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## Agaricales of West Bengal VI : Some mushrooms of 24-Parganas district, West Bengal

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In this paper five species of mushrooms were reported : namely *Hygrophorus agathosmus* (Fr.) Fr., *Lepista sordida* (Fr.) Singer, *Tricholoma crassum* (Berk.) Sacc., *Collybia diminuta* (Berk. & Br.) Sacc. and *Collybia dryophila* (Bull. ex Fr.) Kummer from 24 Parganas district. Of these *H. agathosmus* and *Collybia dryophila* are first reported from West Bengal. *T. crassum* is an edible species.

**Key words :** Taxonomy, mushrooms, 24 Parganas district

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### INTRODUCTION

The contribution of Agaric flora of India have been made by several authors (Sathe and Rahalkar, 1979; Watling and Gregory, 1980; Horac, 1980; Atri *et al.*, 1997; Vrinda *et al.*, 1997; Kalitha *et al.*, 1997; Sani *et al.*, 1997.

The agaric flora of West Bengal has been reported from this laboratory on different districts (Ray and Samajpati, 1976; 1979; 1980 a,b; Roy and Samajpati, 1980). This is the sixth report in the series on agaric flora of West Bengal from this laboratory.

### MATERIALS AND METHODS

The mushroom basidiocarps were collected from the different rural areas of the district of 24-Parganas, West Bengal, an eastern Provincial State of India. From the very beginning of the monsoon (May/June) till to the end of the rainy season (August/September), plains and forests of the above areas were frequently visited and surveyed. Habit and habitat of the mushrooms, pH of the soil, vegetation and other related field data were recorded. As soon as possible the collected basidiocarps were brought to the laboratory for necessary microscopic and macroscopic observations.

Macroscopic observations of the basidiocarps including the measurement and colour study of pileus, lamellae and stipe, spore mass and individual spore were thoroughly made. The colour of the basidiocarps as well as spore mass were verified and noted from the colour identification chart, Flora of British Fungi, published by Her Majesty's Stationary Office, Edinburgh, 1969. Spore print of the fresh specimens had been collected for future use. Amyloid, nonamyloid and dextrinoid nature of the spores had been determined with the help of Melzer's reagent. Spore morphology in detail (i.e. shape

size, ornamentation etc.) had been studied.

Each and every collected basidiocarp, was studied microscopically in detail. For this purpose thin and uniform sections were prepared. The anatomical peculiarities in respect of cellular organisation in pileal and hymenial trama, measurement of the cells, characteristics of hymenium including the morphology of the basidium, sterigmata, cheilocystidium, pleurocystidium, pileocystidium etc. were studied. The different aforesaid fertile and sterile structures were measured carefully. Different parts of the fresh specimens and the fresh section had been treated with a good number of chemicals and reagents.

## ENUMERATION OF THE SPECIES

### *Hygrophorus agathosmus* (Fr.) Fr.

*Pileus* - 4.5-6.5 cm in diam., conic in shape, cuticle drab having deeper shade i.e. snuff brown at the centre when completely matured, dry, adnate, smooth, polished; *Margin* regular, slightly inrolled at young stage, incurved at maturity, somewhat brittle, no veil, *Lamellae* - decurrent, subdistant, distinctly formed, easily separable, not interveined, not pliable, brittle fleshy, 4-9 mm wide, lamellulae of five different lengths; fresh-white at young stage, while cream white at matured stage, lamellae edge - entire, *Stipe* centric, cylindrical, not regularly round throughout, 5-8.5 cm long, diameter ranges from 7-15 mm, average 7 mm in diam. concolourous with pileus, but creamy-white towards gill junction, fleshy, solid, can be easily broken at the junction of pileus and stipe; dry, smooth; base - narrower in most cases. *Volva* and *annulus* - absent; *Context* - white, composed of interwoven hyphae, heteromerous, filamentous forms are 8-10.5  $\mu\text{m}$  in diam., while the sphaerocysts are 12-15  $\mu\text{m}$  diam. *Spore mass colour* - white; *Spores* - subglobose to oval in shape, 8.75-10.0  $\mu\text{m}$  (9.75  $\mu\text{m}$ ) x 7.5  $\mu\text{m}$ ; Q. value - 1.3; thin-walled, smooth, apiculate, pointed, subpolar in position, germ pore - prominent, inamyloid; *Basidium* - long, clavate, 42.5-52.5  $\mu\text{m}$  (46.5  $\mu\text{m}$ ) X 7.5-10.0  $\mu\text{m}$ , (8.0  $\mu\text{m}$ ); tetrasterigmatic, sterigmata - long, 5-7.5  $\mu\text{m}$ , pointed; *Hymenophoral trama* - homoiomerous, regular, consists of long filamentous hyphae, distinctly septate, 5-12.5  $\mu\text{m}$  in diam., hyphae of central tramal tissue are broader than those towards hymenium layers. *Cheilocystidia* - ventricose with long and capitate tips, 30-37.5  $\mu\text{m}$  (33.5  $\mu\text{m}$ ) X 5.0  $\mu\text{m}$ , thin walled, light olivaceous; *Pleurocystidia* - very rare, tubular with capitate tip, 37.5-50  $\mu\text{m}$  long; 10  $\mu\text{m}$  broad. *Pilear surface* - long narrow, filamentous hyphae makes the interwoven cap cuticle, *Pileocystidia* - ventricose, pointed tips, cystidia are 50-72.5  $\mu\text{m}$  X 7.5  $\mu\text{m}$ ; tips of some pileocystidia are forked. *Stipe tissue* - consists of compact, parallelly arranged narrow hyphae, some are branched, surface irregular, *Caulocystidia* - lecythiform, 25-30  $\mu\text{m}$  long (upper - narrow tip- 10-12.5  $\mu\text{m}$  long) X 5  $\mu\text{m}$ .

*Chemical characters* - Tissues of all the organs showed negative reaction in (i)  $\text{Fe}_2\text{SO}_4$  (10%) soln., (ii) NaOH (30%) KOH (20%) and (iii) in Aniline water : colour became whitish; (v) positive reaction obtained in Phenol (2%) (vi) all tissue colour changed to light pink in Formalin (40%), but in (vii) Melzar's reagent - reaction negative.

*Geographical distribution and ecological data* : West Bengal, 24-Parganas district, on soil under shade of *Bambusa balcooa* Roxb., covered by fallen leaves; loamy humous, pH 6.0-6.5, scattered or caespitose, altitude 5m., M.S.L. (approx.); A. K. Manna, 9th May, 1983; M. H. No. 6A/83.

*Lepista sordida* (Fr.) Singer, Lilloa 22 : 195 (1951)

*Agaricus sordidus* Fr., Syst. Mycol. 1 : 51 (1821)

*Tricholoma sordidum* (Fr.) Kummer, Fuhr, Pilzk. 134 (1871)

*Gyrophila sordida* (Fr.) Quel., Euchirdion : 18 (1886)

*Rhodopaxillus sordidus* (Fr.) Maire, Ann. Mycol. Berl. 11 : 338 (1913)

*Pileus* - 2-3 cm. in diam. umbelicate, cuticle - when young - vinaceous grey to lilaceous pink, then gradually paler to whitish at matured stage, dry, adnate, peeling not easy, smooth glabrous, *Margin* - regular at young stage, then rimose or plicate, normally incurved at young age, then tends to be straight when matured. No veil. *Lamellae* - adnate to decurrent, close to moderately crowded, distinctly formed, easily separable, not interveined, brittle, when young deep lilaceous, but lighter at matured condition, lamellulae - 3-4 types, edge - entire. *Stipe* - central, round, not straight. almost equal throughout, 2.5-4.5 cm X 3-5 mm. concolourous with the pileus, then paler to white, fleshy, coreaceous, moist, smooth, solid slightly narrower to the base. *Volva* and *annulus* - absent. *Context* - whitish, composed of interwoven short, filamentous, thin-walled hyphae some are parenchymatous, filamentous cells - 5-7  $\mu\text{m}$  in diam., cell contain crystalline granules, clamp connections present. *Hymenophoral trama* - regular or parallel, filamentous, hyaline, homoiomerous, few layered, diam. of hyphal cells ranges from 7.5-12.5  $\mu\text{m}$ ; *Subhymenium layer* - pseudoparenchymatous. *Spore print* - lilaceous to pink; *Spores* - ellipsoid to oval in shape, 5-7.5  $\mu\text{m}$  in length, 2.5-3.75  $\mu\text{m}$  in breadth, average length and breadth 6.0 and 2.6  $\mu\text{m}$ , Q. value - 2.3, very minutely ornamented, thin-walled, apiculus not prominent, polar inamyloid. *Basidia* - club shaped, 17.5-20  $\mu\text{m}$  (19.5)  $\mu\text{m}$  X 5-7.5  $\mu\text{m}$  (6.0  $\mu\text{m}$ ), tetrasterigmatic, sterigmata - 2.5-5  $\mu\text{m}$  in length. *Pileal surface* - epicutis is provided with cellular cap cuticle hyphal cells are radially arranged, irregular, average diameter 7-12  $\mu\text{m}$ , hyaline, thinwalled, *Cystidia* - not found, instead numerous, long, hairy, very narrow projecting hyphae present on the gill face.

*Chemical characters* - colour reaction responded in (i) 10%  $\text{Fe}_2\text{SO}_4$  very slow change (ii) NaOH soln., (30%) :: positive reaction found in (iii) 40% NaOH, and in (iv) conc.  $\text{HNO}_3$ ; also colour change took place in (v) 2% Phenol; while in (vi) Melzer's reagent - pseudoamyloid reaction was noticed.

*Geographical distribution and ecological data* - West Bengal, 24-Parganas district, Machhlandapur; under complete shade of trees (*Mangifera indica* L.), on moist clay-soil, enriched with decomposing grasses and leaves; pH 5.5-6.0; caespitose; altitude 4.5 m. M.S.L. (apporx.), A. K. Manna, 19th. June, 1980, M.H. No. 30/80.

*Tricholoma crassum* (Berk.) Sacc. Syll. Fungi. Vol. V : 109, Dec. n. 147 (1887)

*Agaricus* (*Tricholoma*) *crassum* Berk., Lond. Jour. Bot., VI, p. 483.

*Agaricus* (*Tricholoma*) *pachymeres* B. & Br., Jour. Linn. Soc., XI, p. 515.

*Pileus* - 6-12.5 cm. in diam. fleshy thick, convex to hemispheric, occasionally obtusely umbonate; surface smooth, cuticle milky white at young stage, pale white at maturity, easily peeled off; to some extent moist, polished. *Margin* - regular, entire, involute when quite young, at maturity becomes incurved. *Context* - white, soft, fleshy, 10-40 mm thick at the centre; *Lamellae* - sinuate to adnexed, regular, distinctly formed, easily

separable, close to moderately crowded, lamellulae length - 3 types, whitish to cream white, gill edge - smooth, 5-10 mm wide at middle. *Stipe* - central, 10-23 cm X 2-8 cm, bulbous towards base, slight attenuated towards pileus, solid, stout, surface fibrillose, whitish at young stage, creamish when matured; *Volva* and *Annulus* absent; *Flesh* soft, fleshy, fresh white, somewhat fibrous, *Spore print* - white, *Spores* - round to ellipsoid, hyaline, thin-walled, smooth, non-amyloid; 5.2-7.8  $\mu\text{m}$  x 4.4-5.9  $\mu\text{m}$  (6.5 x 5.2  $\mu\text{m}$ ); Q value - 1.25; *Basidia* - cylindric to clavate, tetrasterigmatic, 18.2-29.6  $\mu\text{m}$  X 6.9-10.4  $\mu\text{m}$ , sterigmata - 1.8-2.3  $\mu\text{m}$  long. *Hymenophoral trama* - regular, homoiomerous, consisting of thin-walled long filamentous hyphae, bilateral in arrangement, nonamyloid with clamp connections, 5.8-18.6  $\mu\text{m}$  in diam. *Subhymenium* - well developed, thin-walled filamentous hyphae constitute the layer, 5-15.5  $\mu\text{m}$  in diam. *Cystidia* absent, *Pileal surface* - with distinctive epicutis, consisting of long repent hyphae, radially arranged, 5.2-7.8  $\mu\text{m}$  in diam. *Pileal context* - dimitic, comprising of pseudo-parenchymatous cells, 7.8-13.2  $\mu\text{m}$  in diam. and thin-walled long filamentous cells 6.5-11.3  $\mu\text{m}$  in diam. *Stipe surface* - dimitic, consisting of thin-walled filamentous cells - 6.9-13  $\mu\text{m}$  diam., along with round thin-walled cells - 7.8-20.3  $\mu\text{m}$  in diam.

*Chemical character* - Positive colour reaction was noticed in 10%  $\text{Fe}_2\text{SO}_4$  and 40% NaOH soln. and also in 40% Formaldehyde soln when colour of the preparation found to change. Negative reaction noticed in other chemicals. In Melzer's reagent - reaction is inamyloid.

*Geographical distribution and ecological data* - Diamond Harbour, 24- Parganas; Botanical Garden, Botanical Survey of India, Shibpur, Howrah; Ballygunge Lake area, Calcutta; West Bengal, 24-Parganas district, Barasat - on open grassland near base of the tree, clay soil, pH 5.5-6.5, altitude 4 m. M.S.L., A. K. manna, 18th. Oct. 1980, Bongaon, 6th. Nov. 1983; M.H. No. TC 02/80 and 03/83.

*Collybia diminuta* (Berk. & Br.) Sacc., Syll. Fung. 5 : 240 (1837)

*Agaricus diminutus* Berk. & Br. in Journ. Linn. Soc., Bot. 11 : 521 (1871)

*Pileus* - conic to campanulate, 4-10 mm in diam. expanding at matured stage, glabrous, smooth, margin entire, surface - greyish in colour; *Lamellae* - adnexed to free, close distinctly formed, separable, 2mm wide at middle, cream white, lamellulae are of two types, edge - curve entire, *Stipe* - central, equal almost, 1.5 cm X 1-2 mm, cylindrical, finely hairy towards base; surface whitish. *Context* - very thin, white, made up of thin-walled, hyphae, 3-6.5  $\mu\text{m}$  in diam. nonamyloid. *Spore print* - rosy buff to white, *Spores* - oval to ellipsoid, thin-walled, smooth, hyaline, 5-7.5  $\mu\text{m}$  (6.2  $\mu\text{m}$ ) X 2.8-4.1  $\mu\text{m}$  (3.3  $\mu\text{m}$ ), Q. value 1.9. *Basidia* - more or less clavate, 16.5-21  $\mu\text{m}$  X 3-6.5  $\mu\text{m}$ , tetrasterigmatic, sterigmata 2-2.5  $\mu\text{m}$  long, pointed, *Cheilocystidia* - thin-walled, hyaline, irregular shaped, cylindrical, 21-33  $\mu\text{m}$  X 7.5-13  $\mu\text{m}$ ; *Pleurocystidia* - not found, *Gill trama* - divided into two zones - *Hymenophoral trama* - irregularly arranged, with thin-walled hyaline hyphae, the cells 3-6.5  $\mu\text{m}$  in diam. *Subhymenial layer* consists of interwoven, thin walled hyphae 5-9  $\mu\text{m}$  diam. *Pileal surface* - composed of parallelly arranged, thick-walled hyphae, *Caulocystidia* in stipital tramal layer, 9-19  $\mu\text{m}$  X 2.5-6  $\mu\text{m}$ , thin-walled, club-shaped, apex - blunt.

*Chemical characters* - In  $\text{Fe}_2\text{SO}_4$  soln. colour of pileus and lamellae changes to clay buff, while in strong alkali soln. the stipe shade changes to straw colour; in almost all other chemicals negative reaction is noticed. In Melzer's reagent - the reaction is inamyloid.

*Geographical distribution and ecological data* - West Bengal, 24-Parganas district, Basirhat, on road-side slope, under shade, sandy clay-soil enriched with decomposing leaves, moderately illuminated, pH 5.5-6.0; gregarious; altitude about 4 m M.S.L., A. K. Manna, 6th Aug., 1981, M.H. No. 40/81.

*Collybia dryophila* (Bull. ex Fr.) Kummer, Fuhr. Pilzk. : 115 (1871)

*Agaricus dryophilus* Bull. ex Fr., Syst. Mycol. 1 : 124(1821)

*Marasmius dryophilus* (Bull. ex Fr.) Finl. Basidsv. : 103 (1889).

*Pileus* - 4-7.5 cm in diam., conic or convex, finally slightly depressed at the centre, whitish to buff, then drab in colour, having darker shade at the umbonal region, smooth, non-striate, peeling not easy. *Margin* - regular, hygrophanous, incurved. *Veil* - not present. *Lamellae* - adnexed to sinuate, close, distinctly formed, not interveined, pliable, whitish to light buff. lamellulae - three lengths, 5 mm at the middle, gill edge - smooth, somewhat fleshy. *Stipe* - 5-7 cm long, 3-7 mm in diam., cylindrical, cartilaginous, whitish at first, then clay buff to tany brown, smooth, base - somewhat radicating. *Context* - cap and stipe - white, thin, but thicker at the centre, made up of thin-walled, hyaline, filamentous hyphal cells of 5-10  $\mu\text{m}$  in diam. with clamp connection. *Spore mass* - whitish to light buff. *Spore* - subglobose to ellipsoid, 5-7.5  $\mu\text{m}$  x 3.5-5.0  $\mu\text{m}$ , average length and breadth - 7.0  $\mu\text{m}$  and 4.25  $\mu\text{m}$  respectively. Q. value 1.6, thin-walled, hyaline, smooth, prominent apiculous, polar or subpolar, germ pore not observed, non-amyloid. *Basidia* - clavate, 16.5-23  $\mu\text{m}$  x 5.5-8  $\mu\text{m}$ ; tetrasterigmatic, thinwalled. *Hymenophoral trama* - regular, well differentiated, composed of filamentous elongated hyphae, hyaline, 2.5-11  $\mu\text{m}$  diam. *Subhymenial layer* - somewhat irregular, consists of long filamentous interwoven hyphal cells of 5.5-7.5  $\mu\text{m}$  diam. *Cystidia* - cheilocystidia - abundant, vesiculose, having blunt apices, sometimes with long tips, thin-walled, smooth, hyaline, 10-22.5  $\mu\text{m}$  x 6.5  $\mu\text{m}$ . *Pileus surface* - provided with interwoven cap cuticle of thin-walled hyphae, filamentous with numerous projecting outgrowths, some with or capitate tips, 5.0-7.5  $\mu\text{m}$  in diam.

*Chemical characters* - change of colour indicating the positive reaction took place when different parts of the sporophore were treated with (i) 10%  $\text{Fe}_2\text{SO}_4$ , to blakish shade, (ii) 30% NaOH, (iii) conc.  $\text{HNO}_3$  and (iv) 40% Formaline while with Melzer's reagent the reaction is negative.

*Geographical distribution and ecological data* - West Bengal, 24-Parganas district, Gaighata, at the base of the coconut palm (*Cocos nucifera* L.) amongst some creeping and climbing herbs, viz., *Hydrocotyle asiatica* L. and *Antigonon* sp. etc., moist clay-soil, pH 6.5, singly scattered; altitude 4.5 m M.S.L.; A. K. Manna, 19th. June 1980, M.H. No. 27/80.

## DISCUSSION

The order Agaricales constitute a major group under higher Basidiomycetes. There are about three thousand species under this group. In India, however, the work on the Agaricales has not progressed satisfactorily, though the initial attempts in this regard has been started long back and possibly the first record of work on Indian mushroom is that of Montague (1842). The literature records about 800 species only over a span of Indian Agaricology, was made by Bose and his students (1919-1951), although this school of research did not continue their study for a long time.

The district 24-Parganas, in West Bengal, is by far the largest within the state so far population (1,07,26,751 - Census 1981) and area (14,136 sq. km.) are concerned. The major portion of this district is the plain land, with southern part encroaching the Bay of Bengal. During the survey work, about 71 species of mushrooms of different kinds were collected from the grass land of north-eastern region of the district of which five species have been presented here.

The basidiocarps of *Hygrophorus agathosmus* was found to grow in loamy soil only, with acidic pH of 5.5 to 6.5. The sporophores of *Collybia diminuta* were found to grow on sandy-clay soil with rich organic matters and pH range of 5.5 to 6.5. The basidiocarps of *Lepista sordida* and *Tricholoma crassum* were found to grow only on clay soils, having a pH range of 5.5 to 6.5. However, in all the cases the soil was enriched with high organic matters.

As regards the physiographic and ecological information, the data reveal that in general, the major part of plain land of the district is of aluvial type, excepting that 4,620 sq. km. area of Sunderbans in southern part where the soil is saline and more or less covered by thick forest comprising of mangrove vegetation. The general climatic condition of the district is of tropical type with moderate humidity. During summer, the temperature varies from 30-40°C, accompanied by humidity relatively low, while with advent of monsoon temperature gradually drops down and varies between 25° and 32°C. The monsoon generally prevails in this district during June to August which may sometimes extend upto the month of September. The average annual rainfall of the area is recorded as 150-200 cm. with a little variation in Sunderbans due to the formation of occasional depression in the Bay of Bengal. However, towards the end of monsoon and at early stage of winter, temperature becomes lower and varies between 20-25°C, with a relatively high humidity. So as a whole, this sort of ecological factors influence much on the mushroom flora which is richer in the north and north-eastern part than that of southern region of the district.

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