

Taxonomic study on species of *Agrocybe* (*Strophariaceae*, *Agaricales*) collected on dung from Punjab, India

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ABSTRACT

This paper gives an account of two *Agrocybe* species, viz. *A. microspora* and *A. pediades* collected from coprophilous habitats of Punjab state. The taxonomic details of these taxa is given along with the drawings of their morphological and anatomical features. *Agrocybe microspora* forms a new record for India and *A. pediades* is being recorded for the first time from Punjab.

Key words: Basidiomycota, clamp connections, coprophilous, systematics

INTRODUCTION

The genus *Agrocybe* Fayod is characterized by medium to large, dull colored, never deliquescent carpophores; fleshy, convex, semiglobate or applanate, not plicate-sulcate pileus; adnate to adnexed lamellae; white, buff or ochraceous, smooth or fibrillose, mostly annulate stipe, often with basal white rhizomorphs; ellipsoidal basidiospores; vesiculose to lageniform or cylindrical cheilocystidia; absence of chrysocystidia; presence of cellular pileus cuticle; and clamp connections.

The world over 100 species of *Agrocybe* are known (Kirk *et al.*, 2008). MycoBank shows 140 records of the genus till March 25, 2014. As compared to this, 13 species of this genus namely *A. broadwayi*, *A. calicutensis*, *A. fimicola*, *A. guruvayoorensis*, *A. manihotis*, *A. manihotis* var. *microspora*, *A. munnarensis*, *A. musicola*, *A. pediades*, *A. retigera*, *A. semiorbicularis*, *A. temulenta* and *A. wayanadensis* are reported from South India (Natarajan and Raaman, 1983; Natarajan and Purusothama, 1989; Thomas and Manimohan, 2003) while 7 species namely *A. cubensis*, *A. lazoi*, *A. pediades*, *A. platensis*, *A. semiorbicularis*, *A. sororia* and *A. xuchilensis* from North India (Hennings, 1901; Rawla *et al.*, 1982; Saini and Atri, 1982; 1995; Atri *et al.*, 1992; 2000). *Agrocybe guruvayoorensis* was reported growing on elephant dung from Kerala (Thomas and Manimohan, 2003; Manimohan *et al.*, 2007). Rawla *et al.* (1982) recorded *A. semiorbicularis* growing on unspecified dung from Chandigarh. Presently two species of *Agrocybe*, namely *A. microspora* and *A. pediades*, have been documented growing on dung from Punjab. These are described in this paper.

MATERIAL AND METHODS

The standard methodology and terminology as described by Singer (1986), Pegler (1977, 1986) and Atri *et al.* (2005) were used for collecting and describing the agarics. The colour terminology used for macroscopic description is that of Kornerup and Wanscher (1978). The specimens were preserved according to the techniques given by Smith (1949) and Atri and Saini (2000). The drawings of microscopic details were made with the aid of camera lucida under an oil immersion lens. All the collections examined have been deposited in the Herbarium of Botany Department, Punjabi University, Patiala (Punjab), India

under PUN.

KEY TO THE INVESTIGATED COPROPHILOUS SPECIES OF GENUS *AGROCYBE*

1 Pileus surface yellowish white with grayish brown scales; lamellae free to adnexed; basidiospores 5.9-10 x 4.2-5.9 μ m; pleurocystidia present.....*A. microspora*

1' Pileus surface brownish yellow to yellowish brown, with reddish yellow shades, scales absent; lamellae broadly adnate to sub-decurrent; basidiospores 9.3-13 x 6-9.3 μ m; pleurocystidia absent.....*A. pediades*

TAXONOMIC DESCRIPTIONS

i) *Agrocybe microspora* Singer in *Sydowia* 30(1-6): 205, 1977. **Fig. 1 (A-F)**

Carpophores 5-9.3 cm in height; Pileus 1.8-3.8 cm broad, convex; surface dry, yellowish white (2A₂); pileal veil scaly, scales appressed fibrillose, grayish brown (6D₃); margin irregular, splitting at maturity, non-striate, appendiculate in some carpophores; cuticle fully peeling; flesh thin, 0.1 cm thick, yellowish white, unchanging; taste not distinctive; odor mild. Lamellae free to adnexed, unequal, crowded, broad, up to 0.6 cm broad, brown (7F₄); gill edges smooth. Spore print brown (7F₄). Stipe central, 4.6-9.1 cm long, 0.6- 0.7 cm broad, cylindrical, equal in diameter throughout, first solid then hollow, surface yellowish white (2A₂), extensively fibrillose on the upper half; lesser scales towards the base; annulus absent.

Basidiospores 5.9-10 x 4.2-5.9 μ m (Q = 1.57), ellipsoidal, with a small truncate germ pore, thick-walled, smooth, yellowish brown. Basidia 14-20 x 6.7-9.3 μ m, clavate, 2-, 4-spored, thin-walled, hyaline; sterigmata 1.7-5 μ m long. Gill edges heteromorphous. Cheilocystidia 59.5-105 x 20-24 μ m, elongated clavate, thin-walled, hyaline. Pleurocystidia 68-85 x 37.4-59.5 μ m, inflated clavate, projecting well beyond the hymenium, thin-walled, hyaline. Pileus cuticle cellular, cells 17-29 x 7-17 μ m, globose to piriform, thin walled, hyaline; pileus context homoiomerous, made up of septate, interwoven 4.3-7 μ m broad hyphae. Hymenophoral trama regular, composed of thin-walled 3.4-6.7 μ m broad hyphae. Subhymenium pseudoparenchymatous. Stipe context made up of parallel, thin-walled 3.4-12 μ m broad hyphae. Clamp connections present in pileus and stipe context hyphae.

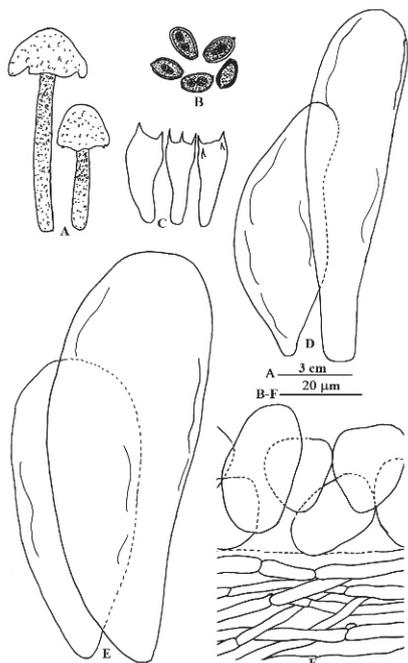


Fig. 1(A-F) *Agrocybe microspora*: A) Carpophores; B) Basidiospores; C) Basidia; D) Cheilocystidia; E) Pleurocystidia; F) Cross section through pileus showing cellular cuticular elements.

Chemical reaction: Basidiospores grayish brown in concentrated H_2SO_4 and dark grayish brown in KOH (5%).

Collection examined: Punjab, Patiala, Bahadurgarh (251 m), growing in groups on manured soil in a cattle pasture, Munruchi Kaur and Yadwinder Singh, PUN 4835, May 28, 2008.

Discussion: The details of this specimen are in agreement with those given for *A. microspora* by Singer (1977) except for the presence of 2-spored basidia along with 4-spored basidia. It belongs to section *Microspora* Singer as it possesses thin-walled cystidia and basidiospores with small germ pore (Watling and Taylor, 1987). *Agrocybe neocoprophi* Sing. belonging to the same section is quite close which can be differentiated from this species in having larger spores measuring $11-16.5 \times 7.5-9.2 \mu m$ (Singer, 1977) as compared to $5.9-10 \times 4.2-5.9 \mu m$ spores in the presently examined collection. It is a new fungus record for India.

ii) *Agrocybe pediades* (Pers.: Fr.) Fayod in *Ann. Sci. Nat. Bot. Ser.* **79**: 359, 1889.

Basionym:

Agaricus pediades Fries in *Systema Mycologicum* **1**: 290, 1821.

Synonyms:

Agaricus pusillus Schaeffer in *Fung. Bavar. Palat. Nasc.* **4**: 45, 1774.

Agaricus semiorbicularis Bulliard in *Herb. France* **9**: 422, 1789.

Agaricus arenicola Berkeley in *London J. Bot.* **2**: 511, 1843.

Naucoria pediades (Fries) P. Kummer in *Der Führer in die*

Pilzkunde p. 78, 1871.

Simocybe pediades (Fries) P. Karsten in *Rysslands, Finlands och den Skandinaviska halföns Hattsvampar. Första Delen: Skifsvampar* p. 427, 1879.

Naucoria arenaria Peck in *Bull. New York State Mus.* **157**: 29, 1912.

Naucoria subpediades Murrill in *Lloydia* **5**: 150, 1942.

Agrocybe splendida Cléménçon in *Nova Hedwigia* **28**(1): 8, 1977.

Figs. 2(A-F) and 3(A-G)

Carpophores up to 5.7 cm in height; Pileus up to 2.4 cm broad, subglobose to convex, exumbonate; surface brownish yellow ($5C_8$) to yellowish brown ($5E_8$), with reddish yellow ($4A_8$) shades, moist, glabrous, smooth, hygrophanous, fading to buff brown; margin regular, not splitting at maturity, non-striate, with hanging velar remnants; cuticle not peeling; flesh thin, 0.2 cm thick, pale, changing to brown where bruised, non-deliquestent; taste and odor mild. Lamellae broadly adnate to sub-decurrent, unequal, 3-sized, ventricose, distant, moderately broad, fragile, light brown. Spore print dark brown ($6F_7$). Stipe central, up to 5.5 cm long, 0.4 cm broad, cylindrical, slightly bulbous at both ends, solid, surface brownish yellow ($5C_8$), not bluing, with powdery squamules, shiny; partial veil evanescent, with scattered remains adhering to the stipe.



Fig. 2(A-F) *Agrocybe pediades*: A) Carpophores; B) Lamellae arrangement; C) Basidiospores; D) Cheilocystidium; E) Pileus cuticle elements; F) Clamp connections in pileus context. Bars C-F 10 m.

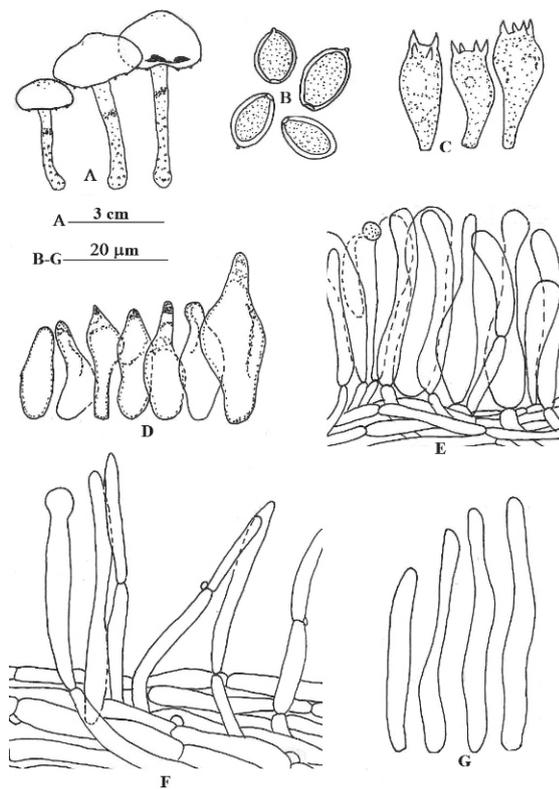


Fig. 3(A-G) *Agrocybe pediades*: A) Carpophores; B) Basidiospores; C) Basidia; D) Cheilocystidia; E) Pileus cuticle; F) Stipe cuticle; G) Caulocystidia.

Basidiospores $9.3\text{--}13 \times 6\text{--}9.3 \mu\text{m}$ ($Q = 1.45$), ovoid to ellipsoidal, with a truncate germ pore, thick-walled, smooth, brownish golden. Basidia $18.8\text{--}23.8 \times 7.5\text{--}10 \mu\text{m}$, clavate, 4-spored, sterigmata $2.5\text{--}4.3 \mu\text{m}$ long. Gill edges sterile. Cheilocystidia $17\text{--}34 \times 6.8\text{--}12 \mu\text{m}$, crowded, polymorphic, cylindrical, lageniform to ventricose fusoid, with acute or round apex, thin-walled, hyaline, some with granular apices. Pleurocystidia absent. Pileus cuticle hymeniform, composed of cylindrical, clavate to ventricose fusoid, $2.5\text{--}8.5 \mu\text{m}$ broad cellular elements; pileus context made up of interwoven $3.4\text{--}10 \mu\text{m}$ broad hyphae. Hymenophoral trama regular, composed of thin-walled $3.4\text{--}6.8 \mu\text{m}$ broad hyphae. Subhymenium pseudoparenchymatous. Stipe cuticle having projecting septate elements along with occasional caulocystidia; context hyphae parallel, loosely arranged, thin-walled, $3.5\text{--}20.5 \mu\text{m}$ broad; caulocystidia $35.7\text{--}47.7 \times 5\text{--}6.8 \mu\text{m}$, cylindrical, filamentous, thin-walled, hyaline. Clamp connections present throughout.

Collections examined: Punjab, Sangrur, Kelon (231m), growing in groups on mixed cattle dung, Amandeep Kaur, PUN 4226, August 14, 2008.

Discussion: The above examined collection has been identified as *A. pediades*. All its macroscopic and microscopic details are in conformity with those given by Watling (1982) and Watling and Taylor (1987) for this species. It is recognized by the smooth pileus surface which is brownish yellow with some reddish shades, appendiculate pileal margin and powdery squamulose stipe with scattered remnants of evanescent annulus.

Watling (1982) reported the species growing in sand-dunes and on rabbit pellets from Scotland. Watling and Taylor (1987) reported it growing on soil from New Zealand. Thomas and Manimohan (2003) recorded *A. pediades* growing gregarious to scattered on sandy soil and among plant debris from Kerala in South India. An earlier report from North India is by Hennings (1901). Here, the species is being recorded for the first time from Punjab.

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