

Studies on *Cephalosporium* species from India. III.

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In continuation of our studies on *Cephalosporium* species from India (Sukapure and Thirumalachar, 1963 & 1965), further isolations were made and studied. An account of these is presented in this paper. The type cultures of the new species and varieties are deposited in American Type Culture Collection, USA; Centraalbureau Voor Schimmelcultures, Baarn, Netherlands; Commonwealth Mycological Institute, Kew, England and Herb. Crypt., Ind. Orient, New Delhi, India.

I *Cephalosporium incoloratum* Sukapure & Thirum. sp. nov.

Caespites in materia "dextrose" et "glucose yeast agar" dicta per dies 10 sub calore 24° C tarde usque ad 25 mm diam. accrescentes, orbiculares, primum hyalini, postea pallide eburnei, appressi et granulosi, subtus achroi; mycelium aerium, per totam caespitum superficiem fasciculatim emergens nec madidum; hyphae hyalinae, septatae, ramulosae, 2—3 μ latae; conidiophoris in ramulis hypharum aeriis ortis, erectis, simplicibus vel ramulosis, non septatis, 25—50 $\times$ 1.5—3 μ ; capitula conidiorum, globosa, 10—20 μ diam., e conidiis 20—30 acrogenis formata; conidia hyalina, ellipsoidea vel ovoidea, recta, levia, utrinque rotundata, tenuiter tunicata, 3—5 $\times$ 1.2—1.5 μ .

Habitat: From soil sample Hingne, Poona 25-1-1959. H. A. C. C. 109 (Type) (= A.T. C. C. 14613), isolated by R. S. Sukapure. From soil sample Kotharud 12-10-1960, leg. P. N. Mathur. Aundh 9-7-1961, leg. S. K. Menon.

On potato dextrose and glucose yeast agars the fungus grows rather slowly and spreads to a diameter of 25 mm. within 10 days at 24° C. Colonies are hyaline, with ivory shade in old cultures. The reverse of the colonies is also colourless. Colonies appear appressed and granular. Tufts of subaerial mycelia protrude over the colony surface. The hyphae do not show any tendency to form mycelial strands. Radial furrows traverse over the colony surface but these are not deep and run only half way from margin to the centre.

The hyphae are hyaline, septate, branched, 2—3 μ in diameter and bear the conidiophores on aerial branches. The conidiophores are 25—50 $\times$ 1.5—3 μ , arise as side branches. They are erect, simple or branched, non-septate or having one septa at base. Conidia are developed in suc-

cession at the tip of the conidiophore to form a globose head. When heads are produced in close proximity they aggregate to form large irregular spore masses either on the surface of the agar or on the aerial hyphae. The heads are globose 10—20 μ in diameter, consisting of 20—30 conidia per head. Conidia are hyaline, elongated, elliptical, straight, smooth, with both ends rounded; measuring 3—5 $\times$ 1.2—1.5 μ .

This isolate may be compared with *Cephalosporium curtipes* Sacc. (Mich. II: 286, 1881) because of the white colour of the colony but differs in several other characters. The conidial measurements of *C. curtipes* are 8—10 $\times$ 3.5—4 μ almost twice in size of this species. *C. incol-ratum* has a topography which is totally different than the floccose appearance of *C. curtipes*.

II *Cephalosporium acremonium* Cda. var. *radiatum*

Sukapure & Thirum. var. nov.

Caespites in materia "dextrose" et "glucose-yeast agar" dicta per dies 8 sub calore 24° C usque ad 45 mm diam. accrescentes, pallide roseoli sed saepe variantes, tunc "Sugar cane", "Sunrise", "Corn-husk" vel "Sun-set", densi, irregulariter et profunde rimosi; mycelium plus minusve immersum et madidum; hyphae hyalinae, septatae, ramulosae, 1.5—3 μ latae; conidiophoris in hyphis aeriis lateraliter ortis, 20—40 $\times$ 1.5—2.5 μ , erectis, vulgo continuis, raro ad basin tantum uniseptatis, simplicibus, apicem versus parum attenuatis; capitula conidiorum irregularia, 6—18 μ diam., e ca. 20 conidiis formata; conidia oblonga vel ellipsoidea, tenuiter tunicata, 3—5 $\times$ 1.5—3 μ .

From soil samples Karad. 21-6-59, H. A. G. C. — 103 (Type) (= A. T. C. C. 14609) isolated by R. S. S u k a p u r e. From soil sample Bandra 19-7-60, 15-8-60, 15-9-61. From soil sample Sewari 15-8-60, 19-10-60, 15-2-61, 15-9-61. leg. V. H. Pawar.

On potato dextrose and glucose-yeast agars growth was rapid, spreading to a diameter of 45 mm. within 8 days when incubated at 24° C. The colour of the colony is pinkish but different isolates vary slightly in colour from "Sugar Cane", "Sunrise", "Corn-Husk" to "Sun-set" (Maerz & Paul, 1950). Colonies are compact with more or less submerged mycelium and appearing moist. In the centre of the colony very few erect mycelia may be present. Irregular and deep furrows are often present throughout the colony.

The hyphae are hyaline, septate, branched and 1.5—3 μ in diameter. The conidiophores arise as side branches of the aerial hyphae. They are variable in length 20—40 $\times$ 1.5—2.5 μ , erect, usually non-septate, but in few isolates there is a septum at base. Conidiophores are simple, straight and slightly tapering at the tip. The conidial heads are irregular 6—18 μ in diameter composed of 20 or more spores per head. The conidia are oblong to elliptic, hyaline to subhyaline, smooth, thin-walled measuring 3—5 $\times$ 1.5—3 μ .

This variety may be readily distinguished from the other varieties of *C. acremonium* by its characteristic growth on the media and conidial measurements. *C. acremonium* var. *majus* Penz. (Mich. II: 486, 1882) and *C. acremonium* var. *uniseptatum* Massee (J. Linn. Soc. London, 24: 48, 1887) have longer spores than those of variety *radiatum* though the breadths of the spores are similar.

III *Cephalosporium acremonium* Cda. var *cereum*

Sukapure & Thirum. var. nov.

Caespites in materia "potato-dextrose" et "glucose yeast agar" dicta per dies 10 sub calore 24° C usque ad 15 mm diam. tarde accrescentes, cerei et madidi, densiusculi, concentrice 2—3-zonati, in centro quasi coremiis nonnullis praediti, parce et non profunde striati, hyphae septatae, 1—1.5 μ latae; conidiophoris in ramulis hypharum aëriarum ortis, 12—20 μ , raro usque ad 30 μ longis, 1—1.5 μ latis, hyalinis, simplicibus, continuis, rectis, raro curvulis; capitula conidiorum, 6—9 μ diam., e conidiis 7—10 tantum formata, mox dilabentia; conidia oblonga, subhyalina, recta, levia, tenuiter tunicata, 2.7—3.7 $\times$ 1.2—1.5 μ .

Habitat: From soil sample Koyna valley 21-5-1958. H. A. C. C. 117 (Type) (= A. T. C. C. 14610) isolated by R. S. S u k a p u r e. From soil sample Bandra 15-9-1960 and Bhandup 15-10-1961. leg. V. H. P a w a r.

On potato-dextrose and glucose yeast agars the fungus grows very slowly attaining a diameter of only 15 mm. after 10 days incubation at 24° C. The colonies are compact with almost submerged vegetative hyphae, waxy, shining and moist with 2—3 growth ring sectors, and few cormia-like protrusions grouped at the centre of the colony. There are few striations but these are not deep and extend only to half the length of the colony. The hyphae do not show any tendency to form ropy strands

The hyphae are septate, 1—1.5 μ in diameter and bear the conidiophores on the aerial branches. The conidiophores are usually short and thin, 12—20 $\times$ 1—1.5 μ but occasionally reach 30 μ in length. They are hyaline, erect, narrow, simple, non-septate, straight but sometimes curved. The conidial heads are 6—9 μ in diameter having 7—10 conidia per head. Average size of 100 conidia on potato dextrose agar at 24° C is 3.5 $\times$ 1.5 μ with a range of 2.7—3.7 $\times$ 1.2—1.5 μ . They are oblong, nearly hyaline, straight, smooth, thin-walled, sessile and borne in heads which are easily dispersed.

The fungus under study differs from *C. acremonium* in topography and texture of the colonies which is waxy in consistency. The conidiophores are also narrow; only 1—1.5 μ in width, while in *C. acremonium* they are 2—2.5 μ in diameter. The only other *Cephalosporium* species having moist appearance and slow rate of growth is *C. gregatum* Allington & Chamberlain (1948) causing brown rot of soybean in U.S.A. Except for these characters there are no other similarities

between *C. gregatum* and the present fungus. The conidia of *C. gregatum* ($3.4-7.6 \times 1.7-3.4 \mu$) are appreciably longer and broader than those of *C. acremonium* var. *cereum*. The measurements of conidia and conidiophores distinguish it from *C. acremonium* proper.

IV *Cephalosporium roseum* Oud.

Cephalosporium roseum was first described by Oudemans (Ned. Kruidk. Arch. 2; Ser. IV; 249, 1884) from Holland on moist mortar wall. The chief differentiating characters were the typical rose colour, conidial measurements and the presence of chlamydospores. A species of *Cephalosporium* similar with the description of *C. roseum* was isolated from soil sample near Bombay.

On potato-dextrose and glucose yeast agars the fungus grows fairly well at 24° C spreading on a plate to a diameter of 40 mm. in 8 days. The colour of the colony is 'Genista' (pink rosy tinge) with same reverse. The aerial mycelium is well developed which gives floccose appearance to the colony. Colonies are not moist and the hyphae do not show tendency to form ropy strands. Similarly the colonies do not show any radial furrows or other distinguishing types of contours.

The hyphae are faintly coloured, $1.5-2 \mu$ in diameter, sparsely septate. When incubated at high temperature of 32° C; chlamydospores are formed. These are simple, $6-12 \mu$ in diameter, spherical, intercalary or terminal. Conidiophores are $6-4 \times 1.5-3 \mu$, stright, simple, nonseptate and subhyaline. Conidia are produced at the tip singly, and get collected to form conidial heads which are globose, $3-6 \mu$ in diameter and composed of 10-15 conidia. The conidia are faint rosy in colour, ovate to elliptical, straight, smooth, thin-walled, measuring $3-7.5 \times 1.5-3 \mu$.

Habitat: From soil sample Bombay 1-2-1960. H.A.C.C. — 121 Leg. V. H. Pawar; from soil sample Indore 10-6-1961. Leg. D. B. Lodhi;

The fungus under study is similar to *C. roseum* Oud. But in type species conidiophores are described in whorls. Except for this, other characters and conidial measurements are fitting into description of *C. roseum*. Hence it is proposed to place fungus under investigation as *C. roseum* Oud.

V *Cephalosporium roseum* Oud. var. **breve** Sukapure & Thirum. var. nov.

Caespites in materia „potato-dextrose“ et glucose-yeast agar per dies 8 sub calore 24° C usque ad 25 mm diam. accrescentes, primum obscure rosei, postea etiam subtus distincte colorati, parum madidi; mycelium aerium ex hyphis primum roseo-albidis, postea obscurioribus, parce ramulosis, $1-1.5 \mu$ tantum crassis, indistincte septatis compositum; conidiophoris brevibus, simplicibus, continuis, antice parum attenuatis, $15-25 \times 1.5-2.5 \mu$; capitula conidiorum acrogena, irregularia, $4-7 \mu$

diam., e conidiis 10—20 raro usque ad 40 formata; conidia ovoidea vel oblonga, recta, tenuiter tunicata, levia, sine vacuolis et granulis $3-4.5 \times 2.2-2.5 \mu$.

Habitat: From soil sample Pimpri, Poona, 9-9-1959 H.A.C.C. — 110 (Type) (= A.T.C.C. 14614) isolated by R. S. Sukapure. From soil sample Bhandup 10-8-1961, leg. V. H. Pawar.

The fungus was first isolated from soil samples collected at Pimpri, Poona. On potato-dextrose and glucose yeast agars fungus grows rather slowly at 24° C, forming colonies upto 25 mm. in 8 days. Colour of the colonies is corn-husk (same as *C. roseum* but little darker) which becomes intense with age with same colour on reverse. The colonies appear almost submerged and slightly moist. The hyphae do not show any tendency to form ropey strands.

The hyphae are pinkish-white, aerial mycelium often composed of many parallel adherent hyphae which are pinkish white at first and later become dark. These are sparsely branched, thin, $1-1.5 \mu$ in diameter with indistinct septation. Conidiophores are $15-25 \times 1.5-2.5 \mu$, short, simple, non-septate, slightly tapering at tip. Conidia are produced acrogenously forming irregular heads which are usually $4-7 \mu$ in diameter and composed 15—20 conidia. Sometimes conidial heads are very large and contain upto 40 conidia per head.

Conidia are $3-4.5 \times 2.2-2.5 \mu$, ovate to oblong, straight, one end of the conidium is round while other is slightly flattened. They are thin-walled, smooth, without any vacuolation or granulation.

The fungus under study is similar to *C. roseum* Oud. in many of the characters, but the conidial measurements are smaller than those of *C. roseum*. The topography and other morphological characters are also slightly different. *C. roseum* is not moist but floccose, while the present one is moist and not floccose. On the basis of these differences in growth characters the two fungi can be readily distinguished. It is, therefore, proposed to designate it as a variety.

The writers thanks are due to Prof. Dr. F. Petrak for rendering the Latin diagnoses.

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Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Sydowia](#)

Jahr/Year: 1965/1966

Band/Volume: [19](#)

Autor(en)/Author(s): Sukapure R. S., Thirumalachar M. J.

Artikel/Article: [Studies on Cephalosporium species from India. III. 171-175](#)