

Survey and Occurrence of Sheath Blight of Rice in Major Rice Growing Areas of Chhattisgarh

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ABSTRACT

Among the various disease of rice, sheath blight caused by *Rhizoctonia solani* Kuhn has become the one of major fungal disease covering different rice growing ecosystem of Chhattisgarh state. For the first time in Chhattisgarh state purposive disease survey was conducted during Kharif-2016 to know the occurrence and spread of sheath blight disease in three different ecosystems i.e. Northern Hills Zone (Zone-I), Chhattisgarh Plains Zone (Zone-II) and Bastar Plateau Zone (Zone-III). Systematically, survey was conducted in twelve major rice growing districts viz., Balrampur, Surguja, Raigarh, Mungeli, Kawardha, Bemetara, Baloda Bazar, Durg, Rajnandgaon, Raipur, Gariyaband and Bastar from September to October 2016. Among the twelve districts surveyed, disease incidence (%) was found highest in Gariyaband district with a mean disease incidence of 76% which is followed by Surguja (60%), Balrampur (50%), Raigarh (50%), Raipur (47.5%), Rajnandgaon (41.6%), Mungeli (30%), Kawardha (30%), Durg (30%), Baloda Bazar (30%), Bemetara (30%) and Bastar (30%). The heavy incidence of sheath blight might be due to the highly favorable factors like high relative humidity, less temperature and water stagnation due to continuous rain on these locations during the period of survey. Large scale cultivation of susceptible varieties as mono crop continuously on the same field might have increased the possibility of perpetuating the pathogen in the crop debris. This study can serve as basic to evaluate location specific integrated disease management strategy against sheath blight disease of rice.

Key words: Sheath blight, Disease incidence, Chhattisgarh.

INTRODUCTION

Rice cultivation has spread to many parts of the world due to its versatility. In India, Chhattisgarh state is popularly known as “rice bowl of India”. It has geographical area of 13.51 m ha of which 5.9 m ha area is under

cultivation. Rice occupies an area of 3.70 m ha with the production of 6.15 tons and productivity of 16.63 q /ha¹. But the crop is attacked by number of diseases which are fungal, bacterial and viral origin.

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Sheath blight disease has shown a remarkable spread, wherever rice is grown. The extent of yield loss in rice due to sheath blight is based on its severity and spread of infection. Among the different fungal diseases, sheath blight caused by *Rhizoctonia solani* Kuhn is gaining importance day by day because of its soil borne nature which is a little difficult to control the disease causes about 11.1-58 % losses in yield depending on disease severity and varieties². Rice sheath blight was reported from Japan and since then it became established in many oriental countries, and is often referred to as oriental leaf and sheath blight.

In Arkansas, for example, sheath blight was found to be present in 50-66 % of rice fields, causing 5-15 % yield reductions in 2001. The rice disease survey conducted by IRRI (2001) has shown that a production loss of 0.9 per cent and 0.8 per cent was observed due to sheath blight in Japan and Korea respectively. It is considered as economically important disease of rice in the world. Due to this rice sheath blight is regarded as an internationally important disease, particularly with the advent of high yielding varieties in the 1960s⁶.

In India, it was first reported from Gurdaspur in Punjab, and later from Uttar Pradesh. Further, the disease was reported from Tamil Nadu, Kerala, Andhra Pradesh and Kashmir¹¹. The disease is occurring regularly in the region and causing sustainable loss in productivity. Study on occurrence of disease in the zone can provide an idea on present status of the disease in the different zone which is prerequisite to take decision regarding different disease management practices⁴. The severity of the disease depends upon the age of the plant, the time of infection, etc. and the yield loss is about 69% . A more recent survey projected the yield loss up to 20% . Heavily infected plants produce poorly filled grains, and additional losses result from aggravated lodging of the plants. The disease also affects quality of straw, limiting its value as fodder. Sheath blight is the most important disease of rice, occurring throughout the rice

growing regions of India. It is one of the major biotic constraints that affects rice production and contributes to severe yield reduction that continues to threaten socio economic status of rice-farmers in India.

In order to understand the spread of sheath blight of rice disease in the country, data was collected over the past twenty five years (1990-2015) from production oriented survey (POS) reports of AICRP on rice⁹. Results revealed that disease has spread widely in terms of both occurrence and intensity over the past twelve years. At present, it is a major production constraint in the states of Punjab, Haryana, Uttarakhand, Eastern UP, Bihar, West Bengal, Odisha, Jharkhand, Chhattisgarh, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala⁹.

Therefore present survey was conducted in major rice growing areas of Chhattisgarh state to know the incidence and severity of sheath blight in different agro-ecosystems, cropping systems, rice varieties, agronomic practices and management methods in the state which is prerequisite to take decision on sustainable disease management practices.

MATERIALS AND METHODS

Purposive sampling survey was conducted during *Kharif* -2016 in rice growing districts of Chhattisgarh State to study the occurrence and spread of sheath blight. Rice is cultivated in three agro climatic zone *viz.*, Northern hill zone (Zone-I), Chhattisgarh plains (Zone-II), Bastar plateau zone (Zone-III) of the state. Hence, survey was conducted in twelve major rice growing districts *viz.*, Balrampur, Surguja, Raigarh, Mungeli, Kawardha, Bemetara, Baloda Bazar, Durg, Rajnandgaon, Raipur, Gariyaband and Bastar are selected for the study. Three plots in each field having an area of one square meter were selected at random. For assessing the Disease Incidence (DI), the number of infected plants and total number of plants in each field were recorded. The DI was calculated using the formula.

$$DI = \frac{\text{No. of infected hills}}{\text{Total No. of hills}} \times 100$$

From each district five to ten rice growing villages were identified based on production oriented survey reported from ICAR-IIRR and randomly 3-5 rice field having crop at the stage of tillering to maturity are selected.

Symptoms on sheath stem and leaf portions and sign (sclerotia) on the disease isolate at each observation during the survey are recorded. Besides, information like plant characters and geographical information (longitude/latitude) were collected. The 72 disease samples were brought to the laboratory and washed under running tap water to remove dirt particles. Infected plant tissues are cut into pieces of 5 cm, surface sterilized with one per cent sodium hypochlorite solution for 30 seconds and were washed in three changes of sterile distilled water and blotted dry. Small samples of plant tissue (0.5 cm of length) are then cut from the lesions and transferred to an isolation medium i.e., 2 per cent water agar. The plates are then incubated for 24-48 h at 27 ± 2 °C. Mycelial tips with morphological characters typical of *R. solani*, growing out from the infected plant tissue are cut and put in fresh PDA plates and incubated at 27 ± 2 °C. Incubated petriplates were observed to record mycelial growth of the pathogen after every 24 hours. Forty one pure cultures of the pathogen isolates were obtained by single hyphal tip isolation technique. All the forty one isolates were identified as *R. solani* based on the right angle branching by microscopic observation. All the forty one isolates proved Koch's postulates at field conditions on rice cultivar TN-1 *Kharif-2016* at, ICAR-IIRR Rajendranagr field by using typha bit inoculation method.

Isolates were assigned code numbers from RS-CG-01 to RS-CG-41, where, RS denotes *Rhizoctonia solani* 'CG' refers to Chhattisgarh '1' refers to the serial number of isolate. Likewise, the other forty one isolates were also named after the location and the details were recorded.

RESULTS AND DISCUSSION

For the first time in Chhattisgarh state purposive disease survey was conducted

during *Kharif-2016* to know the occurrence and spread of sheath blight disease in three different ecosystems i.e. Northern Hills Zone (Zone-I), Chhattisgarh Plains Zone (Zone-II) and Bastar Plateau Zone (Zone-III) (Table 4.1). Systematically, survey was conducted in twelve major rice growing districts viz., Balrampur, Surguja, Raigarh, Mungeli, Kawardha, Bemetara, Baloda Bazar, Durg, Rajnandgaon, Raipur, Gariyaband and Bastar from September to October 2016. During the survey disease incidence (DI) and disease severity (DS) was observed in percentage and disease samples were collected to confirm the etiology of the pathogen. Disease Incidence (DI) of sheath blight in surveyed locations was ranged from 20% to 90%. Incidence was classified into four groups such as very high (>50%), high (31-50%), moderate (21-30%) and low (<20%). Very high disease incidence noticed at paddy fields of Kokdi (90%), Gariyaband (80%), Tavarbahara (70%), Abhanpur (60%), Raipur (college field) (60%), Bhaleshar (60%), Bhagwanpur (60%) and Bhagima (60%); High at Bhatapara (50%), Anjora (50%), Telitola (50%), Dongargarh (50%), Bagbahara (40%), Bhagima (40%), Damapur (40%), Bemetara (40%), Simradhi (40%), Dadutola (40%), Bhatagaon (40%) and Kumhrawand (40%); Moderate at Dabo (30%), Amargaon (30%), Baddo (30%), Damdha (30%), Samoda (30%), Mohar (30%), Toyaggondi (30%), Riva (30%), Takameta (30%), Gigtara (20%), Balodi (20%), Baloda Bazar (20%) and Karanji (20%). We could not observed the sheath blight at low (<20%) at any one of the surveyed location in the state. Among 41 locations 26.8% (11) showed very high (>50%) incidence, 29.2% (12) location showed high (31-50%) incidence and 43.9 % (18) location showed moderate (20-30%) incidence.

Disease severity (DS) of sheath blight in surveyed locations were ranged from 3 to 9 score (SES scale). Very high diseases severity (>65%) observed at Pathermonda and Gariyaband KVK; high diseases severity (46-65%) at Bhagima, Bhagwanpur, Bagbahara, Bhaleshar, Raipur COA, Abhanpur, Kokdi, Tilda and Kumhrawand. Moderate disease

severity (31-45%) at Damapur, Bemetara, Simradhi, Bhatapara, Anjora, Dadutola, Telitola, Dongargarh, zora, Tvarbahara and Takameta. Low disease severity (22-30%) at Dabo, Dharampura, Gigtara, Amargaon, Baddo, Balodi, Dhamdha, Samoda, Mohar, Toyagondi, Riva, Bhatagaon, Karanji and Kumhrawand. Based on the survey disease severity was classified as fallows. Among the locations 4.87% (2 locations) showed > 65% lesion height (9score), 21.9% (9 locations) showed 46-65% lesion height (7score), 26.28% (11 locations) showed 31-45% lesion height (5score) and 34.14% (14 locations) showed 22 to 30% lesion height (3score).

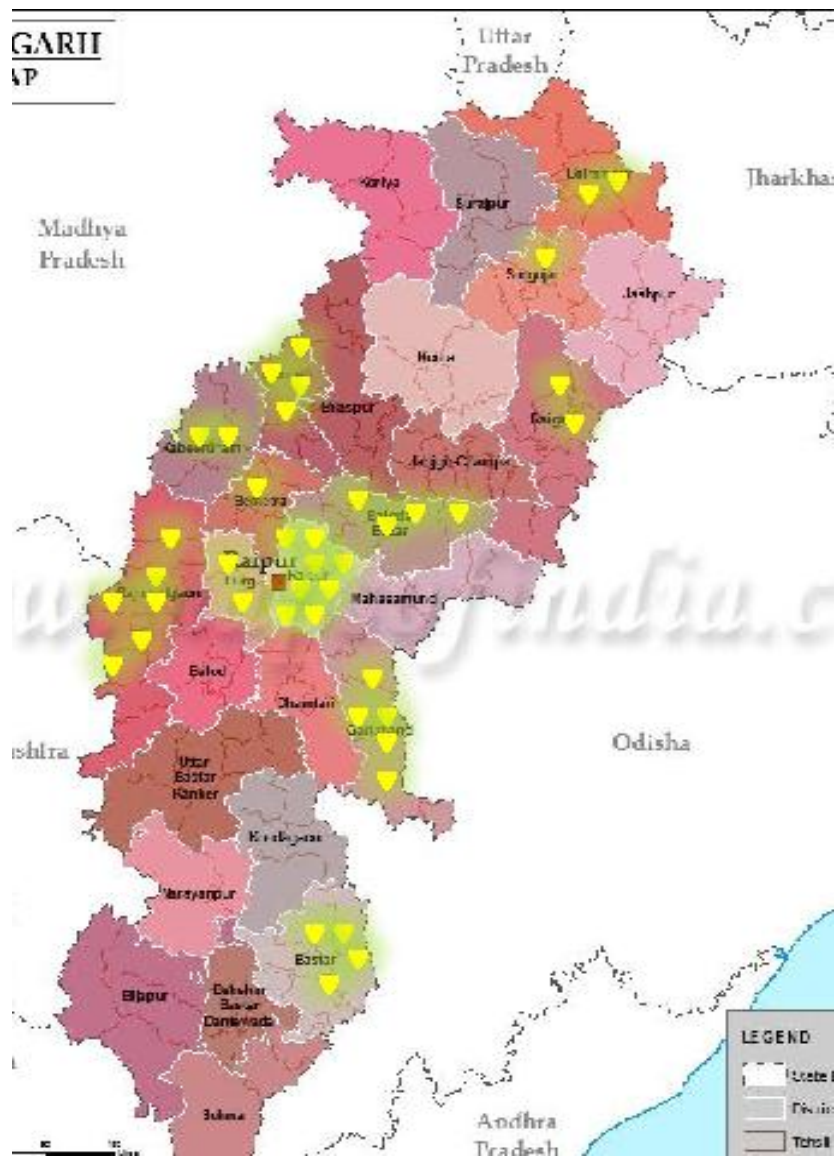
When district averages were considered, the disease incidence (%) was found highest in Gariyaband district recorded an average of 76% followed by Surguja (60%), Balrampur (50%), Raigarh (50%), Raipur (47.5%), Rajnandgaon (41.6%), Mungeli (30%), Kawardha (30%), Durg (30%), Baloda Bazar (30%), Bemetara (30%) and Bastar (30%). Very heavy incidence and disease severity at Gariyaband may be due to mono culturing of rice for around last 15 to 20 years, movement of propagules through canal water. Besides, this district received continuous precipitation during the survey period. This devastating disease was reported in all major rice growing districts of Chhattisgarh State as moderate to severe (30 to 50%) from 1995 to 2014. In order to understand the spread of sheath blight of rice disease in the state, data was collected over the past twenty five years (1990-2015) from production oriented survey (POS) reports of AICRP on rice (POS report 2015-2016).

Rice is cultivated in all three agro ecological zones in Chhattisgarh State. However, Chhattisgarh is known as rice bowl of India but above mentioned districts were showed more sheath blight disease incidence and disease severity during the survey. This is due to introduction of fertilizer responsive

short duration variety like swarna mono-culturing of rice and high amount of N fertilizer application. These results are in accordance with findings of Upma Dutta¹² where he found that the disease was present in all the rice growing areas of Jammu and Kashmir. Maximum disease incidence of 46.6 and 85.6 percent was observed during stem elongation and maturity stages, respectively in Maal Shah in Jammu district.

Survey results showed the disease incidence variation exists even at district/mandal level. Incidence ranged at Bastar (20% to 40%), Baloda Bazar (20% to 50%), Rajnandgaon (20% to 50%), Raipur (30% to 70%), Mungeli (20% to 40%), Raigarh (40% to 60%), Gariyaband (60% to 90%) districts. The variations in incidence might be due to differences in varietal status, time of sowing, transplanting, soil type, fertilizer dose and due to variations in weather conditions.

The survey was conducted during the vulnerable period from active tillering to panicle initiation stage of the crop, which is highly prone to sheath blight development. The heavy incidence of sheath blight might be due to the highly favorable factors like high relative humidity, less temperature and water stagnation due to continuous rain on these locations during the period of survey. Large scale cultivation of susceptible varieties as mono crop continuously on the same field might have increased the possibility of perpetuating the pathogen in the crop debris. *R. solani* being soil borne in nature, thriving in weed hosts and survives as sclerotia in field. Sclerotia remain viable in soil up to 270 days to a depth of 10 cm at the temperature level of 0-40 °C⁵. However, whatever may be the reason sheath blight incidence and severity was moderate to severe form during the survey period at Chhattisgarh.



Locations where sheath blight disease survey and collection of disease samples at Chhattisgarh during Kharif -2016

Table: 4.1 Sheath blight (*R. solani*) of rice disease samples collected from major rice growing areas of Chhattisgarh during Kharif-2016

Isolate code	Agro ecological zones	District	Block/Village	Rice variety	Crop stage	Samples of leaf/sheath	DI (%)	DS (SES scale 0-9)	LA (degrees)	LO (degrees)
RS-CG-01	Z-1	Balrampur	Rajpur/Bhagima	Maheswari	Tillering	Leaf	60	7	23.116	82.962
RS-CG-02	Z-1	Balrampur	Rajpur/Bhagima	PAC807	Booting	Sheath	40	3	23.056	83.319
RS-CG-03	Z-1	Surguja	Ambikapur/Bhagwanpur	US-350	Tillering	Leaf	60	7	23.157	83.153
RS-CG-04	Z-II	Raighar	Raighar/Bagbahara	Swarna	Tillering	Leaf	40	7	20.430	81.534
RS-CG-05	Z-II	Raighar	Raighar/Bhaleshar	Maheswari	Tillering	Leaf	60	7	20.226	81.516
RS-CG-06	Z-II	Mungeli	Mungeli/ Dabo	Kranti	Booting	Sheath	30	3	20.569	81.606
RS-CG-07	Z-II	Mungeli	Lormi/Dharampura	Swarna	Tillering	Sheath	30	3	19.043	81.939
RS-CG-08	Z-II	Mungeli	Mungeli/Damapur	Rajeshwari	Flowering	Sheath	40	5	19.117	81.964
RS-CG-09	Z-II	Mungeli	Mungeli/Gigara	Mahamaya	Tillering	Sheath	20	3	19.120	81.944
RS-CG-10	Z-II	Kawardha	Kunda/Amargaon	US-350	Tillering	Sheath	30	3	21.200	81.656
RS-CG-11	Z-II	Kawardha	Bodla/Baddo	Swarna	Flowering	Sheath	30	3	20.569	81.606
RS-CG-12	Z-II	Bemetera	Bemetera/Bemetera	Bamleshwari	Tillering	Sheath	40	5	21.948	82.549
RS-CG-13	Z-II	Baloda Bazaar	Bhatapara/Semradih	Jirafall	Flowering	Sheath	40	5	18.416	81.334
RS-CG-14	Z-II	BalodaBazaar	Bhilaighar/Balodi	Indrani dhan	PI	Sheath	20	3	19.530	81.506
RS-CG-15	Z-II	Baloda Bazaar	Balodabazar/Balodabazar	Swarna	PI	sheath	20	3	19.053	81.056
RS-CG-16	Z-II	Baloda Bazaar	Bhatapara/Bhatapara	Maheshwari	Tellering	Sheath	50	5	19.002	81.046
RS-CG-17	Z-II	Durg	Damdha/Damdha	Mahamaya	Flowering	Sheath	30	3	21.949	82.582
RS-CG-18	Z-II	Durg	Durg/Samoda	Maheshwari	Tillering	Sheath	30	4	22.103	82.140
RS-CG-19	Z-II	Rajnandgaon	Rajnandgaon/Anjora	HMT	Tillering	Leaf	50	5	19.256	81.128
RS-CG-20	Z-II	Rajnandgaon	Ambagarhchowki/Dadutola	Bamleshwari	Tillering	Sheath	40	5	19.614	81.246
RS-CG-21	Z-II	Rajnandgaon	Rajnandgaon/Mohar	Swarna	Tillering	Sheath	30	3	19.524	81.236
RS-CG-22	Z-II	Rajnandgaon	Kairagarh/Telitola	Indrani dhan	Tillering	Sheath	50	5	19.912	81.209
RS-CG-23	Z-II	Rajnandgaon	Ambagarh/Toyagondi	Swarna	PI	Sheath	30	3	19.714	81.269
RS-CG-24	Z-II	Rajnandgaon	Dongargarh/Dongargarh	Swarna	Tillering	Leaf	50	5	19.759	81.258
RS-CG-25	Z-II	Raipur	Arang/ Riva	Swarna	Tillering	Sheath	30	3	19.117	81.964
RS-CG-26	Z-II	Raipur	Raipur/ Zora	Safri	Tilering	Leaf	60	5	21.120	81.944
RS-CG-27	Z-II	Raipur	Raipur COA	Kranti	PI	Sheath	30	3	21.2366	81.7033
RS-CG-28	Z-II	Raipur	Raipur COA	Swarna	Tillering	leaf	60	7	21.2366	81.7033
RS-CG-29	Z-II	Raipur	Raipur COA	Rajeshwari	Tillering	Sheath	30	5	21.2366	81.7033
RS-CG-30	Z-II	Raipur	Abhanpur/Abhanpur	US-312	Tillering	Leaf	60	7	21.002	81.046
RS-CG-31	Z-II	Raipur	Abhanpur/Bhatagaon	Swarna	PI	Sheath	40	3	21.222	81.245
RS-CG-32	Z-II	Raipur	Tilde/ Tilda	Bamleshwari	Flowering	Leaf	70	7	21.046	81.941
RS-CG-33	Z-II	Gariyaband	Gariyaband/Gariyaban KVK	Mugridubrey	Tilleing	leaf	80	7	20.645	80.064
RS-CG-34	Z-II	Gariyaband	Gariyaband/Gariyaband KVK	HMT	Tillering	Leaf	60	9	20.645	80.064
RS-CG-35	Z-II	Gariyaband	Gariyaband/Tavarbahara	CR-800	Tillering	leaf	70	5	18.645	81.073
RS-CG-36	Z-II	Gariyaband	Gariyaband/Patharmonda	MTU-1001	Tillering	Leaf	80	9	20.125	82.054
RS-CG-37	Z-II	Gariyaband	Gariyaband/Kokdi	Swarna	Booting	Leaf	90	7	20.645	82.074
RS-CG-38	Z-III	Bastar	Jagdapur/Takameta	Swarna	Tillering	Sheath	30	5	19.043	81.939
RS-CG-39	Z-III	Bastar	Jagdapur COA/Kumhrawand	Bamleshwari	Flowering	Sheath	40	7	19.088	81.961
RS-CG-40	Z-III	Bastar	Jagdapur/Karanji	Samleshwari	Tillering	Sheath	20	3	19.117	81.964
RS-CG-41	Z-III	Bastar	Jagdapur/Kumhrawand	RP-BIO	Tillering	Sheath	30	3	19.087	81.964

Note: Z-I: Northern hills zone: Z-II: Chhattisgarh plains zone: Z-III: Bastar plateau zone, PI: Panicle initiation:

LA: Latitude, LO: Longitude, DI: Disease incidence, DS: Disease severity

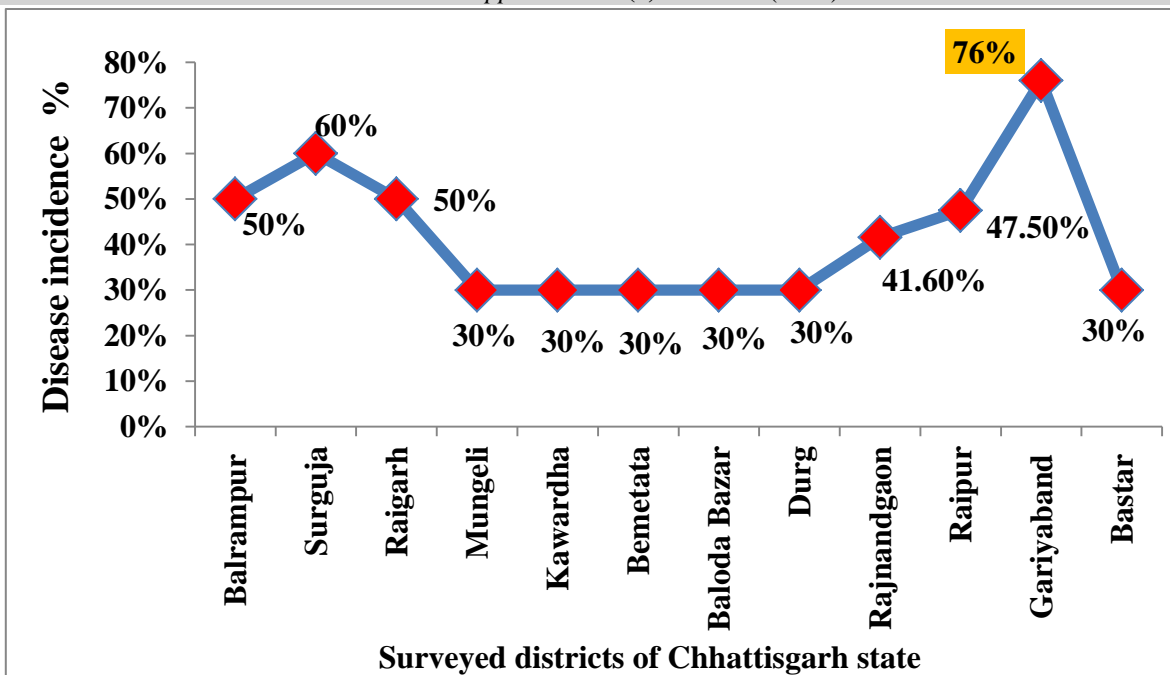


Fig. 1: District wise average disease incidence of sheath blight of rice in Chhattisgarh during Kharif 2016



Fig. 2: Field showing high disease incidence were noticed at Patharmonda village- Gariyaband district – Chhattisgarh Planis (Zone-II)

CONCLUSION

Survey on occurrence and spread of sheath blight of rice in major rice growing areas of Chhattisgarh state revealed that disease is a major problem of zone. Among the twelve districts surveyed Gariyaband district recorded highest mean of incidence 76% and districts like Mungeli, Kawardha, Balooda Bazar, Bemetara and Durg recorded least mean incidence of 30%. The heavy incidence of sheath blight might be due to the highly favorable factors like high relative humidity, less temperature and water stagnation due to continuous rain on these locations during the period of survey. Large scale cultivation of susceptible varieties as mono crop continuously on the same field might have increased the possibility of perpetuating the pathogen in the crop debris. The present study may serve as a precursor for evolving management strategies against the disease effective for the zone in an integrated way for sustainable development of crop in the state.

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