

## A NOVEL TAXONOMIC STUDY OF THE *HELMINTHO SPORIUM* LINK EX FRIES STATUS AND CLOSED RELATED GENERA

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**ABSTRACT :** This study isolated and examined many isolate of *Drechslera* spp., *Bipolaris* spp. and *Exserohilum* from rice cultivar and treated the most changes that occurred in the taxonomy and nomenclature of the genus *Helminthosporium* according to the ICBN rules. This genus was considered as complex of species and deeply entrenched in the taxonomic literature. 100-668 species were recorded in the phytopathological literature and database, but in this study only 49 species were fixed as correct names in *Helminthosporium*, and split it into four genera, also the common species of the genus *Helminthosporium* were distributed the four genera: *Drechslera* (28 spp.), *Bipolaris* (10 spp.), *Exserohilum* (7 spp.) and *Marielliotia* (3 spp.). Most of the species of *Helminthosporium* become synonym for species of the genera *Drechslera*, *Bipolaris*, *Exserohilum* and *Marielliotia* and the names of *Helminthosporium* stilled as basynonym.

**Key words:** Classification, *Drechslera*, *Bipolaris*, *Exserohilum*, *Marielliotia* taxonomical treatment, *Helminthosporium* status.

### INTRODUCTION

The fungus *Helminthosporium* a customs to the dematiaceous of Deuteromycetae, it was treated as a form of a genus (form genus) according to the rules of scientific naming (ICBN). This fungus behaviour as facultative saprophytic fungus and causing brown spot disease on cereals (Bakonyi *et al*, 1997) and has widely hosted a range (Rodriguez-Decuadro *et al*, 2014). *Helminthosporium* was established for the first time by the Link ex Fries in 1809 and the type species of this genus was *H. velutinum* Linke ex Ficus & Schubert. There are inconsistencies in the number of its species, Hesselstine *et al* (1971) were stated that genus includes 175 species, while the number of species that bears the name genus *Helminthosporium* were 686 species based on fungus MycoBank database (www.mycobank).

Since the fifties of the last century and till time, many taxonomic changes were conducted on the nomenclature for those species. Some species been belonging to other genera far down the phenotypes such as *Cladosporium* and *Curvularia* and other genera (Shoemaker, 1959).

The *Helminthosporium* was considered heterogeneous fungus, it includes a species differ in good morph characters, so the *Helminthosporium* was subdivided into two subgenera: subgenus: *Cylindro-Helminthosporium* and subgenus: *Eu-Helminthosporium* (Raemaekers, 1988), depending on the most important

taxonomic characteristics like spores germination and shape of spores and the shape of the hilum, septate characters, the species of *Helminthosporium* were renamed again.

The species belonging to the subgenus *Eu-Helminthosporium* were placed into the genus *Bipolaris* and the species within the subgenus *Cylindro-Helminthosporium* were placed into the genus *Drechslera* and based on the germination mode, where the germination occurred at the poles only considered a diagnostic character to the *Bipolaris*, while if the germination occurred in most the phragmospore considered as a diagnostic character to the genus *Drechslera* (Drechsler, 1923; Shoemaker, 1959; Raemaekers, 1988).

Based on the helium characters like prominent or non-prominent been designated the new genus *Exserohilum* Leonard & Suggs. This genus included 8 species were previously registered in the genus *Helminthosporium* (Leonard and Suggs, 1974). The septa number was considered as a diagnostic character for new genus *Marielliotia* Shoemaker (1999), which includes three species was part of *Drechslera*, they basically were among *Helminthosporium* (Aslani *et al*, 2006). Recently using analysis based on ITS sequences to determine evolutionary relationships and taxonomic status of *Bipolaris oryzae* and other *Cochliobolus* species (Dela Paz *et al*, 2013). The earliest species of *Helminthosporium* were still only synonyms of other species of other genera, or are the

names became Illegitimate names or Ambiguous names according to the rules of the ICBN. On the other hand, the aim of the present study is to clarify the taxonomic status of the *Helminthosporium* spp and remove the confusion surrounding the status of this genus, and re-taxonomic treatment of the species belonging to it. Also to compare between the taxonomic characteristics of the species under study, which addresses this research associated problems in terms of the diagnostic characters and taxonomic status.

## MATERIALS AND METHODS

### Sample collection

A total of 50 leaf samples of rice (*Oryzae sativa*) bearing symptoms of leaf spotting, at various stages was collected and kept in sealed plastic bags. The samples were examined for the possible presence of pathogen structures. *Bipolaris*, *Drchslera* and *Exserohilum* as a dematiaceous fungi were regularly associated with the necrotic tissues was inoculated into plates containing potato dextrose agar (PDA) as described by Imran and Al.Rubaiy (2015). Rice leaf samples were collected from October to December 2015-2016, in the middle regions of Iraq. Daily temperatures ranged were approximately around 5°C in January, 56°C in August and 37°C in October.

### Culturing and isolating of *Bipolaris*, *Drchslera* and *Exserohilum*

The pure cultures of *Bipolaris*, *Drchslera* and *Exserohilum* were isolated by the serial dilution technique using Potato Dextrose Agar (PDA) medium. The isolates of *Bipolaris*, *Drchslera* and *Exserohilum* were sub cultured on the PDA medium in separate triplicate plates for each one of the fungi and incubated at 25°C for 7 days (Imran and Al-Shukry, 2014; Imran and Al Asadi, 2014). Microscopic examination was performed using mounted tiny portion from colony margins each fungus. This was done by using adhesive transparent tape placed on a slide with a drop of lacto- phenol cotton blue stain. *Bipolaris*, *Drchslera* and *Exserohilum* isolates were identified phenotypically using the taxonomic key created by Alcorn (1988). They were maintained on PDA slants at 25°C for four days and were kept in refrigerator at 4°C until use; they were sub cultured every two weeks. The frequency of a fungus is denoted by the number of samplings in which it is recorded against the total: Frequency (%) = No. of observation in which colony appears / total number of observations recorded × 100 (Imran and Al-Rubaiy, 2015).

### Taxonomic treatment method

In this study, it has been the most species recorded

**Table 1** : List of *Helminthosporium* spp with their authorities.

1	<i>Helminthosporium avenaceum</i> M.A. Curtis ex Cooke (1889)
2	<i>Helminthosporium avenae</i> Eidam 1891
3	<i>Helminthosporium australiensis</i> Bugnicourt (1957)
4	<i>Helminthosporium bhawani</i> A.P. Misra 1976)
5	<i>Helminthosporium bicolor</i> Mitra (1931)
6	<i>Helminthosporium biseptata</i> Sacc. & Roum (1881)
7	<i>Helminthosporium cactivorum</i> Petr. (1931)
8	<i>Helminthosporium catenarium</i> Drechs (1960)
9	<i>Helminthosporium coicis</i> Nisikado (1928)
10	<i>Helminthosporium cyclops</i> Drechsler (1923)
11	<i>Helminthosporium dematioideum</i> Bubák & Wróbl (1916)
12	<i>Helminthosporium dictyoides</i> Drechsler (1923)
13	<i>Helminthosporium dictyoides</i> Drechsler var. phlei (1955)
14	<i>Helminthosporium erythrospila</i> Drechsler (1935)
15	<i>Helminthosporium euphorbiae</i> Hansford (1943)
16	<i>Helminthosporium frumentaceum</i> Mitra (1931)
17	<i>Helminthosporium fugax</i> Wallr. (1833)
18	<i>Helminthosporium graminea</i> Rabenh. ex Schlecht (1888)
19	<i>Helminthosporium giganteum</i> Held & Wolf. (1898)
20	<i>Helminthosporium halodes</i> Drechsler (1923)
21	<i>Helminthosporium heveae</i> Petch (1906)
22	<i>Helminthosporium holmii</i> Luttr. (1963)
23	<i>Helminthosporium inconspicuum</i> Cooke & Ellis (1878)
24	<i>Helminthosporium leptochloae</i> Y. Nisik. & C. Miyake (1924)
25	<i>Helminthosporium longirostratum</i> Subram. (1957)
26	<i>Helminthosporium leucostylum</i> Drechsler (1923)
27	<i>Helminthosporium maydis</i> Nisikado (1926)
28	<i>Helminthosporium miyakei</i> Y. Nisik (1929)
29	<i>Helminthosporium monoceras</i> Drechsler (1923)
30	<i>Helminthosporium nodulosum</i> Berk & M.A. Curtis (1874)
31	<i>Helminthosporium oryzae</i> Breda de Haan (1900)
32	<i>Helminthosporium poae</i> Baudys (1916)
33	<i>Helminthosporium pedicellatum</i> A.W. Henry (1924)
34	<i>Helminthosporium ravenelii</i> Curtis (1868)
35	<i>Helminthosporium rostratum</i> Drechsler (1923)
36	<i>Helminthosporium sativum</i> Pammel, King & Bakke (1910)
37	<i>Helminthosporium sativus</i> Pammel (1910)
38	<i>Helminthosporium sacchari</i> E. J. Butler (1913)
39	<i>Helminthosporium setariae</i> Sawada (1919)
40	<i>Helminthosporium solani</i> Durieu & Mont. (1849) Durieu & Mont (1849)

Table 1 continued...

Table 1 continued...

41	<i>Helminthosporium spiciferum</i> (Bainier) Nicot.
42	<i>Helminthosporium stenacrum</i> Drechsler (1923)
43	<i>Helminthosporium siccans</i> Drechsler (1923)
44	<i>Helminthosporium sorghicola</i> Lefebvre & Sherwin (1949)
45	<i>Helminthosporium setariae</i> Lind (1919)
46	<i>Helminthosporium tritici-repentis</i> Diedicke (1903)
47	<i>Helminthosporium turcicum</i> Pass. (1876)
48	<i>Helminthosporium vagans</i> Drechsler (1944)

colored, lobes or bulges that appear on the body of conidia, germination mode of conidia and the location of germination from one pole of the or the two poles, as well as some cultural characters and review their pathogenicity for plant species and humans.

## RESULTS AND DISCUSSION

### The species belonging to the *Helminthosporium*

There is high similarity in the conidial characters between *Helminthosporium*, *Drechslera*, *Bipolaris* and *Exserohilum*. *Helminthosporium* included 48 species.

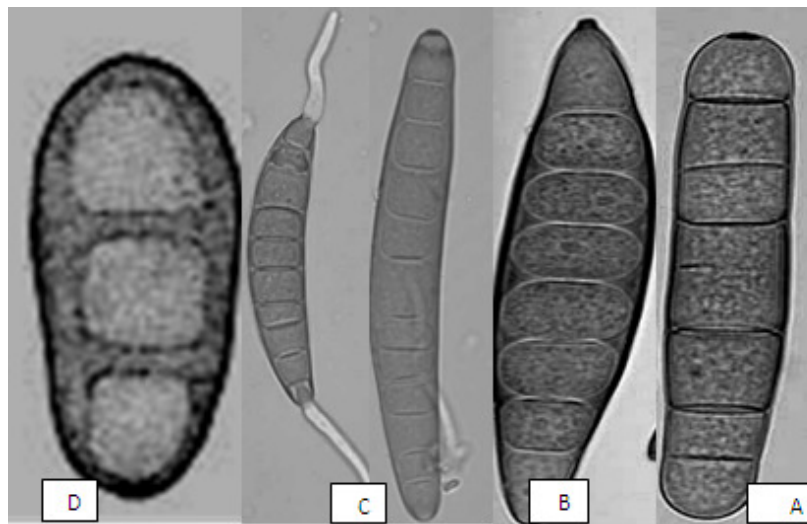


Fig. 1 : Conidial characters: Hilum shapes; septet number in: A : *Drechslera*, B: *Exserohilum*, C: *Bipolaris* and D: *Marielliotia*.

statistic in genus *Helminthosporium* with all of the articles, year of publication and published since 1809 until now, have been identified and diagnostic characteristics and document species names and authority of species in each genus and scheduling those species in the tables, each table included synonyms and telomorpe for each species if present. Illustrated the most important diagnostic characteristics of the species under interest by modern images for slides from fresh cultures performed in this study. The main diagnostic characters included conidiophores shapes, conidiogenesis and conidial appearance of fungal species.

Approved the diagnosis each of the genera: *Bipolaris*, *Drechslera*, *Exserohilum* and *Marielliotia* also these diagnostic characters for separation of *Bipolaris*, *Drechslera*, *Exserohilum* and *Marielliotia* and demonstrated the taxonomic value of conidium apical characteristics : round or truncate, number of septa, constituent double barriers of conidium, triple or multiple septa, present of false septa, characters of Central cells, presence or absence and numbers, Hilum being prominent privileged or slightly raised or low-profile perfectly, scars characters in terms of being a small, narrow or wide dark-

Table 1 shows the species names belonged to the genus *Helminthosporium*.

### The diagnostic characteristics of the *Bipolaris* Shoemaker

The genus *Bipolaris* was diagnosed by Shoemaker in 1959 as a genus differently because it includes many telomorphic species belong to *Trichometa sphaeria* other species located in the telomorpe: *Cochliobolus* has been removed this disparity valuable introduction of a new genus: *Exserohilum*. This genus which is characterized by special hilum which prominently seamlessly termed exerted helium (Safarimotlagh and Kaviani, 2008).

The *Bipolaris* differ from *Drechslera* by the germination mode : the first one germination at polar ends while the second germinated randomly (Alcorn, 1983), while the number of septa about 2-3 considered as taxonomic character of *Marielliotia* (Aslani *et al*, 2006) (Fig. 1).

It was found that the species involved under the *Helminthosporium* have conidia characterized by important changes from the taxonomic feature, those differences in microscopic characteristics led to the split

**Table 2** : *Bipolaris* spp list and common synonyms and their telomorphes if present.

No.	Anamorphe	Telomorphe	Synonym
1	<i>Bipolaris cynodontis</i> (Marignoni) Shoemaker 1959	<i>Cochliobolus cynodontis</i> Nelson 1964	<i>Drechslera cynodontis</i> (Marignoni) Subram. & Jain 1966
2	<i>Bipolaris hawaiiensis</i> (Ellis)Uchida & Aragaki 1979	<i>Cochliobolus hawaiiensis</i> Alcorn 1978	<i>Drechslera hawaiiensis</i> (Bugnic) Subram. & Jain 1966; <i>Drechslera hawaiiensis</i> Ellis 1971
3	<i>Bipolaris maydis</i> (Nisik. & Miyake) Shoemaker 1959	<i>Cochliobolus heterostrophus</i> (Dreschler) Dreschler	
4	<i>Bipolaris ravenelli</i> (Curtis) Subram. & Jain 1966	<i>Cochliobolus ravenelli</i> Alcorn 1981	<i>Drechsleraravenelli</i> (Curtis) Subram. & Jain 1966
5	<i>Bipolaris sorokiniana</i> (Sacc.) Shoemaker 1959	<i>Cochliobolus sativum</i> (Ito & Kurib.) Drechsler ex Dastur 1942	<i>Helminthosporium sativum</i> Pammel, King & Bakke 1910
6	<i>Bipolaris heveae</i> (Petch) B.A. Khasanov 1992	Unknown	<i>Drechslera heveae</i> (Petch) M. B. Ellis 1971 <i>Helminthosporium heveae</i> Petch 1906
7	<i>Bipolaris cactivora</i> (Petr.) Alcorn 1983	Unknown	<i>Drechslera cactivora</i> (Petr.) M.B. Ellis (1971) <i>Helminthosporium cactivorum</i> Petr. 1931
8.	<i>Bipolaris australiensis</i> (M.B.Ellis) Tsuda et Ueyama 1981	Unknown	<i>Drechslera australiensis</i> (Bugnicourt) Subram. & Jain ex M.B.Ellis; 1971 Subram. & Jain <i>Helminthosporium australiensis</i> Bugnicourt
9	<i>Biporalis sacchari</i> (E.J. Butler) Shoemaker, (1959)	Unknown	<i>Helminthosporium sacchari</i> (E.J. Butler,) 1913
10	<i>Bipolaris sorghicola</i> (Lefebvre & Sherwin) Alcorn 1983	Unknown	<i>Drechslera sorghicola</i> (Lefebvre & Sherwin) M. J. Richardson & E. M. Fraser 1968 <i>Helminthosporium sorghicola</i> Lefebvre & Sherwin 1949
11	<i>Bipolaris spicife</i> (Bainire) Subram 1971	Unknown	<i>Brachycladium spiciferum</i> Bainier

and transfer *Helmintho sporium* species to other four genera: *Bipolaris*, *Drechslera*, *Exserohilum* and *Marielliotia*. The former three ones have telomorphic phases *Cochliobolus* (Sivanesan, 1987; Fetch and Steffenson, 1994), *Pyrenophora* and *Setosphaeria* respectively (El-Nashaar and Stack, 1989) as shown in the Tables 2-5. All species of *Helminthosporium* transformed to the four genera and been as synonyms (Hesseltine *et al*, 1971) as shown in Tables 2-5.

### ***Bipolaris* Shoemaker**

The main taxonomic characters of *Bipolaris* spores are being with parallel walls usually with erected conidiophores and upright character feature that spores germinate at the poles (Duveillerand Garcia Altamirano, 2000; Kumar *et al*, 2001) some characters of spores shown in Fig. 2.

### ***Drechslera* Ito**

The *Drechslera* colonies dense, hairy and sometimes velvety, grey or brown ordark brown to black, mycelia immersed. Most of this genus are forming stroma and sclerotia in some cultures. Conidiophores are specialized, mononematic or in clusters, straight or zigzag shape, non-branched and are rarely branched in some species, brown smooth in most species. Single spores were organized in

some species, simple, straight or curved, clavate or cylindrical in shape, curved at the ends or be elliptical or spindle clavate inverted shape. Brown to dark brown to a pale olive to brown. The cells are irregular in color. Terminal cells are paler than those that exist in the centre of spore, mostly smooth and rarely identical, with false septa (Fig. 3). Our finding agrees to report of Zeiders (1980), Dehne and Oerke (1985).

The taxonomic treatment of 28 species belonged to *Drechslera* were shown in Table 3.

### ***Exserohilum* Leonard & Suggs**

This genus includes seven species, these species characterized by good taxonomic character its prominent hilum of conidia as in Fig. 4. Five species of this genus contain the telomorphes: *Setosphaeria*: *S. rostratum*, *S. turcica*, *S. halodes*, *S. pedicellatum* and *S. holmii* as the recording is a new species: *Exserohilum mcginnisii* Padhye and Ajello, sp. Nov. 1986 (Chang and Fan, 1986) (Table 4).

Seven species of *Exerohillium* belonged to *Drechslera* were shown in Table 4.

### ***Marielliotia* Shoemaker**

This a new genus of dematiaceous fungi, it includes



Fig. 2 : Conidial arrangement on the conidiophores of *Bipolaris*.

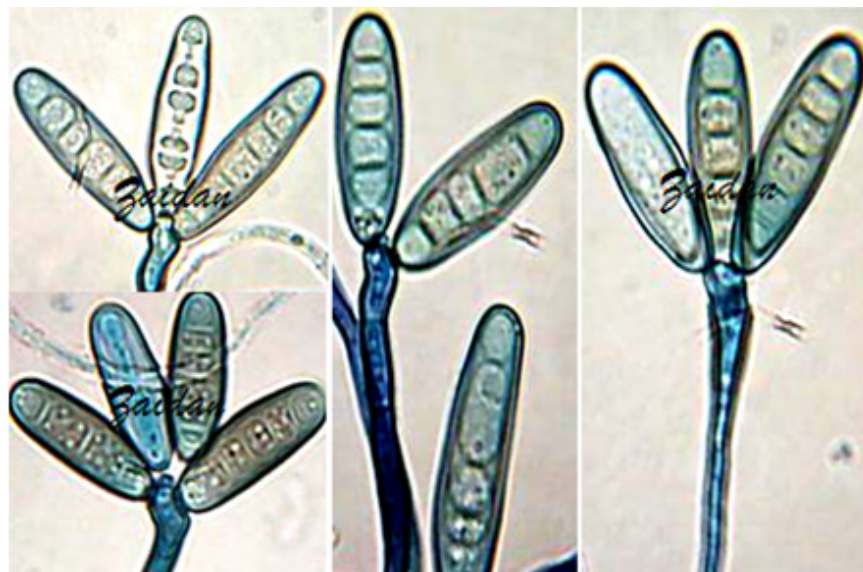


Fig. 3 : Conidial arrangement on the conidiophores of *Drechslera*.

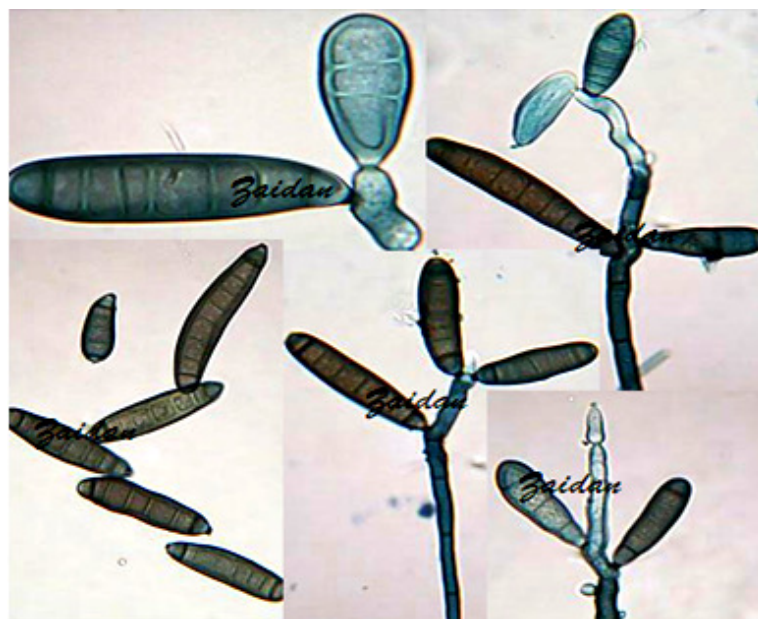


Fig. 4 : Conidiogenesis and conidia arrangement on the conidiophores of *Exerohillium*.

**Table 3** : *Drechslera* spp list and common synonyms and their telomorphes, if present.

No.	Anamorphe	Telomorphe	Synonym
1	<i>Drechslera avenae</i> (Eidam) Scharif 1963	<i>Pyrenophora avenae</i> S. Ito & Kurib. 1930	<i>Helminthosporium avenae</i> Eidam 1891
2	<i>Drechslera avenacea</i> (M.A. Curtis ex Cooke) Shoemaker, (1959)	Unknown	<i>Helminthosporium avenaceum</i> M.A. Curtis ex Cooke, (1889)
3	<i>Drechslera bicolor</i> (Mitra) Subram. & B.L. Jain 1966	<i>Cochliobolus bicolor</i> A.R. Paul & Parbery 1966	<i>Bipolaris bicolor</i> (Mitra) Shoemaker 1959 <i>Helminthosporium bicolor</i> Mitra 1931
4	<i>Drechslera bromi</i> (Died.) Shoemaker 1962	<i>Pyrenophora bromi</i> (Died.) Drechsler 1923	<i>Helminthosporium bromi</i> (Died.) Died 1903
5	<i>Drechslera campanulata</i> (Lév.) B. Sutton, 1976	<i>Pyrenophora semeniperda</i> (Brittleb. & D.B. Adam) Shoemaker 1966	<i>Bipolaris cyclops</i> (Drechsler) R. Sprague 1962 ; <i>Chaetostigma horridula</i> (Syd.) Clem. & Shear ; <i>Helminthosporium cyclops</i> Drechsler 1923 ; <i>Pleosphaeria semeniperda</i> Brittleb. & D.B. Adam 1924; <i>Pyrenophora horrida</i> Syd. 1924
6	<i>Drechsleracoicis</i> (Nisikado) Subram. & Jain 1966	Unknown	<i>Helminthosporium coicis</i> Nisikado <i>Curvulariacoicis</i> Castellani
7	<i>Drechslera dematioidea</i> (Bubák & Wróblewski) Subram. & Jain 1966	Unknown	<i>Drechslera dematioidea</i> (Bubák & Wróbl.) Scharif; (1963) <i>Helminthosporium dematioideum</i> Bubák & Wróbl.; (1916) <i>Marielliotia dematioidea</i> (Bubák & Wróbl.) Shoemaker ; (1999)
8	<i>Drechslera dictyoides</i> (Drechsler) Shoemaker 1978	<i>Pyrenophora dictyoides</i> Paul & Parberry	<i>Helminthosporium dictyoides</i> Drechsler
9	<i>Drechslera erythrospila</i> (Drechsler) Shoemaker 1959	Unknown	<i>Helminthosporium erythrospila</i> Drechsler 1935
10	<i>Drechsleraeuphorbiae</i> (Hansford) M.B.Ellis comb. nov.1971	Unknown	<i>Helminthosporium euphorbiae</i> Hansford 1943
11	<i>Drechslerafugax</i> (Wallr.) Shoemaker 1958	Unknown	<i>Helminthosporium fugax</i> Wallr. <i>H.stenacrum</i> Drechsler
12	<i>Drechslera graminea</i> (Rabenh. ex Schltldl.) S. Ito 1930	<i>Pyrenophora graminea</i> S. Ito & Kurib. 1930	<i>Helminthosporium graminea</i> Rabenh. ex Schlecht 1888
13	<i>Drechslera iridis</i> (Oud.) M.B.Ellis 1971	Unknown	<i>Clasterosporium iridis</i> Oudem. 1898 <i>Bipolaris iridis</i> (Oudem.) C.H. Dickinson 1966
14	<i>Drechslera miyakei</i> (Y. Nisik.) Subram. & B.L. Jain 1966	Unknown	<i>Bipolaris miyakei</i> (Y. Nisik.) Shoemaker 1959 , <i>Helminthosporium miyakei</i> Y. Nisik. 1929
15	<i>Drechslera nodulosa</i> (Berk. & M.A. Curtis ex Sacc.) Subram. & B.L. Jain 1966	<i>Cochliobolus nodulosus</i> Luttrell 1957	<i>Helminthosporium nodulosum</i> Berk. & M.A. Curtis ex Sacc. 1886
16	<i>Drechslera oryzae</i> (Breda de Haan) Subram. & Jain 1966	<i>Cochliobolus miyabeanus</i> (Ito & Kuribayashi) Drechsler ex Dastur	<i>Helminthosporium oryzae</i> Breda de Haan 1900
17	<i>Drechslera pappendorffii</i> (Van der Aa) M.B. Ellis	Unknown	<i>Curvulerie papendorffii</i> Van der Aa
18	<i>Drechslera phlei</i> (Graham) Shoemaker 1959	Unknown	<i>Helminthosporium dictyoides</i> Drechsler var. <i>phlei</i>
19	<i>Drechslera poae</i> (Baudys) Shoemaker 1962	Unknown	<i>Helminthosporium poae</i> Baudys <i>H.vagans</i> Drechsler
20	<i>Drechslera ravenelii</i> (M.A. Curtis) Subram. & B.L. Jain 1966	<i>Cochliobolus ravenelii</i> Alcorn 1981	<i>Bipolaris ravenelii</i> (M.A. Curtis) Shoemaker 1959 <i>Napicladium ravenelii</i> (M.A. Curtis) Speg. 1888 <i>Helminthosporium ravenelii</i> Curtis 1868.
21	<i>Drechslerasacchari</i> (Butler) Subram. & Jain 1966	Unknown	<i>Helminthosporium sacchari</i> Butler
22	<i>Drechslera sativus</i>	<i>Cochliobolus sativus</i> (Ito &	<i>Helminthosporium sativus</i> Pammel King & Bakke

Table 3 continued...

Table 3 continued...

		Kuribayashi) Drechsler ex Dastur	<i>D. sorokiniana</i> (Sacc.) Subram. & Jain
23	<i>Drechslera setariae</i> (Sawada) Subram. & B. L. Jain 1966	<i>Cochliobolus setariae</i> (S. Ito & Kurib.) Drechsler ex Dastur 1942	<i>Bipolaris setariae</i> (Sawada) Shoemaker 1959 <i>Helminthosporium setariae</i> Lind 1919 <i>Helminthosporium setariae</i> Sawada 1919 <i>Ophiobolus setariae</i> S. Ito & Kurib. 1930
24	<i>Drechslera siccans</i> (Drechsler) Shoemaker	Unknown	<i>Helminthosporium siccans</i> Drechsler
25	<i>Drechslera teres</i> (Sacc.) Shoemaker 1959	1923 <i>Pyrenophora teres</i> Drechsler	<i>Helminthosporium hordie</i> Eidam <i>Helminthosporium teres</i> Pleospora teres Died
26	<i>Drechslera tritici-repentis</i> (Died.) Shoemaker 1962	<i>Pyrenophora tritici-repentis</i> (Died.) Drechsler 1923	<i>Helminthosporium tritici-repentis</i> Diedicke: 1903
27	<i>Drechslera victoriae</i> (Meehan & Murphy) Subram. & Jain 1966	<i>Cochliobolus victoriae</i> Nelson	<i>Biplores victoriae</i> (Meehan & Murphy) Subram 1959 <i>Helminthosporium victoriae</i> Meehan & Murphy 1946
28	<i>Drechslera heterostrophus</i>	<i>Cochliobolus heterostrophus</i> (Drechsler) Drechsler	<i>Helminthosporium maydis</i> Nisikado D. (Nisikado) Subram. & Jain

Table 4 : *Exserohillium* spp. list and common synonyms and their telomorphes, if present.

No.	Anamorphe	Telomorphe	Synonym
1	<i>Exserohillium frumentacei</i> (Mittra) M. B. Ellis, 1971	Unknown	<i>Helminthosporium frumentaceum</i> Mitra
2	<i>Exserohilum holmii</i> (Luttr.) K.J. Leonard & Suggs 1974	<i>Setosphaeria holmii</i> (Luttr.) K.J. Leonard & Suggs 1974	<i>Drechslera holmii</i> (Luttr.) Subram. & B.L. Jain 1966; <i>Helminthosporium holmii</i> Luttr. 1963; <i>Keissleriella holmii</i> (Luttr.) Arx 1970; <i>Trichometasphaeria holmii</i> Luttr. 1963
3	<i>Exserohilum monoceras</i> (Drechsler) K.J. Leonard & Suggs 1974	<i>Setosphaeria monoceras</i> Alcorn 1978	<i>Bipolaris monoceras</i> (Drechsler) Shoemaker 1959; <i>Drechslera monoceras</i> (Drechsler) Subram. & B.L. Jain 1966; <i>Helminthosporium monoceras</i> Drechsler 1923; <i>Luttrellia monoceras</i> (Drechsler) Khokhr. 1978; <i>L. monoceras</i> Drechsler 1923; <i>Luttrellia monoceras</i> (Drechsler) Khokhr. 1978
4	<i>Exserohilum rostratum</i> (Drechsler) K.J. Leonard & Suggs 1974	Unknown	<i>Bipolaris halodes</i> (Drechsler) Shoemaker 1959; <i>Bipolaris rostrata</i> (Drechsler) Shoemaker 1959; <i>Drechslera halodes</i> (Drechsler) Subram. & B.L. Jain 1966; <i>Drechslera rostrata</i> (Drechsler) M.J. Richardson & E.M. Fraser 1968; <i>Exserohilum halodes</i> (Drechsler) K.J. Leonard & Suggs 1974; <i>Helminthosporium halodes</i> Drechsler 1923; <i>Helminthosporium leptochloae</i> Y. Nisik. & C. Miyake 1924; <i>Helminthosporium rostratum</i> Drechsler 1923; <i>Luttrellia rostrata</i> (Drechsler) Gornostai 1978
5	<i>Exserohilum pedicellatum</i> (A.W. Henry) K.J. Leonard & Suggs 1974	Unknown	<i>Bipolaris pedicellata</i> (A.W. Henry) Shoemaker 1959; <i>Drechslera pedicellata</i> (A.W. Henry) Subram. & B.L. Jain 1966; <i>Helminthosporium pedicellatum</i> A.W. Henry 1924; <i>Trichometasphaeria pedicellata</i> R.R. Nelson 1965
6	<i>Exserohilum turcicum</i> (Pass.) K.J. Leonard & Suggs 1974	<i>Setosphaeria holmii</i> (Luttr.) K.J. Leonard & Suggs 1974	<i>Bipolaris turcica</i> (Pass.) Shoemaker 1959; <i>Drechslera turcica</i> (Pass.) Subram. & B.L. Jain 1966; <i>Helminthosporium inconspicuum</i> Cooke & Ellis 1878; <i>Helminthosporium turcicum</i> Pass. 1876; <i>Keissleriella turcica</i> (Luttr.) Arx 1970; <i>Luttrellia turcica</i> (Pass.) hokhr. 1978; <i>Trichometasphaeria turcica</i> Luttr. 1958
7	<i>Exserohilum mcginnisii</i> Padhye and Ajello, sp. Nov 1986	<i>Setosphaeria monoceras</i> Alcorn 1978	

**Table 5** : *Marielliotia* spp. list and common synonyms and their telomorphes, if present.

No.	Anamorphe	Telomorphe	Synonym
1	<i>Marielliotia biseptata</i> (Sacc. & Roum. in Roum & Sacc.) Shoemaker 1999	Unknown	<i>Drechslera biseptata</i> (Sacc. & Roum.) M.J. Richardson & E.M. Fraser 1968; <i>Helminthosporium biseptata</i> Sacc. & Roum 1881
2	<i>Marielliotia dematioidea</i> (Bubák & Wróbl.) Shoemaker, 1999	Unknown	<i>Drechslera dematioidea</i> <i>Helminthosporium dematioideum</i> Bubák & Wróbl., 1916
3	<i>Marielliotia triseptata</i> (Drechsler) Shoemaker, 1999	Unknown	<i>Drechslera triseptata</i> <i>Helminthosporium triseptatum</i> Drechsler, 1923

3 species, these species have been described within the *Drechslera*: *D. biseptata*, *D. dematioidea* and *D. triseptata* (Table 5). It was originally registered under the *Helminthosporium* spp (Table 1), the three species differ from the species of *Drechslera* based on conidia that contain mostly three septa and be oval shapes upside down to the oval (Fig. 1). The germination of *Marielliotia* from the basal cell or sometimes from the apical, no central cells in the conidium form. This fungus parasitic on weeds (Aslani *et al*, 2006).

Due to the truth that *Helminthosporium* is a source for many of species, there are seeking to reduce the number of their species. Alcorn (1988) mentioned to the need to reduce and re-identify the species of this genus with 20 species. The number of this genus listed in Table 1 is actually not really species at the present time, it has become synonyms in other species, but the one which non been synonyms are not listed in Tables 2-5 are in a neglected species that counter because they are not supported at the present time and what enhances this opinion that sources have indicated to the neglect of all types of this *H. solani*, which attacked potatoes in wide regions through the world where in South Africa, Egypt, Sudan, Israel, India, Japan, Iran, Lebanon, Tunisia, Turkey, Britain, France and Danamark, Cuba, Argentina, Chile and other South American countries (Tian *et al*, 2007).

Our conclusion in the current study, the four genera were shown high variation and the diagnostic characters based on conidial evidence, not sufficient to classify the four genera, because there are high ranges of variation of spore characters: shapes, helium and locations of germination of spores, so we observed a significant change in these species sites (Tables 2-5). Any future study of these genera should be investigated taxonomic criteria based on genetic criteria.

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