Contribution to the taxonomy of Genus Helminthosporium I.

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With 2 Figs. in the text.

In the literature of the whole world are described 118 species of *Helminthosporium*, out of which 113 are pathogenic on 111 hosts, 4 are from soil and 1 is externally seedborne on celery. Out of 111 hosts 68 belong to Monocotyledons, 55 of these being graminaceous. Among the graminaceous hosts cereal crops like wheat, barley, rice, maize- and oat are more prone to attack by different species of *Helminthosporium*. Wheat alone is attacked by 11 species, whereas rice by 6 and barley by 5 species of *Helminthosporium*.

Several attempts have been made by various workers to describe and classify the species of *Helminthosporium* and among them Drechsler 1923, Nisikado 1928, Ito 1930, Shoemaker 1959, Luttrel 1963, 1964 and Nelson 1964 deserve special mention. Drechsler described 28 species of *Helminthosporium* isolated from various graminaceous hosts and discussed various characters like germination of the conidium, development of the conidium, shape size and color of conidium and conidiophore, forming the basis of species classification. He has raised a doubt regarding emphasis on the use of characters like shape and size of conidia and conidiophores alone in the classification followed by Saccardo and Lindau.

Nisikado divided *Helminthosporium* into two subgenera *Cylindrohelminthosporium* and *Euhelminthosporium* on the basis of method of germination, shape, color and arrangement of conidia. Ito included species of subgenus *Cylindrohelminthosporium* into a new genus and called it as *Drechslera*. Shoemaker accepted the new genus *Drechslera* and erected another genus *Bipolaris* to include species of the subgenus *Eu. helminthosporium* of Nisikado and retained the genus *Helminthosporium* for lignicolous species. Thus he proposed three genera, the former two for graminicolous species and the last one for the lignicolous species. Luttrell followed this classification in his studies of *Helminthosporium* although he expressed doubt regarding advantages in following this system.

The doubt expressed by Luttrell regarding the usefulnes of this system of classification appears to be correct because characters which are supposed to be specific to a genus are generally found in

other genera. For example, Nelson observed that in all bipolar species production of conidia with a protuberant hilum is absent whereas species described in this paper inspite of bipolar germination produces conidia with a protuberant hilum. Another distinguishing feature of this system that graminicolous species should be included into two genera, *Drechslera* and *Bipolaris,* and lignicolous species be

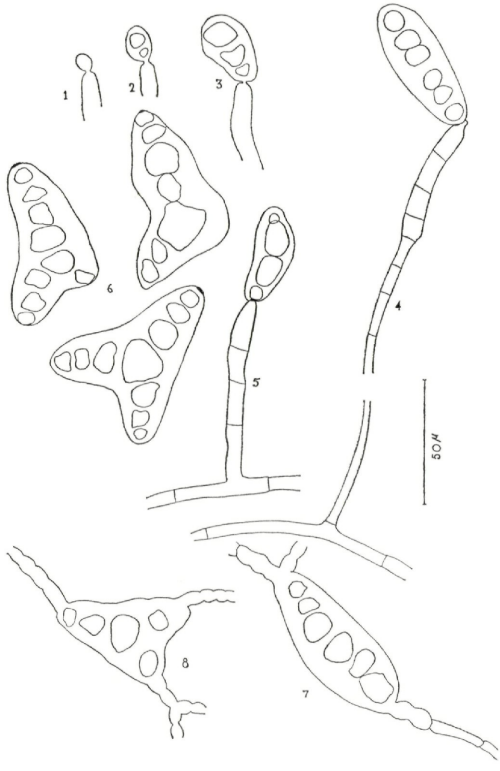

Fig. I. *H. atypicum* Deshpande and Deshpande sp. nov. — 1, 2, and 3. Stages in the development of conidium. — 4. Hypha with a longer conidiophore bearing a normal conidium. — 5. A shorter conidiophore bearing a conidium. — 6. Atypical conidia. — 7. A normal conidium germinating bipolary. — 8. An atypical conidium producing 3 germ tubes.

restricted to *Helminthosporium* can not also be accepted as a rule because here again species can be exchanged. Therefore in this communication authors have described two new fungi under the genus *Helminthosporium*.

Material and Methods.

Species of *Helminthosporium* reported here have been isolated from two dfiferent sources, like leaves of wheat and germinating wheat seed. Isolations from these materials were made on acidified agar by adding ½ a ml. N/1 HCl to Potato dextrose agar (PDA) to bring its pH to 4.5. Plates were incubated at 26 ± 3° C and from them pure cultures and growth was studied on PDA plates for 8 days. Description of morphology of species and cultural characters were recorded. Comparison was made with the morphology of species recorded earlier on similar substrate and on the basis of such a comparative study it is concluded that these two isolates are two new species of *Helminthosporium*.

Observations.

1. *Isolate from wheat leaf:* Leaves of wheat plants showing leaf spots were collected from wheat fields near Ajantha in December 1963. These spots measured 1.5—2 mm, in diameter, were brown in color, and sorrounded by yellow halo. They at the tip coalesced in many leaves and resulted in complete drying of the tips giving ash-grey appearance.

Growth on PDA plates: The fungus grew well on PDA and reached a diameter of 73 mm on the 8th day. The colony spreading olivaceous with white edge, darkened from centre outwards and sporulated on the 3rd day. Vegetative hyphae branched, septate, pale brown, darkening with age, 5.2—7.0 μ in width; conidiophores arise as lateral branches, usu. unbranched; two types of conidiophore on the basis of their length and size could be discerned in this fungus. The shorter ones uniformly wide, brown, representing about 5% of the total number of conidiophores as observed in 20 microscopic fields, 62.4—72.8 × 7.8 μ; the longer ones narrow at the base, palegreen in color, gradually broadening and becoming darker towards the tip; they measure 440—680 × 5.2—10 μ; conidia pseudoacropleurogenous, yellow to brown, darkening at maturity, elliptical with hemispherical ends, widest at the middle, 0—10 septate, average distance between two septa being 5.1 μ and measure 23—93.6 × 26 μ. Both types of conidia produced, by longer as well as shorter conidiophores.

The fungus produces atypical conidia representing about 70% of the total conidia per microscopic field. These are either forked or

roughly triangular, bifurcation conspicuous even in septation. Normal conidia germinate uni- or bipolarly whereas atypical conidia show germination at tips or also at the base producing 3 germ tubes simultaneously. Hilum a flat ringed pore.

Colony also produces white raised compact, spongy, pseudosclerotia, 3—5 mm in diameter with a definite stalk measuring 1—2 mm; sometimes so abundant as to cover 3/4th part of these surface growth.

Helminthosporium atypicum sp. nov.

Colony on PDA olivaceous when young, blackening at maturity, velvetty, slow growing; hyphae branched, septate, palebrown, darkening with age, 5.2—7 μ wide; conidiophores 3—7 septate, usually unbranched, and of two types; shorter conidiophore uniformly wide, brown, 62.4—72.8 × 7.8 μ; longer ones narrow at the base and paler, gradually broadening and darkening towards the apex, 440—680 × 5.2—10 μ; conidia pseudopleurogenous, yellow to brown, darkening at maturity, of two kinds; normal ones relatively few, elliptical with hemispherical edges, widest at the middle, 0—10 septate, average distance between two septa 5.1 μ, 23—93.6 × 26 μ; atypical conidia abundant, forked or geniculate, septation forked, 5—8 septate, brown to dark brown; germination, axial, uni or bipolar in normal conidia, from both tips and sometimes from the base in atypical conidia; white, stalked, compact, spongy pseudosclerotia present; stalk 1.5—2 mm in height; head 2—5 mm in diameter.

Caespites in PDA primum olivacei, in maturitate nigrescentes, velutini, tarde crescentes; hyphae ramosae, septatae, brunneae, postea obscuriores, 6.2—7 μ crassae; conidiophora 3—7-septata, plerumque simplicia, nunc breviora, brunnea, aequaliter crassa, 62.4—72.8 × 7.8 μ, nunc longiora, ad basin angustiora et pallidiora, apicem versus paulatim incrassata et obscuriora, 440—680 × 5.2—10 μ; conidia pseudopleurogena, lutea vel brunnea, in maturitate obscuriora, nunc typica, ellipsoidea, utrinque late rotundata, continua vel usque ad 10-septata, septis inter se ca. 5.1 μ distantibus, 23—93.6 × 26 μ, nunc atypica, furcata vel geniculata, 5—8-septata, brunnea vel obscure brunnea; germinatio conidiorum typicorum axialis, uni- vel bipolaris; conidia atypica utrinque vel postice tantum germinantes; pseudostromata spongiosa, albida, stipitata, stipite 1.5—2 mm alto et capitulo 2—5 mm diam. praedita adsunt.

2. Isolate from germinating wheat grain.

This isolate was obtained from seeds kept for germination on moist filter paper. The fungus appeared in the form of black crust on the surface of the seed and when observed under microscope was

found to be consisting of conidiophores with abundant conidia. Observation further indicated that germination of the seed was not hampered. This is the 2nd record of a species of *Helminthosporium* growing on a germinating wheat grain and not affecting the seedling. Earlier only

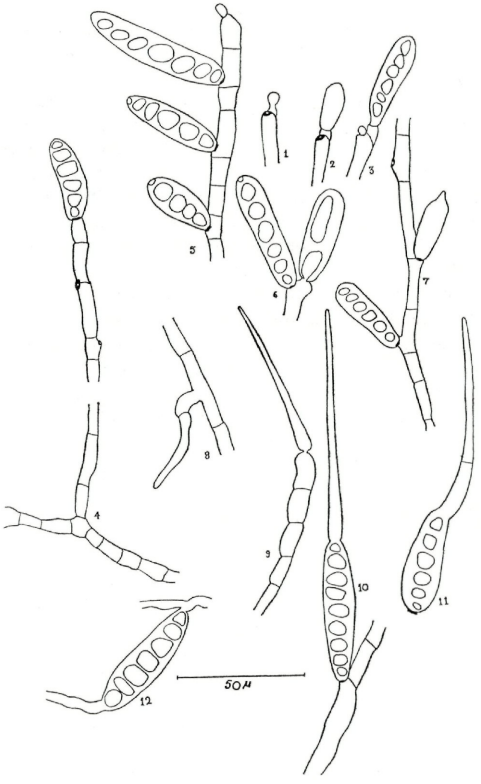

Fig. II. *H. proliferatum* Deshpande and Deshpande sp. nov. — 1, 2, 3. Stages in the development of the conidium. — 4. A part of hypha with conidiophore showing conidail scars and with a conidium. — 5. Tip of a conidiophore showing uniparous arrangement of conidia. — 6. Tip of a conidiophore bearing two conidia. — 7. A part of conidiophore showing alternate arrangement of conidia. — 8, 9, 10, and 11. Proliferations of hyphae, tip of conidiophore and conidia respectively. — 12. A germinating conidium.

one species of *Helminthosporium* i. e. *H. biforme* was recorded from wheatgrain by Saxena and Thammya 1961 and another from Celery seeds (Gobelez, M. 1960). It is described as *H. apii.*

Helminthosporium proliferatum sp. nov.

Colony on PDA fast spreading, reaching a diameter of 90 mm on the 6th day; aerial mycelium abundant, olivaceous to black, wooly; vegetative hyphae profusely branched, septate, olivaceous 5—8—7.0 μ in width, hyphae sometimes give out thread like lateral, rhizoidal proliferations; conidiophores lateral or terminal, usu. unbranched, 5—20 septate; when terminal, 2 conidiophores grow side by side from a common point, pale, olivaceous, septate, 291.6—510 × 7—13.8 μ; conidiophore proliferation percurrent, conidia arranged variously, terminal as well as lateral when lateral, uniparous or alternate, cylindrical, 3—13 septate, average distance between two septa 5.7 μ, olivaceous, 23—126 × 11.5—13.8 μ; conidial proliferation axial; hilum in the form of a short cylindrical protuberance; germination uni- or bipolar percurrent or lateral, producing 1—3 germ tubes from the same cell.

Caespites in PDA celeriter extendentes, post dies 6 usque ad 90 mm diam. accrescentes; mycelium aerium optime evolutum, olivaceum vel nigrescens; hyphae ramosae, septatae, olivaceae, 5—7 μ crassae; conidiophora lateralia vel terminalia, simplicia, 5—70-septata, pallide olivacea, 291.6—510 × 7—13.8 μ; conidia terminalia vel lateralia, tunc in uno latere orta vel alternantia, cylindracea, olivacea, 3—13-septata, septis inter se ca. 5.7 μ distantibus, 28—126 × 10.5—13.8 μ; hilo breviter cylindraceo praedita, uni- vel bipolariter tubulis 1—3 e cellula unica germinantia.

Discussion.

1. *H. atypicum:* Data given in Table 1 clearly suggest that the isolate from leaf spot can be compared with *H. sativum, H. sacchari, H. teres* and *H. gramineum.* It differs from all of them in production of two types of conidiophore, i. e. longer and shorter, and of two types of conidia — normal and atypical. Its normal conidia also differ with those of other species in size and number of septa. Production of two types of conidia appears to be a constant and definitive character of this isolate as it produced the same two types when it was grown on different agar media like Czapek Dox, Richard's Coon's, glucose peptone, Malt extract, cornmeal, etc. In addition, production of pseudosclerotia in culture marks it as distinct from other species of *Helminthosporium.* Nelson 1964 has reported formation of columnar stromata in culture of *H. spiciferum* and development of perithecia from them. The columnar structure here may be a sterile abortive perithecia resembling the columnar stroma of *H. spiciferum.* On the basis of

these morphological differences, it appears that this isolate is a new species.

2. *H. proliferatum:* As far as authors know only two species of *Helminthosporium* have been reported from grains earlier; one is *H. apii* by Gobelez in 1960 from celery seeds and another is *H. biforme* by Saxena and Thammaya from wheat seed in 1961. But the peculiarity of hyphae, conidiophores and conidia to proliferate is non existent in these species. In addition, *H. apii* differs from *H. proliferatum* in number of septa and size of the conidium. Hence it can be concluded that the species isolated from wheat grain and described here is a new species and designated as *H. proliferatum.*

Summary.

Two new species of *Helminthosporium* one isolated from leaf spot of wheat and another from wheat grain are described here as they differ from already described species in characters of hyphae, conidiophores and conidia. They are *H. atypica* and *H. proliferatum.*

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Table 1: Comparison between Species described from leaf spots of wheat.

No. Sl.	Name of the fungus	Source, hyphae, colony.	Conidiophores.	Conidia.
1.	*H. sativum*	Footrot and leaf spot.	Fasciculate, 150—180 × 6—10 μ, dark redish brown.	Straight or curved, tapering towards ends rounded, olivaceous 90—130 × 15—20 μ, 7—14 celled.
2.	*H. tritici repentis* Diedicke.	Leaf spot.	Dark olivaceous, 3—6 septate, 80—200 × 7—9 μ	Subhyaline, straight, cylindrical, 1—9 septate, 45—175 × 12—21 μ
3.	*H. sacchari* (Breda & Haan) Butler	Leaf spot.	Deep greenish brown, 70—200 × 5.6—7.5 in *clusters* of 3—20	8—10 septate, 32—120 × 11—17 μ
4.	*H. teres*. Sacc.	-do-	Brown, olivaceous, single or in a cluster of 2—3, 120—200 × 7—9 μ	Olivaceous, 4—5 septate 110—115 × 18 μ
5.	*H. avenae*. Eidam Eidam	-do-	Scattered stout, many septate 150—200 × 9—12 μ	Straight, cylindrical, olivaceous, 4—6 septate, 80—100 × 15—16 μ
6.	*H. gramineum* Rabh.	-do-	Solitary or in clusters of 1—5 septate.	Elongated, cylindrical solitary, 3—6 septate, 50—100 × 14—20 germination polar or lateral secondary conidia produced on proliferations from conidiophore tip.
7.	*H. atypicum* sp. nov	-do-	of two types, shorter ones uniform, brown, 62.4—72.8 × 7.8 μ; longer ones narrow at base, close septate and brown at tip, 440—680 × 5.2—10 μ.	of two types, normal conidia dark brown, elliptical, 3—10 septate, 23—93 × 26 μ; atypical widest at the middle, forked or roughly triangular, 5—8 septate.