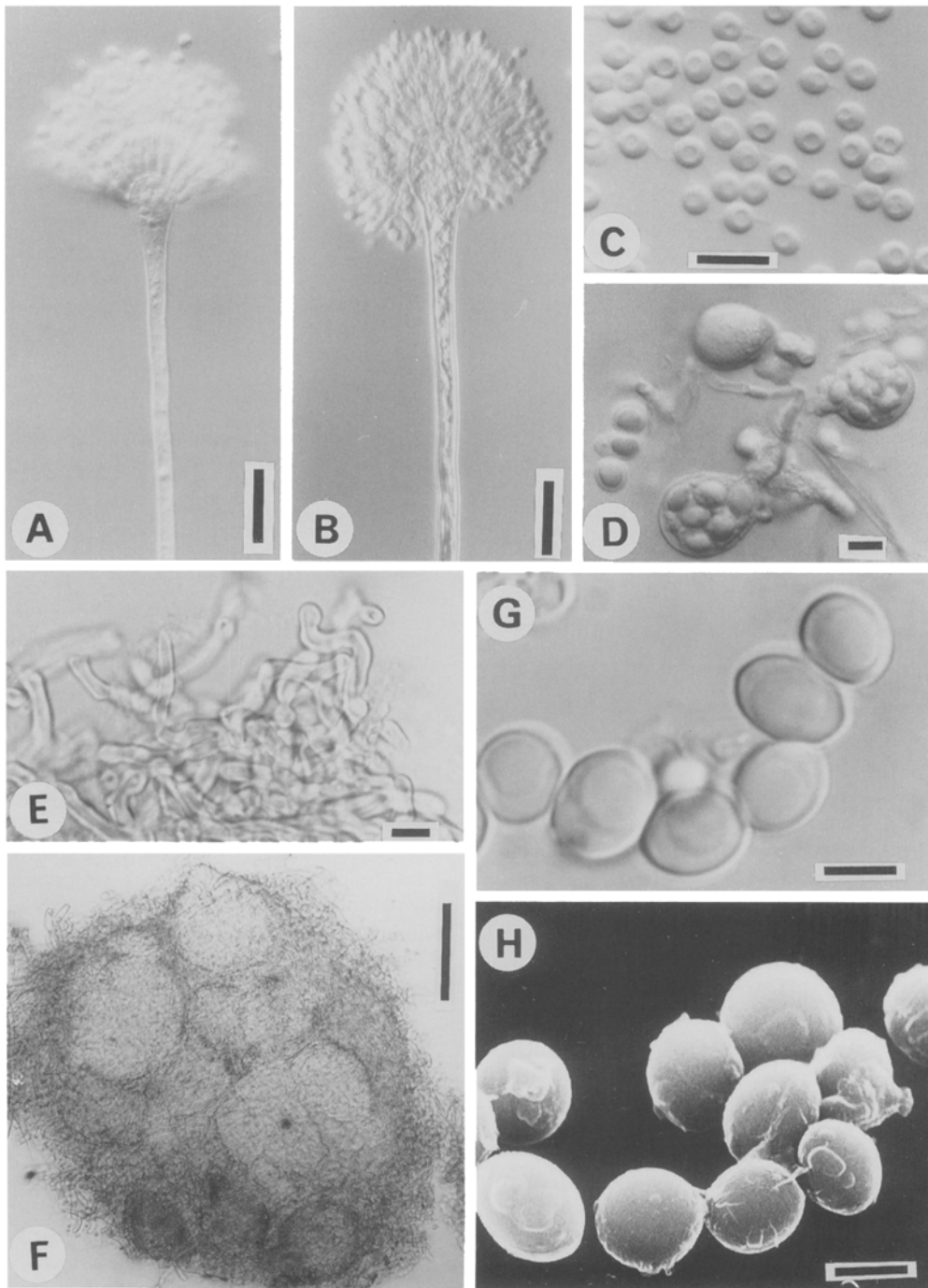


Fig. 1. *Fennellia flavipes*, PF 1146.

A, B. Aspergilla. C. Conidia. D. Asci. E. Hülle cells. F. Ascstroma containing ascomata. G. Ascospores. H. Ascospores (SEM). Scale bars: A, B=10  $\mu$ m. C-E, G, H=5  $\mu$ m. F=100  $\mu$ m.

At 37°C, colonies on all media growing more rapidly than at 25°C.

Specimen examined: PF 1146, a dried culture derived from an isolate of soil, Kohoku-ku, Yokohama-shi, Kanagawa-ken, Japan, 15 May 1992, collected by T. Yaguchi.

The genus *Fennellia* was erected by Wiley and Sim-

mons (1973) for an ascigerous state of *Aspergillus flavipes*, bearing bright yellow ascostromata. The ascostromata develop within the ascostromata, a mass of loosely interwoven narrow hyphae and elongate hülle cells after 2-3 months of incubation, not every strain of *A. flavipes* producing them (Domsch et al., 1980; Subramanian and Rajendran, 1981).

A few minor discrepancies occur between the Japanese isolate and the type strain QM 9131 of *F. flavipes*. The strain PF 1146 agrees in essential morphological characters with the type, but differs in having mostly 8-spored asci and ascospores almost without trace of equatorial grooves. In 1973, Wiley and Fennell called attention to the fact that the cleistothecia of *A. flavipes* bear some resemblance to those described for *Aspergillus rehmsii* Zukai. According to them, Zukai described the ascocarps of *A. rehmsii* as being surrounded

by dense yellow mycelium containing hülle cells like those of *Aspergillus nidulans* but smaller and fewer in number. Furthermore, the asci of *A. rehmsii* contain up to eight smooth, thick-walled, dark gray spores, and those of *A. flavipes* contain four smooth, hyaline to yellow spores with inconspicuous equatorial grooves. The characters of the asci and ascospores of the strain PF 1146 are thus somewhat suggestive of those of *A. rehmsii*. In the other characters of *A. rehmsii* such as the ascocarp wall illustrated as being composed of regular rows of

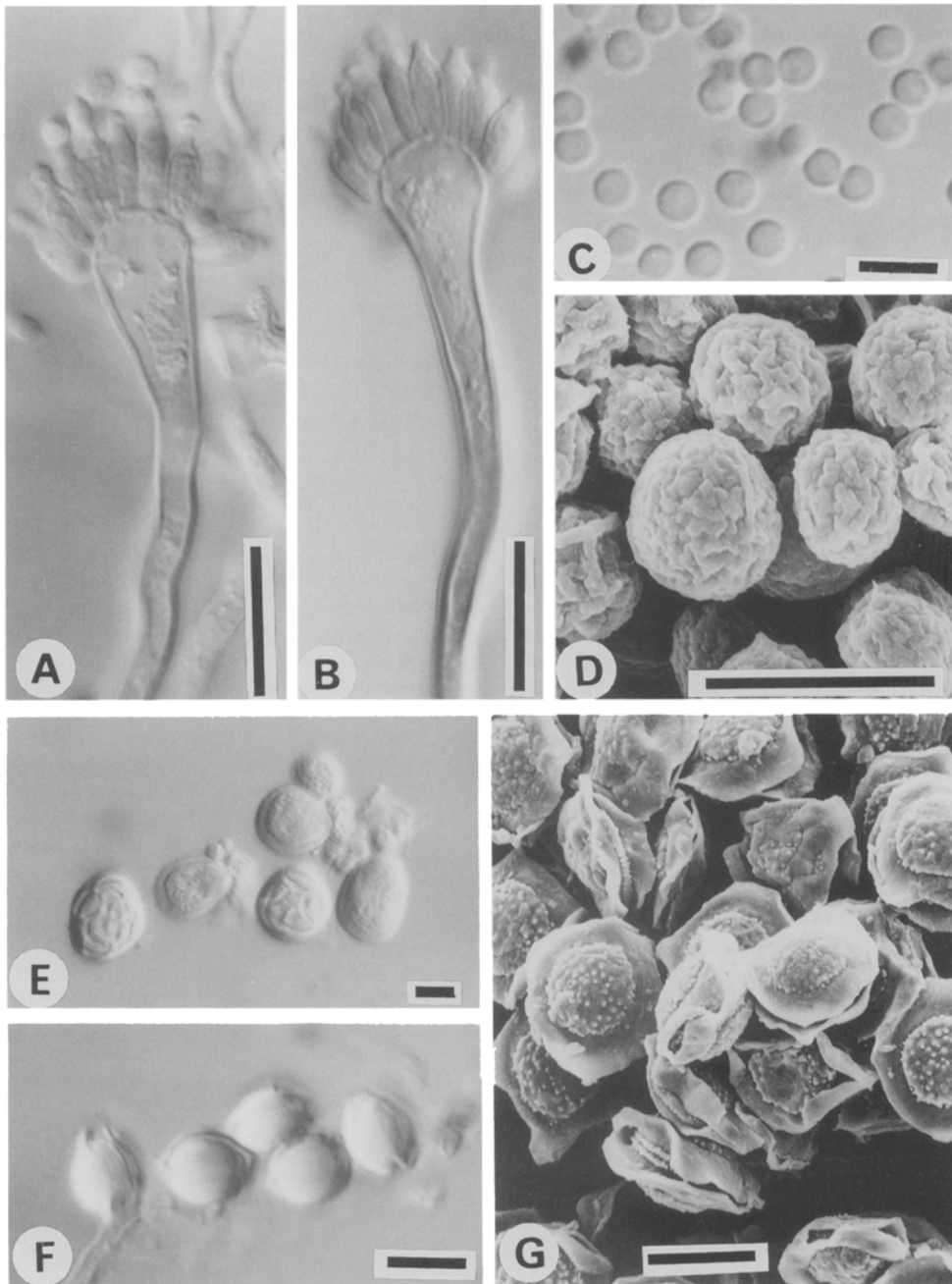


Fig. 2. *Neosartorya stramenia*, PF 1147.

A, B. *Aspergilla*. C. Conidia. D. Conidia (SEM). E. Asci. F. Ascospores. G. Ascospores (SEM). Scale bars: A, B=10  $\mu$ m. C-G=5  $\mu$ m.

black cortical cells and dark gray ascospores, however, its placement to the genus *Fennellia* still remains in doubt.

*Neosartorya stramenia* (Novak et Raper) Malloch et Cain, Can. J. Bot. **50**: 2622, 1972. Fig. 2

Basionym: *Aspergillus stramenius* Novak et Raper, in Raper and Fennell, The genus *Aspergillus*: 260, 1965 (*nom. holo*).

Anam.: *Aspergillus paleaceus* Samson et W. Gams, in Samson and Pitt (ed.), *Advances in Penicillium and Aspergillus Systematics*: 50, 1985.

Colonies on CzA growing restrictedly, attaining a diam of 5–6 mm in 7 days at 25°C, plane, thin, with vegetative mycelium submerged, Dull Yellow (M. 3B4) or Amber (R); ascomata usually lacking; conidiogenesis sparse, Greyish Green (M. 25B4), not affecting the colony appearance; reverse Light Orange (M. 5A5) or Luteous (R). Colonies on CYA growing rather restrictedly, attaining a diam of 20–23 mm in 7 days at 25°C, velvety, plane, consisting of a thin basal felt, Pastel Yellow (M. 2A4) or Pure Yellow (R); ascomata lacking; conidiogenesis moderate, Greyish Green (M. 25B4); reverse Greyish Orange (M. 6B5) or Apricot (R). Colonies on MEA growing rapidly, attaining a diam of 27–30 mm in 7 days and 48 mm in 14 days at 25°C, velvety, plane or radially furrowed, consisting of a thin basal felt, Orange (M. 6B7; R); ascomata scattered on the felt, intermixed with conidial heads; conidiogenesis sparse to moderate, Greyish Green (M. 25B4); reverse Orange Red (M. 8B7) or Scarlet (R). Colonies on OA growing rather rapidly, attaining a diam of 28–30 mm in 7 days and 54–55 mm in 14 days at 25°C, plane, thin, more or less floccose, granular in appearance due to the production of abundant ascomata, Light Yellow (M. 3A5) or Pure Yellow (R); conidiogenesis profuse, Greyish Green (M. 25C3–25B4) or Glaucous Blue-Green (R); reverse Light Yellow (M. 2A4) or Pure Yellow (R).

Ascomata scattered on the basal mycelium, non-ostiolate, globose to subglobose, 35–170  $\mu\text{m}$  in diam, densely covered by yellow-pigmented hyphae, maturing within 14 days at 25°C. Asci 8-spored, globose to subglobose or pyriform, 12–16  $\times$  10–14  $\mu\text{m}$ , evanescent at maturity. Ascospores hyaline to pale yellow, lenticular, totally 6.5–7.5  $\times$  4–5  $\mu\text{m}$ , excl. crests 5–6.5  $\mu\text{m}$  long, provided with two equatorial crests which are somewhat widely separated and up to 1–1.5  $\mu\text{m}$  wide, with convex surfaces finely roughened (spinulose under SEM). Ascoma initials developing as small, tight coils measuring 6.5–7  $\mu\text{m}$  in diam.

Conidial heads loosely columnar, Glaucous Blue-Green (R), up to 65–100  $\mu\text{m}$  long. Conidiophores arising from the basal mycelium or aerial hyphae; stipes sinuous,

hyaline to slightly purplish below and yellowish green in the upper part, 40–150  $\times$  3–7  $\mu\text{m}$ , septate, smooth and fairly thick-walled; vesicles flask-shaped, 8–14  $\mu\text{m}$  in diam. Aspergilla uniseriate; phialides cylindrical, 4–6  $\times$  2.5–3.5  $\mu\text{m}$ , covering the upper one-half to two-thirds of the vesicle. Conidia hyaline to pale colored, globose to subglobose, 2.5–3(–3.5)  $\mu\text{m}$  in diam, delicately roughened (micro-verrucose under SEM).

At 37°C, colonies on all media growing more rapidly than at 25°C; ascoma production observed on OA abundantly.

Specimen examined: PF 1147, a dried culture derived from an isolate of soil, Kagoshima-shi, Kagoshima-ken, Japan, 24 Sept. 1992, collected by T. Yaguchi.

*Neosartorya stramenia* is a readily recognisable species: colonies growing very restrictedly on CzA at 25°C, and on MEA and OA produce pure yellow ascomata; microscopically ascospores are characterized by prominent equatorial crests and delicately roughened surfaces. The conidial ornamentation of this species, as revealed by the SEM, is also distinct (Kozakiewicz, 1989).

Because *N. stramenia* has not been reported in the literature since it was originally described as a soil-borne from Wisconsin in 1965, it is probably a rare fungus (Raper and Fennell, 1965).

#### Literature cited

- Domsch, K. H., Gams, W. and Anderson, T.-H. 1980. "Compendium of soil fungi, Vol. 1," Academic Press, London. 859 p.
- Kornerup, A. and Wanscher, J. H. 1978. "Methuen handbook of colour, 3rd ed," Eyre Methuen, London. 252 p.
- Kozakiewicz, Z. 1989. "Aspergillus species on stored products," Mycological Papers, No. 161. CAB International Mycological Institute, Kew. 188 p.
- Malloch, D. and Cain, R. F. 1972. The Trichocomataceae: Ascomycetes with *Aspergillus*, *Paecilomyces*, and *Penicillium* imperfect states. Can. J. Bot. **50**: 2613–2628.
- 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," Commonwealth Mycological Institute, Kew and British Mycological Society.
- Samson, R. A. and Gams, W. 1985. Typification of the species of *Aspergillus* and associated teleomorphs. In: "Advances in *Penicillium* and *Aspergillus* systematics," (ed. by Samson, R. A. and Pitt, J. I.), pp. 31–54. Plenum Press, New York.
- Subramanian, C. V. and Rajendran, C. 1981. Developmental morphology of Ascomycetes. VII. *Fennellia flavipes*. Cryptog. Mycol. **2**: 85–99.
- Wiley, B. J. and Fennell, D. I. 1973. Ascocarps of *Aspergillus stromatooides*, *A. niveus*, and *A. flavipes*. Mycologia **65**: 752–760.
- Wiley, B. J. and Simmons, E. G. 1973. New species and a new genus of Plectomycetes with *Aspergillus* states. Mycologia **65**: 934–938.