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Survey and collection of soybean wilt in Chhattisgarh

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Abstract
The intensive roving survey was conducted during *kharif* 2016-17 and 2017-18 to record the incidence of wilt in major soybean growing district of Chhattisgarh i.e. Raipur, Bemetara, Kabirdham, Rajnandgaon and Durg. Among the five district, twenty two locations (Dharsiwa, Ranka, Jaibra, Bemetara, Saigona, Kanhera, Kodia, Patharra, Chorbhatti, Chimagondi, Maharajpur, Lohara, Udiya Khurd, Ataria, Narmada, Kanhar, Salebharri, Bhulatola, Parpondi, Basni, Pendri and Rajpur. Observations were recorded from farmer's fields under natural condition. Disease incidence ranged from 30 to 60 per cent during the year 2016-17 with average of (42.63%). The maximum percent of disease incidence (60%) was observed in Jaibra, followed by Chorbhatti (55.30%). The lowest percent of incidence was found in Bemetara and Basni (30.00%). The average percent disease incidence in different soybean growing areas of Chhattisgarh was about 42.63%. During *kharif* 2017-18. less disease incidence was recorded on compared to the previous year crop. It ranged from 15 to 25.10 percent with average disease incidence of 19.12 percent as compared to the last year's average (42.63%). The maximum percent of disease incidence (25.10%) was observed in Ataria followed by Jaibra (25.00%), Bemetara and Parpondi recorded the minimum wilt incidence (15.00%).

Keywords: Disease incidence, soybean, wilt

Introduction
Soybean *Glycine max* (L.) Merrill is a protein rich oilseed crop. It is considered as a golden bean, miracle bean and wonder crop of the 20th century because of its characters and usage. Soybean being the richest, cheapest and easiest source of best quality of protein, it has multiplicity of use as food and industrial product (Sinclair and Shurtleff, 1975) [1]. Soybean has a great potential as an exceptionally nutritive and very rich protein food. It can supply the much needed protein to human diets, because it contains more than forty per cent protein of superior quality and all the essential amino acids particularly glycine, tryptophan and lysine, similar to cow's milk and animal proteins. Soybean also contains about twenty per cent oil with an important fatty acid, lecithin and Vitamin A and D. The four percent mineral salts of soybeans are fairly rich in phosphorous and calcium.

Soybean is grown throughout the world mostly in USA, Brazil, China, Argentina and India. In a country like India, people largely dependent on vegetable oil in diet and soybean play an important role in supplementing fats and oil of vegetarian origin. Seeds are used primarily as pulse and green and dried parts are used for cattle feed (Saxena, 1976) [2]. At present, soybean occupies an area of 126.29 million ha producing 348.47 million tones with a productivity of 2289 kg per ha in the world (SOPA, 2018) [3]. Soybean was introduced to India during 1980. In India it occupies an area of 10.15 million ha. With a production of 9.14 million tonnes and productivity of 952 kg ha^{-1} (SOPA, 2018) [3]. The major states which cultivate soybean are Madya Pradesh, Chhattisgarh, Bihar, Gujarat, Himachal Pradesh, Maharastra, Karnataka, Rajasthan and Uttar Pradesh.

In Chhattisgarh the area under soybean is 1.014 lakh ha. With the production of 1.261 lakh mt. and productivity 1242 kg ha^{-1}. The major soybean growing districts in Chhattisgarh are Kabirdham, Bemetara, Rajnandgaon, Durg, Mungeli, Bilaspur and Raipur (Commissionar Land Record, C.G. Raipur 2018). In Chhattisgarh, Soybean is grown during *kharif* season and it suffer from a number of diseases such as many fungal, bacterial, viral, nematode and abiotic diseases which are responsible for low producing.

In India, annual yield losses due to various diseases are estimated as 12% of total production. Over hundred pathogens are known to affect soybean (Sinclair and Shurtleff, 1975) [1], of

which 66 fungi, six bacteria and eight viruses have reported to be associated with soybean seeds (Sinclair, 1978) [4]. The diseases include rust, wilts, leaf spot, rots, powdery mildew, bacterial and viral diseases. Among, all the soil borne diseases wilt caused by *Fusarium oxysporum* f. sp. *glycines* is gaining more importance as they reduce plant population in the field resulting in the heavy yield losses. *F. oxysporum* f. sp. *glycines* can infect plants at any stage of soybean development but infection is particularly favored when plants are weakened. *F. oxysporum* f. sp. *glycines* is commonly isolated from soybean roots (Arias *et al.*, 2013) [5].

Materials and Methods

Survey and collection of soybean wilt sample

An intensive roving survey was conducted during *kharif* 2016-17 and 2017-18 to record the incidence of wilt disease in major soybean growing districts of Chhattisgarh. Samples of 3–5 infected Soybean plants showing typical symptoms of wilt were collected from the infected plants from farmer's field at different locations of Chhattisgarh (Rajnandgaon, Durg, Bemetara, Kabirdham and Raipur). Total 10-15 fields were surveyed randomly in each district. Wherever required, the complete infected plants were also collected for isolation of the pathogen and other studies. Symptomatological studies and per cent disease incidence was calculated by using the following formula.

$$\text{Per cent} = \frac{\text{Number of plants affected}}{\text{Total number of plants observed}} \times 100$$

Preservation and transportation of specimens

Each diseased samples was taken in brown envelopes / paper bags and then packed in 15×20 cm polyethylene bags and labeled, samples were brought to the lab and analysed on the day of collection or keeping under refrigerated conditions (4 °C) until processed for identification. Root samples were used for detection of fungi associated with wilted plants.

Results and discussion

The intensive roving survey was conducted to record the incidence of wilt in major soybean growing district of Chhattisgarh i.e. Raipur, Bemetara, Kabirdham, Rajnandgaon and Durg. Among the five district, twenty two locations (Dharsiwa, Ranka, Jaibra, Bemetara, Saigona, Kanhera, Kodia, Patharra, Chorbhatti, Chimagondi, Maharajpur, Lohara, Udiya Khurd, Ataria, Narmada, Kanhar, Salebharri, Bhulatola, Parpondi, Basni, Pendri and Rajpur during *Kharif* 2016-17 and 2017-18. Observations were recorded from farmer's fields under natural condition.

Results of survey; conducted during *kharif* 2016-17 are presented in table 1 and Fig.1 which indicated the appearance of disease in all the soybean growing areas of Chhattisgarh. Disease incidence ranged from 30 to 60 per cent during the year 2016-17 with average of (42.63%). The maximum percent of disease incidence (60%) was observed in Jaibra, followed by Chorbhatti (55.30%), Parpondi (50.50%), Udiya Khurd (50.40%), Patharra (50.00), Kodia (45.80%), Ataria (45.60%), Maharajpur (45.55%), Chimagondi (45.50%), Narmada (40.70%), Kanhera and Bhulatola (40.60%), Ranka (40.50%), Saigona (40.40%), Pendri (40.30%), Salebharri (40.10%), Kanhar and Rajpur (40.00%), Lohara (35.50%), Dharsiwa (30.70%). The lowest percent of incidence was found in Bemetara and Basni (30.00%). The soybean crop gets damaged substantially in the Chhattissgarh state due to the wilt disease (Fig. 1). The average percent disease incidence in different soybean growing areas of Chhattisgarh was about 42.63%.

Survey of soybean wilt was also carried out during the *kharif* 2017-18. The results presented in table 2 and Fig. 1 indicates that less disease incidence was recorded on compared to the previous year crop. It ranged from 15 to 25.10 percent with average disease incidence of 19.12 percent as compared to the last year's average (42.63%). The maximum percent of disease incidence (25.10%) was observed in Ataria followed by Jaibra (25.00%), Lohara and Kodia (20.70%), Saigona (20.60%), Chorbhatti (20.50%), Ranka, Bhulatola, Basni and Pendri (20.40%), Dharsiwa (20.30%), Chimagondi, Udiya Khurd, Narmada and Salebharri (20.00%), Kanhera (15.70%), Rajpur (15.60), Kanhar (15.30%), Maharajpur (15.20%) and Patharra (15.10%). Bemetara and Parpondi recorded the minimum wilt incidence (15.00%).

Data of disease incidence presented in table 1 & 2 and Fig. 1 indicate the seasonal variation of disease. It was reported that during *kharif* 2016-17 Chhattisgarh recorded high rainfall and low temperature that favours the high disease incidence without consideration of variety. During *kharif* 2017-18 less disease incidence was reported, because during this period state reported the low rain fall and high temperature which is not suitable for wilt disease A survey of soybean growing areas of Chhattisgarh was conducted in the districts i.e. Durg, Rajnandgaon, Mungeli, Bemetara and Kabirdham where the wilt incidence varied from 3-30% (Anonymous, 2017) [6].

Table 1: Incidence of soybean wilt in different locations of Chhattisgarh during *Kharif* 2016-17

S. No.	District	Block	Location	Variety sown	% Disease incidence
1.	Raipur	Dharsiwa	Dharsiwa	JS 97-52	30.70
2.	Bemetara	Bemetara	Ranka	JS 335	40.50
3.	Bemetara	Bemetara	Jaibra	JS 335	60.00
4.	Bemetara	Bemetara	Bemetara	JS 335	30.00
5.	Bemetara	Bemetara	Saigona	JS 335	40.40
6.	Bemetara	Bemetara	Kanhera	JS 335	40.60
7.	Bemetara	Bemetara	Kodia	JS 335	45.80
8.	Bemetara	Bemetara	Patharra	JS 335	50.00
9.	Bemetara	Bemetara	Chorbhatti	JS 335	55.30
10.	Kabirdham	Kabirdham	Chimagondi	JS 335	45.50
11.	Kabirdham	Kabirdham	Maharajpur	JS 335	45.55
12.	Kabirdham	Lohara	Lohara	JS 335	35.50
13.	Kabirdham	Lohara	Udiya Khurd	JS 335	50.40
14.	Rajnandgaon	Ataria	Ataria	JS 97-52	45.60
15.	Rajnandgaon	Narmada	Narmada	JS 335	40.70
16.	Rajnandgaon	Kanhar	Kanhar	JS 335	40.00
17.	Rajnandgaon	Salebharii	Salebharri	JS 97-52	40.10
18.	Rajnandgaon	Bhulatola	Bhulatola	JS 335	40.60
19.	Durg	Dhamdha	Parpondi	JS 335	50.50
20.	Durg	Dhamdha	Basni	JS 335	30.00
21.	Durg	Dhamdha	Pendri	JS 97-52	40.30
22.	Durg	Dhamdha	Rajpur	JS 335	40.00
	Mean				42.63

Table 2: Incidence of soybean wilt in different location of Chhattisgarh during *kharif* 2017-18

S. No.	District	Block	Location	Variety sown	% Disease incidence
1.	Raipur	Dharsiwa	Dharsiwa	JS 335	20.30
2.	Bemetara	Bemetara	Ranka	JS 335	20.40
3.	Bemetara	Bemetara	Jaibra	JS 335	25.00
4.	Bemetara	Bemetara	Bemetara	JS 97-52	15.70
5.	Bemetara	Bemetara	Saigona	JS 335	20.60
6.	Bemetara	Bemetara	Kanhera	JS 335	15.70
7.	Bemetara	Bemetara	Kodia	JS 335	20.70
8.	Bemetara	Bemetara	Patharra	JS 97-52	15.10
9.	Bemetara	Bemetara	Chorbhatti	JS 335	20.50
10.	Kabirdham	Kabirdham	Chimagondi	JS 335	20.00
11.	Kabirdham	Kabirdham	Maharajpur	JS 97-52	15.20
12.	Kabirdham	Lohara	Lohara	JS 335	20.70
13.	Kabirdham	Lohara	Udiya Khurd	JS 335	20.00
14.	Rajnandgaon	Gandai	Ataria	JS 97-52	25.10
15.	Rajnandgaon	Gandai	Narmada	JS 335	20.00
16.	Rajnandgaon	Gandai	Kanhar	JS 335	15.30
17.	Rajnandgaon	Khairagarh	Salebharri	JS 335	20.00
18.	Rajnandgaon	Khairagarh	Bhulatola	JS 335	20.40
19.	Durg	Dhamdha	Parpondi	JS 97-52	15.00
20.	Durg	Dhamdha	Basni	JS 335	20.40
21.	Durg	Dhamdha	Pendri	JS 97-52	20.40
22.	Durg	Dhamdha	Rajpur	JS 335	15.60
	Mean				**19.12**

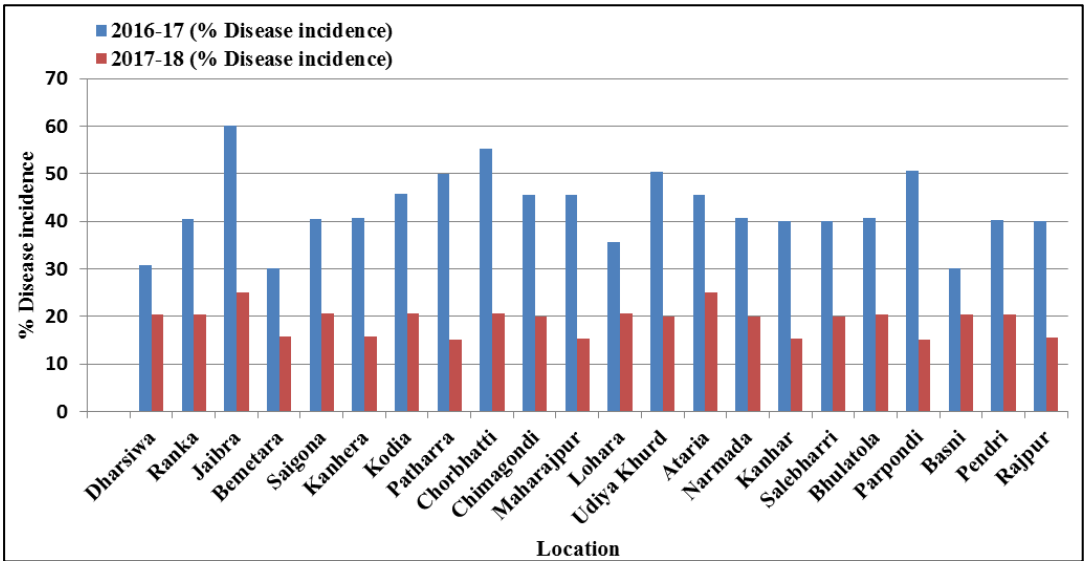

Fig 1: Incidence of soybean wilt in different location of Chhattisgarh during *kharif* 2016-17 and 2017-18

Conclusion

The seasonal variation of disease reported that during *kharif* 2016-17 Chhattisgarh recorded high rainfall and low temperature that favours the high disease incidence without consideration of variety. During *kharif* 2017-18 less disease incidence was reported, because during this period state reported the low rain fall and high temperature which is not suitable for wilt disease.

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