SECTION - VI

SYSTEMATIC STUDIES
INTRODUCTION

In this section a systematic account of some of the important species isolated during the course of these studies has been given. A total number of seventy isolates spread over various groups were studied. These isolates were obtained from different diseased conditions, rhizosphere, rhizoplane, normal soil and some were called for experimentation. The number under various categories fall as given below.

<table>
<thead>
<tr>
<th>No. of isolate</th>
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<tbody>
<tr>
<td>20</td>
<td>Diseased seedlings</td>
<td>Many of the forms were common for different sources. However, some of the forms could be isolated from a particular source only. Such forms were: 6 from normal soil, 13 from rhizosphere soil and Rhizoctonia spp. and some sterile forms from rhizoplane.</td>
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<tr>
<td>56</td>
<td>Rhizosphere and normal soils</td>
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<td>24</td>
<td>Rhizoplane</td>
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<td>9</td>
<td>Inside the tissues of healthy plants</td>
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<td>From other laboratories</td>
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<td>6</td>
<td>From other workers in this department</td>
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All these isolates were studied in detail with a view of their identification, but for the sake of brevity all are not described here in details. Out of these the description of twenty six selected ones are given in the following.
pages. This selection is based upon such interesting features as pathogenicity, rarity, occurrence in rhizoplane, abnormal behaviours, etc., the notes about which are given under each description. Systematically the seventy species studied fall as under.

**Phycomycetes**

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**Ascomycetes**

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<td>Nectriaceae</td>
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<td>Gomoniaceae</td>
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**Deuteromycetes**

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<td>Tuberculariaceae</td>
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<td>Mycelia sterilia</td>
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DESCRIPTION OF SPECIES

Chaetomium trilaterale Chivers

(Pl. XV-A & B).

Colonies on Czapek's agar broadly and moderately spreading, covering the dish in about 20 days; subflocose; olivaceous to brown (Colour Pl. 13.I 8), central sporulating area greenish (Colour Pl. 14.I 6); reverse bright red turning to dark brown with age (Colour Pl. 8.A 9); red pigmentation diffuses in the medium.

Perithecia abundantly formed, greenish to dark brown, broadly elliptical to vase shaped, 143 x 107-122 u, ostiole inconspicuous; hairs all over, terminal hairs arcuate at the base and usually incurved in a 2-3 spiral convolute tip, coils of diminishing diameter, brown at the base, fading above, septate, about 3.4-6.8 u wide; lateral hairs little arcuate with none to two coils, finely roughened. Asci club-shaped, evanescent, stipitate, 8 spored, 25.5-30.6 x 8.5 u. Spores brownish black, smooth walled, semi-ovoid, flattened on one side, 8-13.6 x 5-6 u.

Note: The fungus closely agrees with type description in general characters and measurements. The form was isolated
from diseased plant parts after surface sterilization. Preliminary tests showed that the form possesses bacteriostatic properties. It has been reported from India by Ramkrishnan (1955).

**Thielavida sp.**

(Fig. 2, Pl. XV-C & D).

Colonies on Czapek's agar, broadly and rapidly spreading, covering the dish in about 14 days; subflocose, uniform or radiating growth; yellowish to Italian straw (Colour Pl. 11.D 2), reverse Pine-apple (Colour Pl. 11.J 2), exudate drops bright pinkish, small, scattered on the aerial turf in peripheral zone. Chlamydospores abundant forming yellowish crust, usually terminal in short chains or clusters, wall thick, echimulate, 8.5-11.9 μ in diameter. Cleistothecia superficial or partially submerged, no appendages, dark brown to black, spherical, without ostiole, 86-143 μ in diameter. Asci many, broadly club-shaped to pyriform, evanescent, 8 spored, 25.5 - 29 x 17 μ. Ascospores unequal, spindle-shaped, slightly spiculate, dark brown to black with uniformly thickened wall, 11.9 - 17 x 6.8 - 9.4 μ.

**Note:** The fungus was isolated from soil and rhizosphere soil plate of 'Hansa'. The isolate differs from *T. terricola* (Gilman and Abbott) Emmons, in the formation of chlamydospores and uniformly thickened wall of the ascospores.
**Necromycospora vasinfecta** Smith.
(Pl. XVI-A & B).

Perithecia gregarious, often closely crowded, flask shaped, bright red, smooth with prominent obtuse ostiole, becoming perforate, 178-357 × 143-320 μ. Asci nearly cylindrical, many, 8 spored, 83-94 × 14-19 μ. Paraphyses inconspicuous, simple, septate, with bulged cells. Asco- spores uniseriate, globose to subglobose, at first hyaline, becoming brown with outer surface rough and wrinkled, 12-15 μ in diameter.

**Note:** The fungus agrees closely with the type description except for the larger size of perithecia and ascospores. It was isolated from soil.

**Ophiocelus gresminia** Sacc.

Colonies on potato dextrose agar, growing moderately, attaining a diameter of about 3.5 cm. in 7 days, subflocose with thin felt of aerial mycelium, at first white changing to black brown through shades of grey (Colour Pl. 16.E 4, 15.A 1), aerial mycelium remaining grey throughout, reverse turning to black with shades of English grey and faint brown (Colour Pl. 15.C 2, 16.E 2); hyphae profusely branched, 1.5 to 6.8 μ in diameter, forming aggregations of swollen cells with comparatively dense contents, suggesting perithecia formation (remaining sterile through out), sometimes swollen
cells appearing like spores 2.0 to 3.0 u in diameter.

Note: The fungus which was isolated from diseased wheat seedlings, grows rapidly on nutrient agar covering the dish completely in 2 weeks at room temperature. No perfect perithecia could be observed. The identification of the present isolate is based on wheat seedling test. Confirmation of it was done by Dr. Garrett of Cambridge University, Cambridge. The form has been reported by Padwick (1940) but the description was not available.

**Peyronellaea sp.**

(Fig. 3, Pl. XVI-C).

Colonies on Waksman's glucose peptone agar broadly spreading attaining a diameter of about 5 cm. in 10 days, aerial hyphae sparse, greyish brown with abundant brown to black pycnidia; reverse brownish black. Abundant dark dictyosporous chlamydospores of variable length and breadth intercalary or terminal. Pycnidia produced on the surface of medium and on aerial hyphae, not on subiculum, globose to pyriform with 1 or 2 papillate ostioles, dark brown, up to 257 u in diameter. Conidiophores simple. Conidia hyaline, 1 celled, oblong to cylindrical, sometimes slightly curved, 4.3 - 6.4 x 2.1 - 2.9 u.

Note: The form belongs to **Peyronellaea** Goidanich and agrees in the diagnostic features to the description
given by Barnett (1960). It was isolated commonly from normal as well as rhizosphere soil platings. This is reported for the first time from Indian soils.

_Cephalosporium roseo-griseum_ Saksema.

(Fig. 4, Pl. XVI-D).

Colonies on Czapek's agar rather slow spreading, reaching a diameter of about 5 cm. in 14 days, floccose, white at first becoming pinkish (Colour Pl. 4.A 9), greyish at the sporulating spots; reverse pink (Colour Pl. 4.A 10) to cream with grey spots. Submerged hyphae creeping, septate, branched, hyaline, 2-3 μ wide; aerial hyphae prominently funiculose, reddish, branched, 2-2.5 μ thick with conidiophores arising as side branches. Conidiophores erect, slightly tapering, simple, 20-36.2 x 2.1 μ, without swollen heads. Conidia enclosed in slime at the tips, oval to elliptical, thick and smooth walled, one end flattened, faint cream coloured with blackish outer wall and slime, 4-8 x 2-5 μ.

Note: The form agrees closely with the type description and was collected from rhizosphere soil. It was first reported from forest soils of Sagar by Saksema (1954).
Penicillium fellulatum Biourge

Syn. P. cinerascens Biourge

(Fig. 5, Pl. XVII-A).

Colonies on Czapek's agar restricted, reaching a diameter of about 2.5 cm. in 10 days, floccose, forming a fairly tough turf of about 1-2 mm., radially furrowed, humped in the centre, bluish grey (Colour Pl. 15, E 1) becoming brownish (Colour Pl. 14, C 2) with age; margin entire white, exudates in the form of fine drops on aerial hyphae, odour nil; reverse creamish (Colour Pl. 9, G 2) to faint orange (Colour Pl. 9, I 5), coloration restricted to colony only.

Penicilli strictly monoverticillate; conidiophores from creeping hyphae, septate, hyaline, smooth, 13.5-50 x 2-2.5 u. Sterigmata in clusters of 3-9, hyaline, tapering, 7-9 x 2-3 u, occasionally borne at a slightly lower level than the tip. Conidia in long, tangled chains, hyaline to light olivaceous, globose to oblong smooth walled, 2.5 - 3.5 x 2-2.5 u.

Note: The present isolate was recovered from rhizosphere soil plate. It has been reported from Indian soils by Subramanian (1952).
Gliocladium fimbriatum Gilman and Abbott

(Pl. XVII- C&D).

Colonies on Czapek's agar spreading broadly, reaching a diameter of 7 cm. in 30 days, pure white at first with zones of dark green fruiting areas appearing near the centre of the colony, reverse yellowish to Salmon (Colour Pl. 10.A 6, Pl. 10.F 6), zonation good. Conidiophores from a stolon like hyphae, erect, usually branched and clustered, smooth, up to 25 μ long. Fructification in two stages; primary segments hyaline, in whorls of 3-5, about 7-10.7 x 1.4-2 μ. Phialides in whorls of 2-5, hyaline, about 11 x 2 μ. Conidial chains indistinguishable, enveloped in round balls of slime, which remain much extended due to aggregation of conidiophores, green in mass, light green individually, elliptical or elongate, smooth, 7 x 2.8 μ.

Note: The fungus agrees closely with the type description and was isolated abundantly from rhizosphere soil plates. It has been reported from soils of China and U.S.A. (Gilman, 1957). Dhivedi (1960) and Lily (1961) reported it from India.
Paecilomyces fusiformis Saksema
(Fig. 6, Pl. XVII-B).

Colonies on Czapek's agar broadly and moderately spreading, reaching a diameter of 4.5-5 cm. in 8 days at 26°C, low growing with superficial growth consisting mostly of trailing fertile hyphae, faintly zonate, surface white at first becoming reddish cream (Colour Pl. 11.D 6), reverse of the same colour but deeper in shade (Colour Pl. 13.B 7), (almost black on PDA). Aerial hyphae branched, septate, creeping, 2-3 µ in width. Phialides arising mostly singly, terminally or laterally as short spindle to flask shaped, hyaline protuberances of about 5.7 - 10.7 x 3.5 - 6.4 µ; rarely a phialide may bear lateral phialides in a cluster. Conidia in chains of about 100-125 µ, mostly fusiform, rarely rounded to ovate, walls thick, roughened, spiral markings less conspicuous, 4.3 - 5.7 x 2.9 -4.3 µ.

Note: The fungus resembles the type form except for smaller conidia and phialides, peculiar clustering of the phialides and inconspicuous marking of the conidia. The form was isolated quite commonly from rhizosphere and normal soil platings. The form has been described from Sagar soils by Saksema (1954) and Lily (1961).
Paecilomyces flavescens Brown and Smith
(Fig. 7, Pl. XVIII-A).

Colonies on Czapek's agar broadly spreading, reaching a diameter of 7 cm. in 12 days, markedly funiculose, colourless to light pink (Colour Pl. 1.A 9); sporulating areas in the centre and in circular patch just before margin, dark grey to almost black (Colour Pl. 24.E 1); reverse yellowish (Colour Pl. 10.D 3), with blackish shades. Aerial hyphae predominantly funiculose, hyaline to slightly yellowish, septate, branched, 1.3 - 3.5 μ. Conidiophores absent, phialides borne on the funiculose or single hyphae, abundant, long, slightly undulate, tapering, occasionally in whorls of 2-3 only, unseptate, 10.5 - 35 x 1.8 - 2.6 μ. Conidia in chains, blackish in mass, faint yellow to almost colourless individually, oval to spindly shaped, smooth, 3.5 - 6 x 2.6 - 3.5 μ.

Note: The isolate resembles closely with the type description by Brown and Smith (1957), except for the larger phialides and conidia which are up to 35 μ and 6 μ respectively and the conidia being blackish in mass. The isolate was recovered from the rhizosphere soil plate and is reported for the first time from India.
**Hymicola sp.**

(Fig. 8, Pl. XVIII-B).

Colonies on PDA slowly spreading, reaching a diameter of 2-3 cm. in 10 days at room temperature, velvety, greyish green (Colour Pl. 16.E 1, 16.E 2); reverse ranging from greyish (Colour Pl. 16.E 3) to brownish black in later development (Colour Pl. 15.C 8 and 16.A 5); reddish colour extending beyond the colony. Submerged hyphae hyaline, branched, septate, about 1.7 μ wide. Conidiophores hyaline, slender, arising from submerged hyphae, of variable length, repeatedly branched and rebranched, septate, about 1.5 μ thick, conidia borne singly at the tips of branches and branchlets. Sporulation very heavy.

Spores mostly one celled, elliptical, globose to ovate, with one flat end, very rarely bicelled, brown, smooth thick walled, 5-10.7 x 4.3-7 μ. In old cultures cells subtending the conidia also become brown and distinct (chlamydo-sporas), thus giving the appearance of false chains. No other type of conidia could be seen.

**Note:** The culture is peculiar in many respects. It was, therefore, referred to Commonwealth Mycological Institute. According to the expert there, this is a species of *Hymicola* Corda hitherto undescribed. The form was isolated only once from rhizoplane of wheat variety Hy 65.
Curvularia ramosa (Bainier) Boedijn

(Fig. 9, Pl. XVIII-C & D, and XXI-A).

Colonies on Czapek's agar rapidly growing, reaching a diameter of 9 cm. in 10 days, subfloccose, Cub (Colour Pl. 15.C 1) to almost black, zonation medium; reverse bluish black; sectors of sterile hyphae sometimes seen. Conidio-
phores from submerged or aerial hyphae, brown, erect, septate, unbranched, bearing conidia spirally, new conidium arising at the hyaline tip, 14-236 x 2-6 u. Conidia elliptical to cylindrical, uniformly light brown to brown, 3 septate, cells nearly equal; a scar at the point of attachment with the geniculations of the conidiophore, symmetrical rarely unequi-
lateral, 14-28 x 6-10 u.

Cylindrical, branched or unbranched stromatal eleva-
tions (pseudoparenchymatous) appear in the central part, bearing unbranched, stiff, up to 250 u long conidiophores (Pl. XVIII-D), mostly terminally. The conidia of this do not separate easily. In subsequent subcultures, the production of stromata was meagre.

Note: The form belongs to symmetrical series of Curvularia Boedijn. The formation of stromata and two types of conidiophores warrant its inclusion in Halminthesporium biformae Mason and Hughes, as per description by Chesters (1948). The stromata formation, however, is not a constant
feature and in subsequent subculturing little to no stromata are formed. So the form is identified as \( C. \) \( ramosa \) for convenience. In the body of the thesis, it is designated as \( W \) and was isolated abundantly from diseased seedlings, rhizosphere, rhizoplane, seeds and stubble during the course of studies and records the first report for India.

**Curvularia specifera** (Bainier) Boedijn

*Syn* Helminthosporium tetraroma McKinney

(Fig. 10).

Colonies on Czapek's agar, fast growing, attaining a diameter of 9 cm, in 9 days, densely floccose, whitish, faint grey green to slate; reverse variously coloured, usually brownish black, zonation poor, occasionally sectors of less floccose growth appear. Conidiophores from aerial hyphae, rarely from submerged hyphae at the margins; erect, septate, geniculate; conidia in close spirals, growth continued by subterminal axis; light olivaceous brown, 28-150 x 3-4 μ.

Conidia obovate, straight or slightly curved, symmetrical, mostly 3 septate, light olivaceous, conspicuous scar at the proximal end, distal end rounded, 16-30 x 6-10 μ.

**Note**: The fungus was isolated from wheat seeds and rhizosphere of wheat seedlings. It has been reported by Chattopadhyay (1953) and Rao and Salam (1954) from India.
**Curvularia sp.**

(Fig. 11, Pl. XIX-A).

Colonies on Czapek's agar attaining a diameter of about 5.5 cm. in 6 days, loosely floccose; light grey, greenish to black; reverse in the same shades, zonation poor. Aerial hyphae light olivaceous, septate, branched, bearing and sometimes terminating into fertile zone, tips hyaline; 3-5 µ wide.

Conidiophores from superficial and aerial hyphae, erect, septate unbranched, olivaceous brown, bearing conidia alternately, growth continued by subterminal points; very variable in size 40 - more than 500 x 2-5 µ. Conidia asymmetrical, curved, olivaceous to brown, 3 septate, third cell from base bigger and darker, pedicillate, 22-28 x 10-15 µ.

Cylindrical, branched or unbranched pseudoparenchymatous stromata are abundantly formed (particularly on PDA), bearing conidiophores and conidia which do not differ from normal ones in characters.

**Note:** The form though belonging to *Curvularia* Boedijn is characterised by pedicillate conidia and formation of stromata. It was isolated from wheat seeds.
Bipolaris bicolor Shoemaker

(= Helminthosporium bicolor Mitra)

(Fig. 12, Pl. XIX-B and XXI-B).

Colonies on Czapek's agar rather restricted, attaining a diameter of about 4.5 cm. in 10 days, densely floccose, greyish black (Colour Pl. 24, E 1) to black; reverse in the same shades; radial furrows may be present; sporulation heavy. Conidiophores dark olivaceous to brown, septate, occasionally branched, conidia bearing part thicker; conidium borne at the tip, growth continued by subterminal axis and the final arrangement seems to be spiral; about 120-630 x 4-8 u. Hyphae and the lower portions of conidiophores occasionally show hyphal connections with the adjacent hyphae. Conidia olivaceous, uniformly pigmented to dark brown and opaque, cylindric to oblong, rounded blunt ends, longer conidia showing curvature but place, intensity direction not definite; walls thick, end cells less thickened and less dark and so more clear; walls of opaque conidia with flat ends easily folding in; 8-102 x 8-15 u, septation ranging from 2-13; germination bipolar.

Generally three types of cultural variations are obtained which are interchangeable. (1) The heavily sporulating colonies with restricted growth, as described earlier. (ii) Very fast growing olivaceous green, flouppy with little or no sporulation. (iii) Moderate growth and sporulation,
The colony showing elevated islands of grey mycelium which are
devoted of sporulation.

All the three types may appear on the same medium, but type (ii) is most common on potato dextrose agar.

*Note*: The form shows a consistent character of conidia, i.e., light coloured end cells. The form was first reported by Mitra (1931) as a causal organism of foot-rot of wheat. The form was found to be widespread in the soils investigated and has been isolated from diseased seedlings, rhizosphere, rhizoplane and soil.

*Helminthosporium* sp.

(Fig. 13).

Colonies on Czapek's agar rather slow growing, attaining a diameter of about 3.5 cm. in 10 days, velvety to subfloccose, bluish to greenish (Winter leaf to Cashew nut, Colour Pl. 16.B 1, 16.H 1), reverse in various shades, starting from bluish centre and bluish black, brown to yellowish towards periphery. Older colonies dark brown to black, reverse bluish black. Aerial hyphae light olivaceous brown, septate, branched, 3-4 μ wide, ending in and bearing fertile part.

Conidiophores arising from submerged or aerial hyphae, olivaceous to brown, septate, occasionally branched, geniculate,
conidia in close spirals, tip hyaline, very variable, 7-180 x 2-6 μ.

Conidia oblong, cylindrical to spindle-shaped, tapering and abruptly rounded ends, olivaceous to light brown, uniformly pigmented, 1-5 septate, majority being 3-5 septate, 8-20 x 6-10 μ.

Note: The form was isolated only once from rhizosphere soil of healthy wheat plants.

*Stemphylium* sp.

(Fig. 14, Pl. XIX-C).

Colonies on PDA rather slow growing, attaining a diameter of about 4.5 cm. in 20 days, restricted, floccose, forming an uneven turf of about 2-3 mm., margin irregular; in various shades of pink yellow and straw (Colour Pl. 10.A.5, 10.B.1, 10.E.2), reverse in orange shades, with scattered dark tan to black spots; coloration orange peel (Colour Pl. 10.L.10) diffusing into the medium. Aerial hyphae orange, septate, branched, 1.7 - 6.8 μ wide. Submerged hyphae creeping, bulged at the septa (producing dumbbell-shaped cells), lightly coloured, 3.4 - 10.5 μ wide.

Conidiophores short, one called initially, becoming 2-3 septate at maturity; erect, occasionally branched, dark,
3.4-10.2 x 5-6.8 u; fertile hyphae and conidiophores usually aggregate to form big bunches.

Conidia globose to top shaped, muriform, dark brown, almost opaque when mature, many called due to irregular septation, wall heavy and rough; upper cell of conidiophore remaining attached to conidium and forming pedicel; 15-20.4 x 13.6 - 20.4 u.

Note: The form belongs to *Stemphylium* Wallrath, but does not agree with any of the species known. It was poorly sporulating and was isolated from soil.

*Stemphylium macrosporoidum* (Berkely and Broome) Saccardo (Fig. 15, Pl. XIX-D).

Colonies on Czapek's agar broadly spreading, reaching a diameter of about 5 cm. in 10 days, subfloccose, light grey to brownish black; reverse in the same shades. Aerial hyphae freely branched, septate, olivaceous brown to brown, 5 u wide. Submerged hyphae hyaline to light olivaceous brown, branched, closely septate, sometimes anastomosing, 3.4 - 5 u wide.

Conidiophores from aerial branches, hyaline and branched or short, unbranched, brown knob-like, conidia borne terminally. Occasionally, an intercalary cell swells up and bears conidium.
Conidia at first one celled, soon becoming 4 celled, cells either crosswise or fourth cell forming the stalk. Soon the septations increase to form irregularly lobed, opaque dark brown spore. Commonly a part of the spore body produces very short hyaline hyphae bearing conidia and giving catemulate appearance, less commonly spores arise intercalarily, 14-30.6 u in diameter, rarely extending up to 42 u.

Note: The form resembles S. macrosporidica in general characters, except for the lobed, opaque conidia with variable origin. The isolate was recovered from soil and rhizosphere of the normal wheat seedlings.

**Tubercularia vulgaris Tode**

(Pl. XX-A).

Colonies on Czapek's agar growing moderately, attaining a diameter of about 7 cm. in 20 days, lightly floccose, initially white, turning to faint red with age; reverse whitish at first becoming Salmon pink with yellowish shades.

Sporodochia rather large, erumpent, flat above, greenish black, smooth, usually single occasionally confluent, appearing somewhat stipitate. Conidiophores bushy, repeatedly forked, erect, ultimate branches alternate or whorled, hyaline, about 77 u long, 1.5 - 3 u thick. Conidia borne terminally, ellipsoid with tapering ends, almost hyaline, 7.5-9 x 2-3.6 u.
Note: The isolate agrees closely with type description by Gilman (1957), except for coloration of conidia and whorled arrangement of the branches of conidiophores. The isolate was collected abundantly from rhizosphere soil platings of healthy wheat seedlings.

*Esarum rose* (Peck) Wr.

(Fig. 16).

On potato dextrose agar growth fluffy, aerial mycelium white with tinges of pink, carmine-purple, and violet, spreading radially 7.5 cm. in seven days. Conidia numerous, mostly micro, globose or ovoid to sub-globose, pear-shaped, none to one-septate. Macroconidia long, spindle shaped to sickle shaped, two septate rarely three septate, ends pointed or rounded, slightly pedicellate, found scattered all over the mycelium. Sperodochia and pionnotes lacking. Chlamydo- spores one celled or two celled or in long chains of five or even eight, globose to sub-globose, 4-12 μ in diameter.

Measurements of conidia: 0-septate 12 x 4 (3.2-14 x 3.6) μ, 1-septate 15 x 3.6 (5.6-18.4 x 9.5) μ, 2-septate 12 x 2.4 (9.16.3 x 2.4-4.5) μ, 3-septate 17.6 x 3.2 (12-22 x 9.5) μ.

Note: The fungus agrees with the type description. The isolate was recovered from diseased seedlings and rhizosphere. The fungus has been described by Subramanian (1952) from black cotton soil of South India.
**Fusarium avenaceum** (Fr.) Sacc.
(Fig. 17).

On potato dextrose agar growth was advanced, with very little aerial mycelium, cottony white to various shades of pink and rose, **Vernonia,** Persia pink (Colour Pl. 3. H 4) with a radial spread of 7-8 cm. in 7 days, reverse showing Rose abony colour. Both micro and macroconidia present, usually in sporodochia or pionnotes, microconidia oval, rare, zero to one septate. Macroconidia long, thin walled awl shaped, filiform, somewhat straight and more curved near the apex than in the middle, ends pointed, basal cell mostly pedicellate, 3 to 5-septate mostly, rarely 6-7 septate. Chlamydospores were entirely lacking. Measurements of conidia: 0-septate 6.4 x 1.6 (5-10 x 1-3) μ, 1-septate 13 x 2 (9-20 x 1-3.2) μ, 2-septate 17.6 x 2 μ, 3-septate 26.4 x 2.4 (20-35 x 2-4) μ, 4-septate 19 x 2 (19-35 x 2-3) μ, 5-septate 30 x 3 (30-45 x 2-4) μ, 6-septate 33 x 3 (30-50 x 2-4) μ.

**Note:** The fungus agrees closely with the type description except for the smaller size of conidia. It was isolated from diseased wheat plants and rhizosphere. The form has been reported by Subramanian (1952) from South India.
**Fusarium culmorum** (W.G. Smith) Sacc.

(Fig. 18).

On potato dextrose agar broadly spreading, attaining a diameter of 7.5 cm. in 7 days, floccose, cottony white aerial mycelium with various shades of yellow pink to coffee brown tinged with rose red and golden yellow with brownish pionnotes frequently seen. Reverse showing Chinarose (Colour Pl. 5.A 6) to Ruby (Colour Pl. 6.G 6). Conidia scattered in the aerial mycelium, in sporodochia or brownish slimy masses (pionnotes). Microconidia absent. Macroconidia 3 to 5 septate, mostly 5-septate, more than 5-septate not seen. Spindle to sickle shaped, gradually or sharply tapering at both the ends, sometimes the apical cell constricted, base pedicellate. Sclerotia lacking. Chlamydospores both conidial and mycelial present, mostly intercalary, rarely terminal, globose or oval, one to two celled, even in long chains, rough walled, 6-12 μ in diameter. Measurements of conidia: 3-septate 27.2 x 4.2 (20.4-35 x 4.2-5) μ, 4-septate 35.7 x 4.2 (29-37 x 4.2-6) μ, 5-septate 42.5 x 5.1 (30-50 x 4.2-6) μ.

**Note:** The form resembles fully with the type description. It was collected from rhizosphere and rhizoplane of wheat seedlings abundantly. Just after isolation the form was fluffy and only chlamydospores were produced. By subsequent subculturing conidia appeared but were less frequent.
Rhizoctonia solani Kühn
(Pl. XX-B).

Strain 1. Colonies on potato dextrose agar rapidly spreading, mostly forming a crust on the medium, aerial fluffy mycelium sparse, dirty white at first turning yellowish brown to brown with age. Uneven surface layer comprised of hyaline hyphae with constrictions giving moniliform appearance, up to 12 μ wide, but never forming definite sclerotia. Aerial fluffy mycelium of brownish, septate, branched hyphae, showing typical constriction at the branching, up to 7 μ wide; loose sclerotia, up to 210 μ in diameter, formed entangled in aerial hyphae.

Strain 2. This has got more fluffy growth with abundant tangled, loose sclerotia; crust formation on the surface of the medium a little tan. (Pl. XX-D).

Strain 3. This is more like strain 1 in having a crust of superficial hyphae. The fluffy mycelium, although less than strain 2, is more than that of strain 1. The characteristic feature of this strain is the formation of elevated patches in the superficial crust, which are compact and dark brown to tan coloured. (Pl. XXI-D).

Note: All the three strains were isolated from diseased wheat seedlings, but only strains 2 and 3 were isolated from rhizoplane of wheat plants.
Rhizoctonia sp.

(Fig. 19, Pl. XXI-C).

Colonies on potato dextrose agar very rapidly growing covering the dish in about 4 days, growth mostly adpressed, but even; hyphae rising at the walls of the dish and spreading over the lid; whitish at first, turning to bright red or light orange, reverse in the same shades, superficial hyphae, septate, branched, showing typical constrictions at the branching, light orange, 7-12.3 μ thick; sometimes dense floccose mycelium is formed, hyphae similar to the superficial one, 3.5-7 μ wide. Sclerotia formed at 10 day stage, embedded in medium and on the inner face of the lid; fairly compact, orange, 71-580 μ in diameter, no rind differentiation.

Note: The isolate although in general features is like R. solani, differs in smooth growth, bright coloration and fairly compact, distinct sclerotia. It was isolated from wheat seedlings showing pre-emergence blight and from rhizoplane of wheat seedlings.

Rhizoctonia bataticola (Taub.) Butler

(Pl. XX-C).

Colonies on potato dextrose agar fast growing covering the dish in 4 days at 28°C, with little fluffy mycelium; white at first turning to brownish black, reverse in the same shades; soon scattered conglomeration in aerial as well as
submerged hyphae are formed which form blackish sclerotia with a fringe of hyphal strands, but no differentiating rind tissues; hyphae closely septate, cells short and barrel shaped, up to 12 μ wide.

**Note:** The fungus agrees closely with that of Mehrotra (1961) who isolated it from betel vine orchards. The isolate was obtained from rhizosphere and rhizoplane platings of wheat plants.

*Sclerotium rolfsii* Saccardo

Colonies on Czapek's agar broadly and rapidly spreading, attaining a diameter of about 7 cm. in 6 days, sparse, curly with prominent rope formation, white, reverse colourless. Hyphae septate, branched, hyaline, 2-3.4 μ wide, clamp connections not observed. Sclerotia definite, black, mustard like with outer rind and inner medulla, about 2 mm. in diameter.

**Note:** The form is a widespread seedling parasite. It was isolated from unemerged seedlings, black foot portion and black roots of wheat seedlings. It has been reported as a wheat seedling parasite by Chattopadhyay (1953) and Asthana (1954-55).
Other sterile forms:

(Pl. XX-D).

Isolate No. 62.

Colonies on potato dextrose agar rapidly spreading covering the dish in 2 days, adpressed to almost submerged growth; colourless at first, turning to brownish black and black with age; reverse in the same shades; sclerotia formation starts from periphery in superficial layers. Superficial hyphae brown, closely septate, sparsely branched, with abundant globular contents, up to 13.6 μ wide. Side branches produced from these intermingle to form ill defined sclerotia of variable size.

Note: The fungus was isolated repeatedly from the straws buried in unsterilized soil and was found to be able to check the growth of pathogens to due to its very fast growth rate.

Isolate No. 73.

(Pl. XX-E).

Colonies on potato dextrose agar broadly and rapidly spreading, attaining a diameter of about 7 cm. in 14 days, lowly floccose, white to grey, nonation good, reverse brownish black. Aerial hyphae hyaline, septate, branched, 1.5-2 μ
broad, with numerous conglomerations of rounded to oval, brownish black cells forming balls of variable structure and size; cells of conglomerations up to 8.5 u wide. Superficial and submerged hyphae hyaline, branched, closely septate, 3.4 - 5 u wide, conglomerations as in aerial hyphae abundant.

**Note:** The fungus remained sterile throughout, except for these irregular balls due to twisting and retwisting of short rounded brown celled hyphal fragments. The fungus was isolated from rhizosphere soil of wheat seedlings.

*Isolate No. 54.*

*(Fig. 20).*

Colonies on PDA growing moderately, attaining a diameter of about 2 cm. in 7 days, floccose funiculose, light to dark grey *(Colour Pl. 7.A 1)*; reverse olivaceous brown to black *(Colour Pl. 15.J 6)*. Aerial hyphae funiculose, septate, 1.7 - 5 u wide, young ones hyaline, older ones light brown, exudate greasy, on ropes and individual hyphae fairly firm, giving undulate appearance to the hyphae. Submerged hyphae hyaline to light olivaceous, septate, branched, ranging from 1.7 - 5 u.

Tip portions, intercalary cells or protuberances from terminal and intercalary cells of aerial hyphae become brown, swollen, rounded, and cut off as spores which may form
very short chains. In later stages, these hyphal parts and spores are red brown; spores (chlamydospores) thick-walled, smooth, spherical about 5-8.5 μ in diameter. No other type of spores could be observed.

**Note:** The form reproduced by chlamydospores only and showed very characteristic firm exudate. It was isolated from rhizosphere soil of wheat seedlings.