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Prevalence and Diversity of *Bipolaris oryzae* Causing Rice Brown Leaf Spot in Cauvery Command Region of Karnataka, India

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Abstract

Rice is the major food crop in India. It is affected by many fungal, bacterial and viral diseases. Among them, brown leaf spot caused by *Bipolaris oryzae* is one of the important disease which reduces the yield (6-90%) and quality of the crop. The present investigation was carried out to study the cultural and morphological characteristics of Rice brown spot in Cauvery command region of Karnataka. Roving survey was conducted in Hassan, Mandya, Mysuru and Chamarajanagar districts of Cauvery command region to record the disease severity of brown leaf spot of rice during *kharif* 2022 and disease severity was expressed in Percent Disease Index (PDI). The symptoms are seen on coleoptile, leaves, panicle branches, glumes and spikelet and in the field it is recognized by the greyish brown spots. Among the four districts surveyed, the mean PDI was highest in Mysore (12.11 %) and least was recorded in Chamarajanagar district (7.21 %). Among the different media's tested, paddy leaf extract agar showed maximum radial growth (80.40 mm) in all the isolates followed by potato dextrose agar (78.80 mm). Different isolates showed different colony characters, colony diameter, colony abundance, colony colour, margin, texture, topography and time taken to cover entire petri plate. Conidia in different isolates were light brown, brown and dark brown with size ranging 16.39 – 103.06 × 6.45 – 19.60 µm. The shape of the conidia was either curved, slightly curved, spindle or fusoid and number of septa was between 3-10.

Keywords : Rice brown leaf spot, Severity, Percent disease index, Isolates, Media

Rice (*Oryza sativa* L.) is one of the most significant cereal food crop in the world, an annual grass belonging to the *Gramineae* family (Gadal *et al.,* 2019). It is regarded as one of the most strategically important commodities for the globe, strongly tied to not only global food security but also economic growth, employment, social stability and regional peace (Yadav and Kumar, 2018).

In India, rice is grown in an area of 46.15 million hectares with the production and productivity levels of 116.47 million tonnes and 2638 kg per hectare, respectively. In Karnataka rice is grown in an area of 1.13 million hectares with the production and productivity levels of 3.43 million tonnes and 3012 kg per hectare, respectively (Anonymous, 2020). Karnataka has roughly 27 rice growing districts, 14 of which fall into the high productivity category (yield more than 2500 kg/ha) and the Tungabhadra command area, which includes the districts of Koppala, Bellary and Raichur and is referred to be the 'Rice bowl of Karnataka' (Anonymous, 2019).

Rice is attacked by more than 70 diseases which are caused by different pathogens like fungus, bacteria, viruses and mycoplasma like organisms. Among these

brown leaf spot caused by *Bipolaris oryzae* is one of the major diseases of rice due its unique character, global distribution and existence of multiple physiological races (Chatterjee *et al.,* 2021). In all regions of the world where rice is grown, it is reported and has been widely distributed. Brown spot has been responsible for yield reductions ranging from 6 to 90 per cent in Asia and Bengal (India) witnessed a loss of 50 to 90 per cent yield in 1942, which led to the deaths of two million Indians (Imran *et al.,* 2020). The loss in grain yield has been reported to vary with rice cultivars and stage of infection (Kulkarni *et al*., 1980 and Nagaraju *et al*., 1991). The disease is an issue mostly during the *kharif* season, particularly in uplands and hill ecosystems. In fields that are not well-managed, the disease can cause sufficient yield loss. In general, it causes yield losses of 3.7 per cent to 90 per cent, but under conditions that are favourable to the disease, yield losses could reach up to 90 per cent (Sunder *et al.,* 2014).

In the recent years, because of the climate change and cultivation practices, disease was found to be severe in dry/ direct seeded rice in the states of Bihar, Chattisgarh, Madhya Pradesh, Odisha, Assam, Jharkhand and West Bengal. It is often referred to as 'Poor man's disease' (Baranwal *et al.,* 2013). The present study was conducted to investigate on disease severity and distribution of *B. oryzae* in Cauvery command area.

Material and Methods

A roving survey was conducted to know the disease prevalence and disease severity of brown spot in rice growing areas of Mandya, Hassan and Mysore districts of Karnataka during *kharif* 2022. Disease rating was done based on IRRI SES (Standard Evaluation System) scale (2002) as mentioned in the Table 1.

Using the disease rating, per cent disease index was calculated by using the formula given by Wheeler (1969).

$$PDI = \frac{\text{Sum of the individual rating}}{\text{Total no. of ratings x Maximum disease rating}} \times 100$$

Table 1

IRRI SES (Standard Evaluation System) Scale (2002) for brown spot disease

Score	Description (infected leaf area)
0	No incidence
1	Less than 1%
2	1-3%
3	4-5 %
4	6-10%
5	11-15 %
6	16-25 %
7	26-50 %
8	51-75 %
9	76-100%

The cultural and morhological studies were conducted at Department of Plant Pathology, College of Agriculture, V. C. Farm, Mandya, Karnataka. A total of twenty samples of rice leaves infected with *Bipolaris oryzae* were collected from different rice growing regions of Cauvery command area of Karnataka during survey and used for isolation of pathogen (Table 2).

Isolation and Purification of the Pathogen

Rice plants showing typical brown spots symptoms were collected from different places and the standard tissue isolation technique was followed to get pure culture of *Bipolaris oryzae* as described by Rangaswami (1972). Based on the morphological characters described by Shoemaker (1959), the pathogen identification was carried out. The diseased leaves were washed in tap water for a few minutes. Leaf bits of about 0.5cm in size were cut with a sterilized blade. The leaves were surface sterilized in 1 per cent sodium hypochlorite solution for 60 seconds and washed with sterile water thrice to remove the traces of sodium hypochlorite. The leaves were transferred to the PDA medium contained in Petri plates and incubated at 27±1°C for the growth of the fungus. The mycelial tips with morphological characteristics typical of *B. oryzae*, growing out of the infected plant tissue were cut and inoculated on

TABLE 2

List of paddy isolates of *Bipolaris oryzae* collected from different taluks of Cauvery command area

District	Taluk	Village	Isolate designation
Chamarajanagara	Yellandur	Shivkahalli	BOCH1
	Kollegala	Satyagala	BOCH2
Mandya	Srirangpatna	Chinnahalli	BOMD1
	Nagamangla	Nagamangla town	BOMD2
	Mandya	V C Farm	BOMD3
	Pandavapura	Kenalu	BOMD4
	Maddur	Nembnayakanahalli	BOMD5
	Malvalli	Bhugatagalli	BOMD6
	Mandya	Sonaganahalli	BOMD7
Hassan	Arkalgud	Kellur	BOHA1
	Alur	Kanadahalli	BOHA2
	Sakleshpura	Kerodi	BOHA3
	Hassan	Doddahalli	BOHA4
	Chanraypatna	Cholenahalli	BOHA5
	Holenarsipura	Yedegowdanahalli	BOMY1
Mysuru	T. Narsipura	Utali	BOMY2
	Hunsur	Kallahalli	BOMY3
	Nanjangud	Nanjangud village	BOMY4
	Mysore	Ramanhalli	BOMY5
	Periyapatna	Basalapura	BOMY6

fresh plates with PDA and incubated at 27±1 °C. Pure cultures of the pathogen isolates were obtained by single hyphal tip isolation technique which on development was transferred to PDA slants and incubated at 27±1°C and pure culture was maintained at 4°C.

Morphological Characteristics : The morphological characters (length and width of conidia, number of septa, conidia shape and colour) of the fungus were studied periodically by observing under microscope. Morphological characteristics of conidia like length, width, length : width ratio and number of septa of all the twenty isolates of *B. oryzae* was determined. Spores of *B. oryzae* of all the isolates from the culture were mounted on a clean glass slide. Spores were mixed with lactophenol thoroughly in order to obtain uniform spread, on which cover slip was place. Spores were measured under high power objective using light microscope (40X). The average size of the spores like length, width and number of septa were recorded. Microphotographs were taken to show the typical spore morphology of the pathogen.

Cultural Characteristics : The variability of cultural characteristics of the collected isolates of *B. oryzae* such as colony colour, colony abundance, colony diameter, topography, texture, margin and time taken for complete growth on Petri plate was recorded on different solid media *viz*. Potato dextrose agar media, oat meal agar media, Richard's agar media, tryptic soya agar media, Czapek-Dox agar media, yeast extract agar media, malt extract agar media, rye agar media, paddy leaf extract media and paddy grain extract media. The colour of the colony was determined with the help of Munsell's soil colour chart (Munsell Colour Company, *Inc.,* 1954).

Results and Discussion

Under field condition the symptoms manifest as dark brown, ellipsoidal to eye shaped spots on the upper surface of the leaves and a fully developed spot had a greyish brown central region surrounded by a deep, reddish-brown margin. On leaves, typical brown spots with grey or whitish centre, cylindrical or oval in shape resembling sesame seeds usually with yellow halo. Similar symptoms were observed by Channakeshava (2016) in a survey carried out in Cauvery command areas of Mandya district during *kharif* 2015.

During the survey, it was also observed that the disease prevailed throughout the growth stages of the rice plant from tillering to harvest in the farmer's field. It was also observed that disease was also recorded in both local and hybrid varieties of rice at varying per cent disease severity. The survey data revealed that, the level of disease severity varied from location to location with a range of 2.14 to 27.88 per cent in different taluks of the districts surveyed (Table 3 and Fig. 1), which was independent of variety, irrigation ecosystem and growth stage.

Among the different district surveyed Mysore district had the highest brown spot per cent severity (12.11%), followed by Hassan (10.14%), Mandya (8.46%) and Chamrajanagar had the lowest mean disease per cent severity of 7.21 per cent (Table 3 and Fig. 2).

In Mandya district, the disease severity was documented in seven taluks, out of which, highest mean brown spot severity was recorded in Malavalli taluk (16.9%) followed by Mandya (9.79%) and Maddur (8.87%). The least severity was recorded in Nagmangala and Srirangapatna taluks of 5.48 and 5.59 per cent, respectively.

Seven taluks in Hassan district were covered. Out of which, the highest brown spot severity was recorded in Sakleshpur taluk (18.97%) followed by Belur (9.22%). The least severity was recorded in Hassan and Alur taluks of 7.49 and 7.87 per cent, respectively.

In Mysore district, seven taluks were surveyed and recorded the mean brown spot severity of 10.38 per cent. Highest mean disease severity was recorded in Nanjangud (14.35%) taluk, followed by Periyapatna (13.98%) taluk. The least severity was observed in Mysore (4.51%) and K.R Nagara (6.03%) taluk.

Similarly, in three taluks of Chamarajanagar district, highest mean brown spot disease severity was

Table 3

Disease severity of brown spot of rice in Mandya, Hassan, Mysuru and Charamarajanagara districts during *kharif* 2022

Districts	Taluks	PDI **	Mean PDI **	Cultivars
Mandya	Mandya	9.79		MTU 1001, IT 64, BNR, Jaya, Kaveri price, Siri, Chethana, Meenakshi
	Pandavapura	6.54		
	Maddur	8.87		
	Malavalli	16.90	8.46	
	Krishnarajpet	6.07		
	Srirangapatna	5.59		
	Nagamangala	5.48		
Hassan	Channarayapatna	9.72		BR 2655, BPT 5204, Thanu, Sona, Crossington, Jyothi, VNR, Tunga, Penna, Sanna madhu
	Hassan	7.49		
	Belur	9.22		
	Holenarsipura	3.09	10.14	
	Sakleshpur	18.97		
	Arkalgud	8.64		
	Alur	7.87		

Continued....

TABLE 3 Continued....

Districts	Taluks	PDI **	Mean PDI **	Cultivars
Mysore	Mysore	4.51	12.11	IR 64, Jaya, Mahendra, Jyothi, KMP 175, Super BPT, BPT 564, MTU 1001
	H.D Kote	1.82		
	K.R Nagara	6.03		
	Hunsur	11.21		
	T. Narsipura	9.78		
	Periyapatna	13.98		
	Nanjangud	14.35		
Chamrajanagara	Kollegala	8.78	7.21	Super BPT, BPT 5204, IR 64
	Yellandur	7.00		
	Chamrajanagar	5.84		

(*= Mean PDI from all the villages, **= Mean PDI of all taluks)

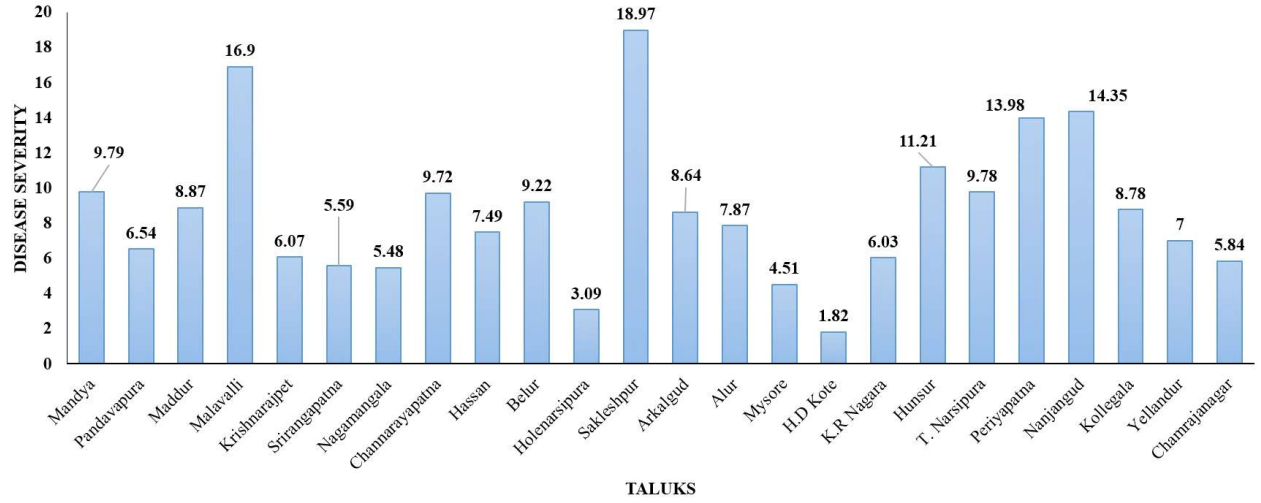

Fig. 1. Disease severity of brown spot of rice in different surveyed taluks during *Kharif* 2022

recorded in Kollegala taluk (8.78%) followed by Yelanduru (7%). The least mean brown spot disease severity was noticed in Chamrajanagar taluk (5.84%).

In the present study, the results revealed that there is variation in disease severity among the districts surveyed and average disease severity ranging from 7.21 to 12.11 per cent was observed. Likewise, the average disease severity varied from one taluk to another taluk, ranging from 4.51 to 18.97 per cent.

Similar results of varying per cent disease severity were recorded in Mandya, Karnataka, India in field survey conducted by Channakeshava and Pankaja (2019) during *kharif* 2015. They recorded that brown spot severity ranged from 7.91 to 16.88 per cent in 6 taluks of Cauvery command area, Mandya. Similarly, Sathish Kumar (2017) also reported that during *kharif* 2016, brown spot caused by *Bipolaris oryzae* surveyed in North Karnataka, the per cent disease severity was maximum in Dharwad with 16.76 per cent and least was noticed in Uttara Kannada district with 9.12 disease severity.

Also Chethana *et al.* (2016) conducted survey in major rice growing districts of Karnataka. They reported that, disease severity ranged from 6-15 per cent in

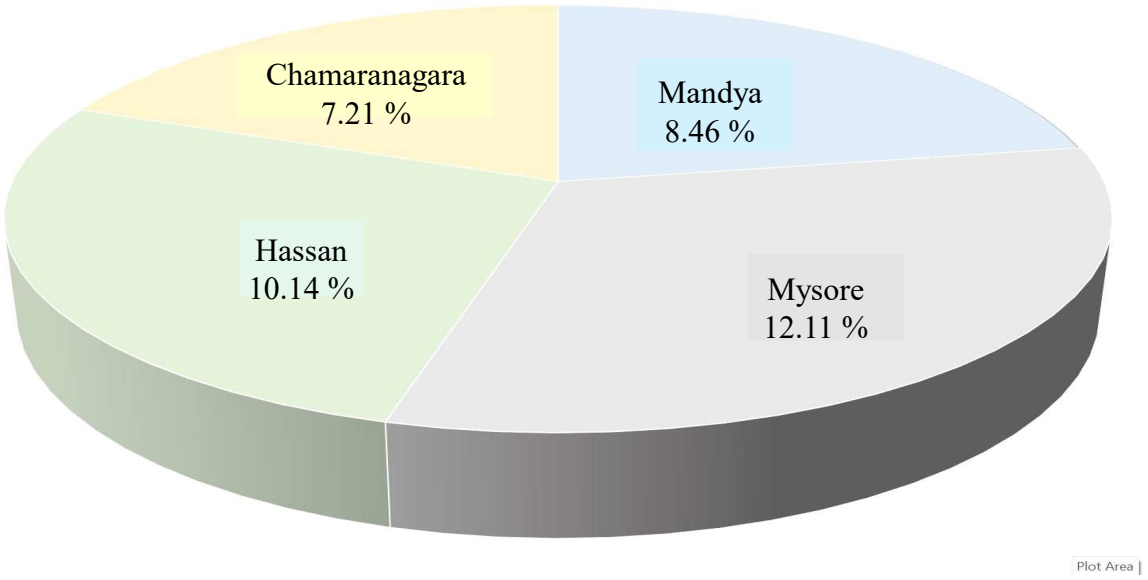

Fig. 2 : Mean per cent disease severity of various districts of Cauvery command area during *Kharif* 2022

Mysore and Mandya district and traces in other districts. Kumari *et al.* (2015) also found that the disease was prevalent in all the places surveyed in Bihar and the disease severity percentage varied from 15.30 to 52.10. Kulkarni (1976) conducted a survey for the incidence of brown spot disease of rice under different agro climatic regions of Karnataka and noticed that maximum loss is noticed in Shivamogga (41.45%), followed by Mandya (33.27%) and least in case of Thirthahalli (22%).

Isolation and Identification of the Pathogen Isolates : *B. oryzae* isolates were isolated from the infected leaves on PDA medium through tissue isolation technique. Growth of the fungus was observed 2-3 days after incubation at 27±2°C in all isolates and were identified based on morphological characters (Shoemaker, 1959).

Cultural Characteristics

Cultural characteristics of *B. oryzae* was studied using ten different solid media. Mean radial growth of all the isolates which were recorded at 7 days in different media after incubation are presented in Table 4 and Fig. 3.

Among the ten different solid media tested, significant difference pertaining to radial mycelial growth was observed. Highest mean radial mycelial growth of 80.40 mm was recorded in Leaf extract agar followed by Potato dextrose agar (78.80mm), Czapeck - dox agar (76.77mm), Rye agar (76.55mm) and Oat meal agar (75.92mm). The lowest mean radial mycelial growth of 47.33 mm was observed in Richard's agar followed by Yeast extract agar (48.22mm), Tryptic soya (47.20mm) and Malt extract agar (65.49mm).

Kumari *et al.* (2015) found that the maximum growth of 90 mm in different isolates of *B. oryzae* was on Potato dextrose agar media.

Morphological Characteristics

Studies on morphological characteristics of twenty isolates of the pathogen grown on PDA medium were made by recording the shape, size, number of septa and colour of the conidia.

There were significant differences in size, shape, number of septa and colour among all the twenty isolates as presented in Table 5. The mycelia of all the twenty isolates were septate with brown in colour. Similarly, the conidia were either light brown, brown or dark brown septate with size ranging 16.39 - 103.06 × 6.45 - 19.60 µm. The shape of the conidia were either curved, slightly curved, spindle or fusoid.

TABLE 4

Radial growth of *B. oryzae* isolates on different solid media

Isolates	PDA	Czapek-dox agar	OMA	MEA	YEA	Rye agar	Tryptic soya	Richards	Leaf extract agar	Grain extract agar
	Radial growth (mm)									
BOCH 1	88.67	86.00	54.33	73.53	58.67	62.00	48.33	42.00	79.33	80.67
BOCH 2	64.00	73.33	73.67	60.33	53.33	84.67	43.00	43.67	72.67	63.00
BOHA 1	66.67	73.00	64.67	52.67	47.33	71.00	49.67	40.67	69.33	66.67
BOHA 2	87.33	87.00	69.67	69.00	56.33	68.00	51.33	58.67	81.33	79.67
BOHA 3	78.67	78.00	80.33	69.33	57.67	86.00	34.00	37.67	78.33	72.33
BOHA 4	76.67	83.00	86.33	76.67	37.67	84.00	53.67	59.00	81.67	83.33
BOHA 5	87.00	78.33	86.00	86.67	43.33	71.67	48.67	63.53	87.67	89.00
BOMD 1	77.00	77.33	67.33	57.67	69.67	68.67	42.33	42.00	84.33	76.33
BOMD 2	87.67	85.33	63.00	69.67	41.00	77.33	49.67	54.67	74.00	66.00
BOMD 3	86.67	43.33	72.67	65.67	40.00	62.67	51.00	41.67	71.00	68.67
BOMD 4	79.33	85.67	87.00	52.33	43.67	86.67	42.33	32.33	76.67	54.33
BOMD 5	69.00	77.00	86.00	86.67	42.67	84.33	49.00	68.00	87.00	69.33
BOMD 6	62.00	72.00	86.00	72.67	43.00	86.67	50.33	48.00	74.00	87.67
BOMD 7	85.33	66.33	79.33	78.67	44.67	88.33	54.33	58.33	85.67	74.33
BOMY 1	87.67	85.33	59.33	46.33	62.33	64.33	46.67	48.00	85.00	79.67
BOMY 2	85.33	85.33	82.33	82.67	54.00	87.67	83.00	64.33	87.67	87.33
BOMY 3	79.33	84.00	72.33	59.00	32.67	69.67	31.67	49.00	78.33	68.00
BOMY 4	86.33	61.33	88.00	46.00	45.67	86.67	48.33	31.67	87.00	49.33
BOMY 5	54.67	66.33	72.67	38.33	40.67	65.00	33.00	31.67	85.67	61.67
BOMY 6	86.67	87.33	87.67	66.00	50.00	74.67	50.00	40.00	81.33	79.00
Mean	78.80	76.77	75.92	65.49	48.22	76.5	48.20	47.73	80.40	72.82
F				**						
SE m ±				Media = 0.03, Isolates = 0.04, Media × Isolates = 0.13						
CD @ p=0.01				Media = 0.11, Isolates = 0.16, Media × Isolates = 0.50						
CV				3.21						

*OMA – Oat Meal Agar, MEA – Malt Extract Agar, YEA – Yeast Extract Agar, PDA – Potato Dextrose Agar

The highest conidial length was noticed in BOMY5 (103.06 µm) followed by BOMY2 (85.23 µm). The highest conidial width of 19.60 µm was recorded in BOMY3 followed by BOMY5 (18.47 µm). The length/ width (L/W) ratio of the conidia among the isolates ranged from 1.99 to 5.77. The highest L/W ratio of 5.77 was recorded in BOMY2 followed by BOMD1 (5.75). Varied number of septation was observed in the conidia of the isolates ranging from 3 to 10. Maximum number of septation was observed in BOMY5 (8 -10) followed by BOMY2 (7 - 10)

Results of microscopic characteristic studies are in conformity with Nayak and Hiremath (2019), wherein they reported that *Bipolaris oryzae* conidia varied with length of 59.78-111.54 µm and width of

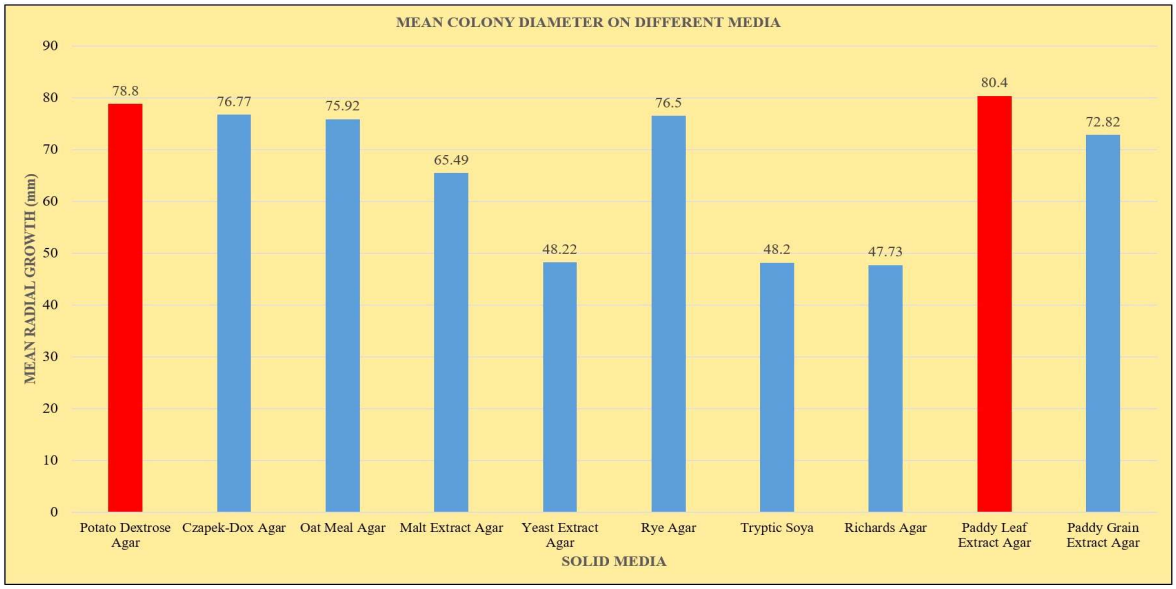

Fig. 3: Mean colony diameter of *B. oryzae* on different solid media

TABLE 5

Morphological characteristics of *Bipolaris oryzae* isolates (40X)

Isolates	Length (µm)	Width (µm)	Length: widthratio	Number of septa	Conidial shape	Conidial colour
BOCH1	29.56	11.11	2.65	4-6	Spindle	Brown
BOCH2	55.03	14.67	3.75	5-7	Slightly curved	Brown
BOHA1	24.33	6.45	3.77	4-6	Spindle	Brown
BOHA2	63.73	13.78	4.62	6-8	Slightly curved	Brown
BOHA3	46.99	14.52	3.23	5-7	Spindle	Brown
BOHA4	46.89	13.34	3.51	5-8	Spindle	Brown
BOHA5	16.39	8.23	1.99	3-4	Spindle	Brown
BOMD1	78.75	13.67	5.75	6-9	Curved	Light brown
BOMD2	36.24	12.82	2.82	4-7	Spindle	Brown
BOMD3	48.00	12.77	3.75	5-7	Spindle	Brown
BOMD4	18.78	7.87	2.38	3-5	Fusoid	Brown
BOMD5	51.87	16.54	3.13	6-8	Fusoid	Light brown
BOMD6	48.19	11.01	4.37	6-8	Slightly curved	Light brown
BOMD7	52.27	13.19	3.96	5-7	Spindle	Brown
BOMY1	24.93	7.38	3.37	5-7	Spindle	Brown
BOMY2	85.23	14.76	5.77	7-10	Slightly curved	Brown
BOMY3	79.26	19.60	4.04	5-8	Fusoid	Brown
BOMY4	57.40	17.84	3.21	5-7	Spindle	Dark brown
BOMY5	103.06	18.47	5.57	8-10	Curved	Dark brown
BOMY6	71.70	14.47	4.91	7-9	Spindle	Brown

13.14-20.95 µm bearing 7-11 septa. Similarly, Abrol *et al.* (2022) reported that conidia of isolates were curved or straight with size of conidia varying from 59.67-99.71 x 10.04-24.93 µm with 4-8 septa. Also Jaiganesh and Kannan (2019) found varying conidia length from 29.3-33.2 µm and width from 13.5-14.8 µm with 3-5 septa and colour of conidia being either brown or light brown.

Varied colour of the colony *viz.,* grey to greyish black was noticed among the isolates. Three isolates *viz.,* BOHA2, BOMY1 and BOMY3 produced dark grey, three isolates BOCH1, BOHA1 and BOMD1 produced greyish black, eight isolates BOCH1, BOHA3, BOHA4, BOHA5, BOMD4, BOMD5, BOMD6 and BOMD7 produced whitish grey. Three isolates BOMD3, BOMY1 and BOMY6 produced light grey. One each isolate produced dark black (BOMD2), grey (BOMY4) and BOMY5 produced blackish colour colony.

Regular uniform slightly raised and abundant form of colony was observed in BOMD1, BOMY1, BOCH1, BOMY6, BOMY3, BOHA2 and BOMY2 isolates. Regular non uniform slightly raised and moderate was noticed in BOHA1 isolate. Regular non uniform slightly raised and abundant colony was observed in BOHA3 and BOCH2 isolates. Irregular uniform raised

TABLE 6

Cultural variability of the isolates of *Bipolaris oryzae* on potato dextrose agar

Isolates	Colony colour	Colony abundance	Topography	Texture	Margin	Time taken to complete plate (in days)
BOCH 1	Greyish black	Abundant	Slightly raised	Regular	Uniform	7
BOCH 2	Whitish grey	Abundant	Slightly raised	Regular	Non uniform	12
BOHA 1	Greyish black	Moderate	Slightly raised	Regular	Non uniform	9
BOHA 2	Dark grey	Abundant	Slightly raised	Regular	Uniform	7
BOHA 3	Whitish grey	Abundant	Slightly raised	Regular	Non uniform	8
BOHA 4	Whitish grey	Moderate	Flat	Regular	Uniform	10
BOHA 5	Whitish grey	Abundant	Flat	Regular	Non uniform	8
BOMD 1	Greyish black	Abundant	Slightly raised	Regular	Uniform	9
BOMD 2	Dark black	Abundant	Raised	Irregular	Uniform	7
BOMD 3	Light grey	Slight	Flat	Irregular	Non uniform	7
BOMD 4	Whitish grey	Moderate	Slightly raised	Irregular	Uniform	9
BOMD 5	Whitish grey	Moderate	Flat	Regular	Non uniform	8
BOMD 6	Whitish grey	Moderate	Flat	Regular	Uniform	11
BOMD 7	Whitish grey	Moderate	Flat	Regular	Non uniform	8
BOMY 1	Dark grey	Abundant	Slightly raised	Regular	Uniform	7
BOMY 2	Light grey	Abundant	Slightly raised	Regular	Uniform	7
BOMY 3	Dark grey	Abundant	Slightly raised	Regular	Uniform	8
BOMY 4	Grey	Abundant	Raised	Irregular	Non uniform	7
BOMY 5	Black	Moderate	Slightly raised	Irregular	Non uniform	13
BOMY 6	Light grey	Abundant	Slightly raised	Regular	Uniform	7

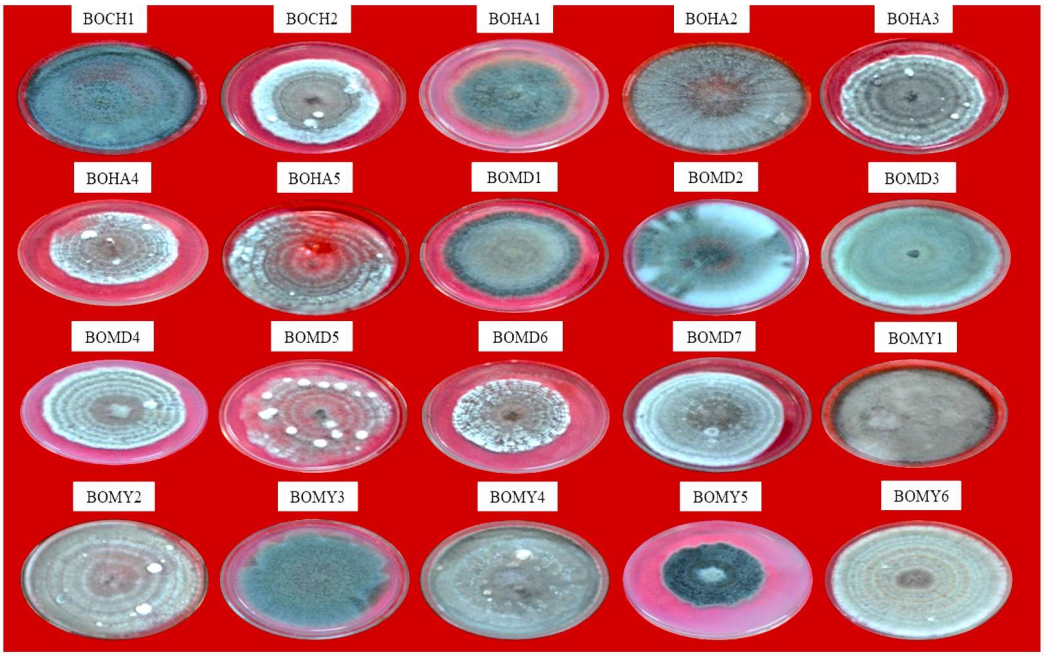

Plate 1. Cultural variability of the isolates of *Bipolaris oryzae* on potato dextrose

and abundant colony noticed in BOMD2 isolate. Regular non uniform flat and abundant was observed in BOHA5 isolate. Irregular non uniform flat and slight colony noticed in BOMD3. Regular uniform flat and moderate colony observed in BOMD6 and BOHA4. Regular non uniform flat and moderate colony observed in BOMD7 and BOMD5. Whereas, the isolate BOMY4 produced irregular non uniform raised and abundant form of colony, irregular non uniform slightly raised and moderate colony noticed in BOMY5 and irregular uniform slightly raised moderate was observed in BOMD4 isolate (Table 6 and Plate 1).

Isolates BOCH1, BOHA2, BOMD2, BOMD3, BOMD1, BOMD2, BOMD4 and BOMD6 took as early as 7 days after incubation to grow completely in the Petri plate followed by BOHA3, BOHA5, BOMD5, BOMD7 and BOMY3 isolates took 8 days, BOHA1, BOMD1 and BOMD4 isolates took 9 days. The BOHA4 isolate covered the surface of the plate lately at 10 days after incubation followed by BOMD6 (11 days), BOCH2 (12 days) and BOMY5 (13 days).

These findings are agreed with the earlier workers. Kumari *et al*. (2015) reported that cultural characters on the basis of colony morphology and growth pattern on PDA and all isolates could be grouped into 5 categories: black with fluffy growth (16 isolates), black with suppressed growth (10 isolates), grey with cottony growth (9 isolates), grey and white mix with cottony growth (12 isolates) and white with cottony growth (5 isolates). Valarmathi and Ladhalakshmi (2018) categorized 17 isolates of *B. orate* based on colony morphology and growth pattern into four groups *viz.,* (Group I) black with fluffy growth, (Group II) grey with fluffy growth and white spots, (Group III) grey with fluffy growth and (Group IV) grey with suppressed growth.

Four districts of Cauvery command area were surveyed for the prevalence of brown spot on paddy. Mysore district had the highest disease severity followed by Hassan and Mandya, whereas, Chamarajanagara had the lowest disease severity. Twenty isolates collected during the survey from four districts showed variation in cultural characteristics. On different solid media tested, variation was noticed in abundance, margin, texture, topography and colour of the colony.

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