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***Bipolaris*: A Plant Pathogen Causing Human Infections: An Emerging Problem in Saudi Arabia**

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Abstract: The aim of the present research was to study infections caused by *Bipolaris* species which is usually recognized as a saprophyte and plant pathogen. Three species of *Bipolaris* viz., *B. australiensis*, *B. hawaiiensis* and *B. spicifera* were isolated causing infection at different sites of human body at Riyadh Military Hospital. Eight cases of infection from nasal site while four case each from wound and burn sites, three cases of post-operation and two case each from lung and skin of *Bipolaris* infections were recorded during the study period between April 2004 and April 2008. We conclude that *Bipolaris* species are now emerging as a potential human pathogen involving various parts. Although, immune-deficient patients are at high risk of infection but these species could also cause infections in immune-competent patients.

Key words: *Bipolaris* infection, nasal, wound, burn, lung, skin, post operation, emerging pathogen

INTRODUCTION

The presence of pale to dark brown melanin-like pigment in the cell walls of mycelium are the characteristic features of dematiaceous fungi. Clinical infections caused by dematiaceous fungi are classified as chromomycoses, mycetomas, or phaeohyphomycoses.

Chromomycoses are chronic, localized, subcutaneous or cutaneous infections characterized by sclerotic bodies in tissue called muriform cells (Fleming *et al.*, 2002; Brandt and Warnok, 2003; Robb *et al.*, 2003; Espinel-Ingroff, 2001). In contrast, mycetomas are chronic infections of the skin and subcutaneous tissue with the potential to invade adjacent bone. This condition is characterized by anatomic distortion, draining sinus tracts and distinctive granules composed. Phaeohyphomycosis are superficial, cutaneous, subcutaneous, corneal, or systemic infections characterized by dematiaceous mycelial elements, which include hyphae, pseudohyphae-like structures and yeast-like cells in tissue with variable pigmentation of the fungus. (Fleming *et al.*, 2002; Brandt and Warnok, 2003; Robb *et al.*, 2003; Espinel-Ingroff, 2001). *Bipolaris* separated from genus *Drechslera* mainly because of bipolar conidial germination as compared to *Drechslera* where conidia could germinate from side too. *Bipolaris* is a dematiaceous, filamentous fungus, cosmopolitan in nature and usually grown on plant debris and in soil (Ellis, 1994) and well known to cause plant diseases (Fang *et al.*, 2007; Koo *et al.*, 2003). Among *Bipolaris* species, *B. australiensis*, *B. hawaiiensis* and *B. spicifera* are the major species causing infections in human and animals (Ellis, 1994). Earlier researches indicated that these species could cause infection in both immune-competent and immune-deficient patients (Flanagan and Brycesan,

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1997; Fleming *et al.*, 2002; Brandt and Warnok, 2003) allergic fungal sinusitis, mycotic keratitis, corneal ulcers, orbital cellulitis and cyst of conjunctiva (Koshy and Daniel, 2002; Eghtedari and Pakshir, 2006; Leck *et al.*, 2002; Hamilton *et al.*, 2006; Bashir *et al.*, 2009). Allergic bronchopulmonary disease caused by *Aspergillus* and *Bipolaris* shown almost similar symptoms (Lake *et al.*, 1991). Besides these *Bipolaris* species can colonise prosthetic heart valve (Drought *et al.*, 1992) cutaneous and subcutaneous infections (Shafii *et al.*, 2006), brain infection (Filizzola *et al.*, 2003), osteoarthritis (Ziza *et al.*, 1985) and fungemia (Walsh *et al.*, 1995). *Bipolaris* causing lung infection has been reported from Saudi Arabia. The aim of the present research was to study the infections caused by *Bipolaris* species at Riyadh Military Hospital, Riyadh, Saudi Arabia.

MATERIALS AND METHODS

Collection of Samples

The site of collection and type of sample collected for study are given below:

Site	Type of sample collected
Nasal	Nasal polyp or nasal mud
Lung	Bronchoalveolar lavage
Skin	Swab
Wound	Swab and tissue
Post operation infection	Swab or tissue
Burn	Swab or tissue

These samples were collected from inpatient and outpatient clinics of Riyadh Military Hospital.

Microscopic Examination

Microscopic examination was done by KOH Method. Slides were also prepared for Silver and PAS (Period Acid Schiff) Stain (Evans and Richardson, 1989).

Medium for Isolation

Sabouraud dextrose agar (Oxoid Ltd., London) and Sabouraud dextrose agar added with 5% horse blood were used for isolation of fungi from samples. These media also contain three antibiotics, ciprofloxacin, vancomycin and penicillin or gentamycin sulphate (0.03 g L⁻¹ each) to check the growth of bacteria (Parvez, 2010; Internal SOP of Riyadh Military Hospital) (Evans and Richardson, 1989; Ellis, 2005).

Isolation and Identification of Fungi from the Samples

Isolation of fungi carried out according to Standard Operating Procedures (SOP) for Medical Mycology (Parvez, 2010; Internal SOP of Riyadh Military Hospital) (Evans and Richardson, 1989; Ellis, 2005). Inoculated plates were incubated at 30°C for 2 weeks. Isolated fungi were sub-cultured and maintained on Sabouraud dextrose agar slants in tissue culture bottles. Identification of *Bipolaris* species was carried out according to colony and microscopic morphological characteristics as described and well documented earlier (Ellis, 1994; www.mycology.adelaide.edu).

RESULTS AND DISCUSSION

A total number of 23 cases of *Bipolaris* infection were recorded from different types of samples during the study period.

Table 1: Number of cases of *Bipolaris* infections according to age group

Age group (years)	Nasal	Lung	Skin	Wound	Post operation	Burn
0-10	0	0	0	0	0	2
11-20	4	0	0	1	0	0
21-30	4	1	1	1	1	0
31-40	0	1	1	1	1	1
41-above	0	0	0	1	1	1
Total	8	2	2	4	3	4

Table 2: *Bipolaris* species causing infections at different sites

Species	Nasal	Lung	Skin	Wound	Post operation	Burn
<i>B. australiensis</i>	2	1	0	1	0	2
<i>B. hawaiiensis</i>	2	0	0	1	1	1
<i>B. spicifera</i>	4	1	2	2	2	1

Table 3: Clinical details of patients having *Bipolaris* infection

Site	No. of cases	Clinical condition of patient
Nasal	8	Immunocompetent
Lung	2	1-renal transplant 1-immunodeficient
Skin	2	Immunocompetent
Wound	4	2 sugar patient 2 with other immunodeficiencies
Post operation	3	1 renal transplant 2 heart operation
Burn	4	Immunocompetent

Bipolaris species were *B. australiensis*, *B. hawaiiensis* and *B. spicifera*. There were eight cases of nasal infection, two cases each of lung and skin infection, four cases each of wound and burn infection and three cases of post operation of *Bipolaris* were recorded. In the age group of 0-10 years only two cases of *Bipolaris* infection were recorded from burn cases. Age group of 11-20 yielded 5 cases, 4 of nasal infection and one wound infection. Age group of 21-30 yielded 8 cases, 4 nasal and one each of lung, skin, wound and post operation. Age group of 31-40 yielded 5 cases, one each lung, skin, wound, post operation and burn samples. Age 41 and above yielded only 3 cases, one each of wound, post operation and burned infection. Eight cases of allergic sinusitis were recorded and all from age group between 11-30 and these were immune-competent patients (Table 1).

Bipolaris spicifera was the leading species with 12 cases followed by *B. australiensis* and *B. hawaiiensis*. *Bipolaris spicifera* isolated from all types of samples. All these species were isolated from nasal, wound and burn sites although most number of cases were from nasal sites (*B. spicifera* 4 cases and 2 cases each of *B. australiensis* and *B. hawaiiensis*). All three *Bipolaris* species also isolated from nasal, wound and burn samples (Table 2).

All patients were immune-competent in the case of allergic fungal sinusitis caused by *Bipolaris* species. Also in the cases of burn and skin infection patients had no immune-deficiencies. In all other cases patients having some sort of immune-deficiencies including diabetic, renal transplant, post operations and other types of immune-deficiencies (Table 3).

Distinguishing features of *Bipolaris australiensis* conidia and conidiophores are shown in Fig. 1 and 2.

As far as researcher knowledge are concerned this is the first report of *Bipolaris* human infection from Saudi Arabia. All the three species of *Bipolaris* recorded here, have been known to cause human and animal infections (Ellis, 1994). *Bipolaris* species have caused infections both in immune-compromised and immune-competent patients as it was reported

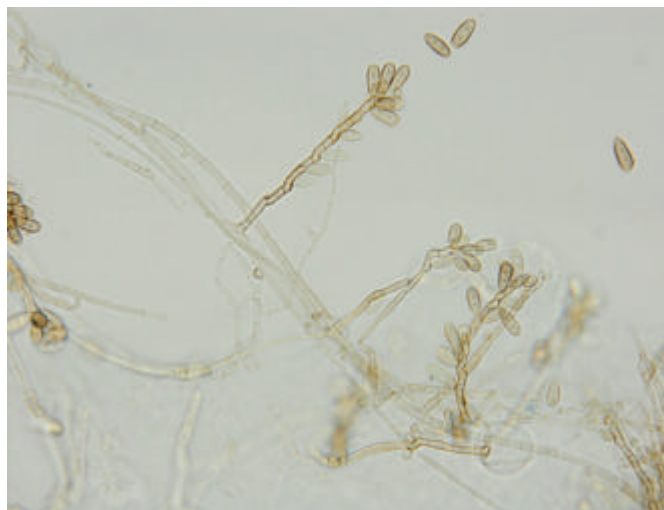


Fig. 1: *Bipolaris australiensis* conidia and conidiophores (x400)



Fig. 2: *Bipolaris australiensis* conidia and conidiophores (x1000)

earlier (Flanagan and Brycesan, 1997; Fleming *et al.*, 2002). Lung infection caused by *Bipolaris* species also reported earlier (Lake *et al.*, 1991). Infections of the skin, wound, post operation infection and burn infection caused by *Bipolaris* recorded earlier. In Saudi Arabia, only one case of lung infection was reported from a renal transplant patient.

Bipolaris species emerging as a potential pathogen of human and can infect almost every site of human body (Koshy and Daniel, 2002; Hamilton *et al.*, 2006; Bashir *et al.*, 2009; Ellis, 1994; Filizzola *et al.*, 2003). Mainly *Bipolaris* cases were encountered in areas where a hot climate is predominant (Texas, South Carolina, Arizona and Georgia in the United States; Brisbane, Australia; Pakistan and India). Schubert made the same observations and actually reported *Bipolaris spicifera* to be the most common cause of allergic fungal sinusitis

in the Southwestern United States. The climate of Saudi Arabia also has very hot and dry Summers with mild Winter, which indicate a suitable environment for the survival of *Bipolaris*.

Appropriate treatment consists of amphotericin B or itraconazole with surgical excision if necessary (Fleming *et al.*, 2002). We conclude that *Bipolaris* species are now emerging as a potential human pathogen involving various parts. Although, immune-deficient patients are at high risk of infection but these species could also cause infections in immune-competent patients.

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