Biological Forum – An International Journal **14(1): 1596-1600(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Survey and Epidemiological Studies of Sesame Phyllody Diseases

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(Received 01 December 2021, Accepted 08 February, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Sesame (*Sesamum indicum* L.) belongs to family pedaliaceae, which have basic chromosome number 2n =26 and originated in India. It is oldest oilseed crop. The sesame phyllody was observed to be widely distributed the entire ten village of Jaipur district. , a roving survey of sesame fields at 50 per cent capsule forming stage in Jaipur district near in 10 locations were under taken during *Kharif*-2019. The maximum disease incidence was recorded at Bhutera (26.05%) followed by Pachkodiya (25.23%) and the severity of sesame phyllody in surveyed areas was from 17.90 to 26.05%. Among the environmental factors effecting sesame phyllody were minimum temperature, relative humidity and rainfall that increase both leaf hopper population and per cent disease incidence except maximum temperature which show non-significant negative correlation with disease incidence and leaf hopper population.

Keywords: Phyllody, temperature, disease incidence, leaf hopper.

INTRODUCTION

Sesame (*Sesamum indicum* L.) belongs to family pedaliaceae, which have basic chromosome number 2n =26 and originated in India. It is also Known as *til* (Hindi), *tal* (Gujarati), *till* (Panjabi), *nuvvulu* (Telugu), *ellu* (Tamil) and *ragi* (oriya) in different til growing parts of India. Sesame is an important annual oilseed crop which requires warm and hot climate and commonly grown under stressed condition from tropical to temperate region. Sesame is an annual, tall growing (1.0 to 1.5 meter) herbaceous plant which mature in about 90 to 110 days. As an ancient and important oily seed crop, sesame is cultivated mainly for its valuable edible oil used for human cooking oil and besides its positive human health benefits (Jayaraj *et al.,* 2020). Due to its amazing cosmetic and skin-care properties it's oil widely used in shampoos, massage toilatery products, soaps, detergents, pharmaceuticals and perfumes etc. and due to these properties, it is called "Queen of oils" (Anonymous, 2006). Sesame crops suffers from many fungal, viral, bacterial and phytoplasma diseases. The diseases such as Phytopthora blight (Butler,1918), Root rot (Mehta,1951), Bacterial blight (Rao, 1962; Kolte,1985; Vyas *et al.* 1984), Bacterial leaf spot (Vyas *et al.*1984; kolte,1985), Cercospora leaf spot (kolte,1985), Alternaria leaf spot (Kolte, 1985), Powdery mildew (Rajpurohit,1993), Phyllody (Gibbion MC,1924; Kashiram, 1930) etc. Among all the above mentioned diseases phyllody is a severe disease of sesame which cause a major loss in crop yield in most of the crop growing region, chiefly in warm areas (Manjunath, 2012). Sesame phyllody was first reported in Burma (Myanmar) and was nominate as "*Green flowering disease/ Pothe*" (Gibbon MC, 1924) and subsequently reported from many parts of india (Rao & Nabi, 2015). First report of phytolasma as plant pathogens responsible for yellows disease (Doi *et al*., 1967). Now-a-days, phytoplasma are among the most serious plant pathogens that negatively affect economically valuable crops, like sesame, threatening worldwide food security (Hemmati *et al.*, 2021). Phytoplasma are covered by single unit membrane, lacking rigid cell wall, pleomorphic in shape with average diameter of 0.2 – 0.8 µm and transmitted is mainly occur by sap sucking insect vectors belonging to families Cicadellidae (Leaf hopper) and Fulgoridae (Plant hopper). Transmission of sesame phyllody disease is occured by leaf hopper (*Orosius albicinctus*), grafting and dodder. There is no transmission by sap.

MATERIAL AND METHODS

Survey. To know the occurrence and distribution of phyllody disease of sesame, a roving survey of sesame fields at 50 per cent capsule forming stage in Jaipur district near in 10 locations were under taken during *Kharif*-2019. The survey for sesame phyllody disease was under taken in near the vicinity of Jobner *viz*., Bhojpura, Jagmalpura, Malikpur, Kaladera, Bobas, Bhutera, Khejrawas, Jobner, Dhani Boraj, Pachkodiya.

The disease diagnosis in the field was based on typical symptoms. The per cent disease incidence were recorded at random on different locations in the field by counting total number plants and number of plant showing phyllody disease symptoms using the formula given below

$$\text{Per cent disease incidence (PDI)} = \frac{\text{Number of plants infected}}{\text{Number of plants observed}} \times 100$$

Epidemiological studies on disease development

Meteorological parameters in relation to disease incidence. In order to study the relationship of meteorological parameters on the natural occurrence of sesame phyllody, observations were taken from 23-08-2019 to 19-10-2019 consisting of 9 meteorological weeks during *kharif* -2019 under field condition at Experimental plot of Department of Plant Pathology, S.K.N. collage of Agriculture, Jobner. The weather parameters like maximum and minimum temperature (°C) maximum and minimum RH (%) and rainfall (mm) were co-related with phyllody disease incidence. The PDI was recorded following a standard scale (0-5) based on the incidence of disease appearance on sesame plant through visual estimation. Per cent disease incidence (PDI) was calculated by using the formula as mentioned below

$$\text{Per cent Disease Incidence (PDI)} = \frac{\text{Number of infected plants}}{\text{Number of plants observed}} \times 100$$

RESULT AND DISCUSSION

Survey. A survey was conducted during *Kharif* - 2019 at ten sesame growing villages of Jaipur district *viz.*, Bhutera, Pachkodiya, Malikpur, Jobner, Bhojpura, Kaladera, Bobas, Jagmalpura, Khejrawas and Dhani Boraj. The Results presented in Table 1 and Fig. 1 depicted that sesame phyllody disease incidence was more severe in sesame growing villages of Jaipur district (Plate 1a and 1b). The disease incidence of sesame phyllody disease was ranging from 17.90 to 26.05 per cent in all surveyed areas of jaipur district. The Minimum disease incidence was recorded in Dhani Boraj, where as maximum disease incidence was recorded in Bhutera followed by Pachkodiya (25.23%), Malikpur (24.91%), Jobner (22.15%), Bhojpura (21.90%), Kaladera (21.10%), Bobas (20.76%), Jagmalpura (19.98%), Khejrawas (18.46%) and Dhani Boraj (17.90%), respectively.

Similar results have been reported by Kalita *et al.* (2018) the sesame phyllody incidence was varied from 2% to 29% in different location with incidence the highest in sonitpur in the variety ST-1683.

Table 1: Sesame phyllody incidence in Jaipur district, during *Kharif*- 2019.

Sr. No.	Villages	Per cent Disease Incidence
1.	Bhojpura	21.90
2.	Bhutera	26.05
3.	Jagmalpura	19.98
4.	Malikpur	24.91
5.	Kaladera	21.10
6.	Khejrawas	18.46
7.	Dhani Boraj	17.90
8.	Jobner	22.15
9.	Bobas	20.76
10.	Pachkodiya	25.23

Jagmalpura

Khejrawas

Bhojpura

Jobner

Malikpur

Plate 1a: Field of sesame crop visited during survey.

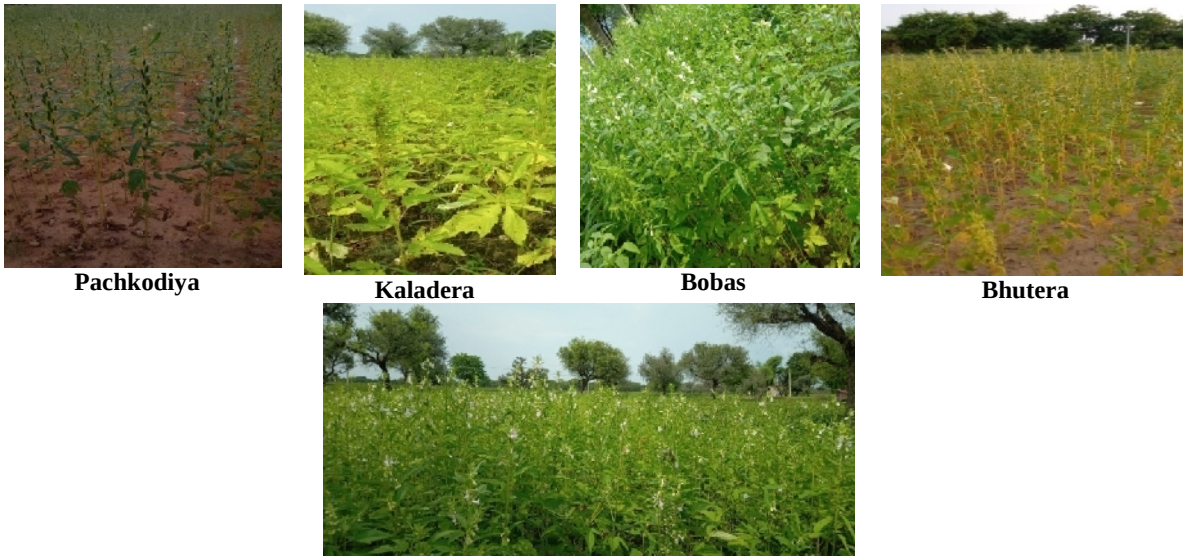

Plate: 1b Field of sesame crop visited during survey.

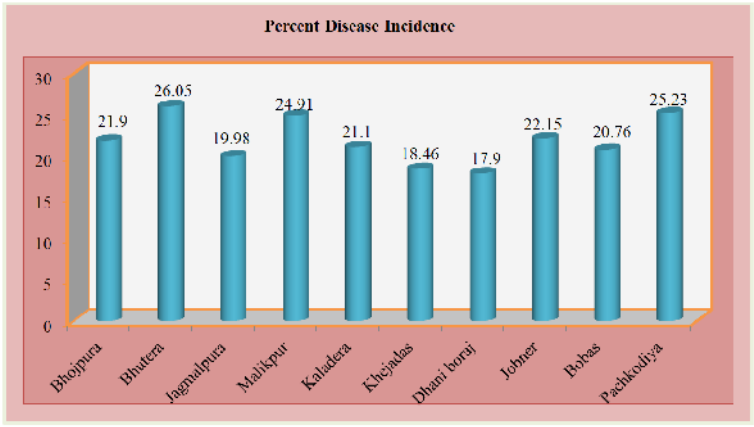

Fig. 1. Occurrences of phyllody disease of sesame in Jaipur district during *Kharif*-2019.

Epidemiology studies on disease development

Effect of environmental factors. Influence of weather and climatic parameter on per cent disease incidence and vector population were computed through correlation studies at S.K.N. Collage of Agriculture Jobner. It was observed that the maximum population of leaf hopper 7.71/leaf was recorded at 36 standard week with the maximum disease incidence of 37.7 per cent. Minimum per cent disease incidence (20.3) recorded at 41 standard week with minimum vector populations 3.06/leaf (Table 2 & Fig. 2). Formula for correlation factors of weather parameters like maximum temperature, minimum temperature, relative humidity per cent and total rainfall.

The effect of all the four weather parameters were represented in Table 3. It was revealed that minimum temperature, relative humidity and rainfall had positive correlation except maximum temperature for the leaf hopper population and Per cent disease incidence. Both per cent disease incidence and plant leaf hopper count had highly significant positive correlation with relative humidity (0.9647 and 0.963, respectively). Maximum temperature had non- significant negative correlation with disease incidence and plant leaf hopper. A multiple correlation between the disease incidence and a group four independent variables (weather parameters) was responsible for the disease in cropping season under study. The coefficient of multiple determinations (R^2) was 0.989 per cent (Table 4).

Similar results have been reported by Choudhari and Prasad (2007) studied effect of weather parameter and vector population on incidence and development of phyllody disease. Study reported that, significant positive correlation between phyllody incidence with maximum and minimum temperature and negative correlation with maximum relative humidity and rainy days were observed. Vector population was satistically non-significant and showed negative effect on phyllody incidence. Maximum temperature was negatively correlated while minimum relative humidity was positively correlated with vector population. Ahirwar *et al.* (2009) studies on seasonal incidence of insect pest of sesame in relation to abiotic factors and reported that, *Orosius albicinctus* was maximum at 32nd, 34th, 36th and 37th metrological week, also reported that maximum temperature and rainfall were significantly positively correlated with the population of insect and minimum temperature and relative humidity was

negatively correlated with insect population. Kumar *et al.* (2009) reported that the seasonal incidence of insects and pests of sesame, peak infestation of vector *Orosius albicinctus* (leaf hopper) was observed in 36th metrological week there for crop sown in 35-36 metrological week transmit highest phyllody disease. Cagirgan *et al.* (2013) the impact of climate variability on occurrence of sesame phyllody and symptomatology of the disease in a Mediterranean environment.

Table 2: Effect of climatic parameters on disease incidence of phyllody in sesame during *Kharif*-2019.

Sr. No.	Standard Meteorological Weeks (SMW)	Date of observation	Temperature (°C)		Relative Humidity (%)	Total Rainfalls (mm)	Mean leaf hopper population/ leaves	Disease Incidence (%)
			Maximum	Minimum				
1.	34	23-08-2019	34.0	20.0	75	0.8	5.89	31.2
2.	35	30-08-2019	33.9	19.5	83	44.2	6.94	35.6
3.	36	06-09-2019	33.8	22.9	83	6.6	7.71	37.7
4.	37	14-09-2019	36.3	24.9	70	0.0	4.80	28.6
5.	38	21-09-2019	35.2	23.3	63	0.0	3.87	25.9
6.	39	28-09-2019	32.8	24.3	75	12.2	6.77	33.8
7.	40	05-10-2019	33.3	22.7	67	0.6	5.41	31.9
8.	41	12-10-2019	33.7	17.6	53	0.0	3.06	20.3
9.	42	19-10-2019	34.7	17.7	55	0.3	3.14	21.8

Table 3: Correlation of leaf hopper population and phyllody disease incidence with major environmental factors during *Kharif*- 2019.

parameter variable	Maximum Temperature (°C)	Minimum Temperature (°C)	Relative Humidity (%)	Rainfalls (mm)
Leaf hopper Population	- 0.3605	0.5034	0.9638	0.5268
Per cent disease Incidence	- 0.4298	0.4273	0.9647	0.5441

Table 4: Prediction equation and R^2 for predicting phyllody in sesame (Multiple regression equation).

Multiple regression equation					R^2
Y = 28.816	- 0.688 X_1				0.185
Y = 27.235	-0.842 X_1	0.319 X_2			0.450
Y = 8.754	-0.411 X_1	0.061 X_2	0.134 X_3		0.987
Y = 8.643	-0.411 X_1	0.040 X_2	0.143 X_3	- 0.008 X_4	0.989

X_1 = Maximum Temperature, X_2 = Minimum Temperature, X_3= Relative Humidity, X_4 = Rainfalls (mm)

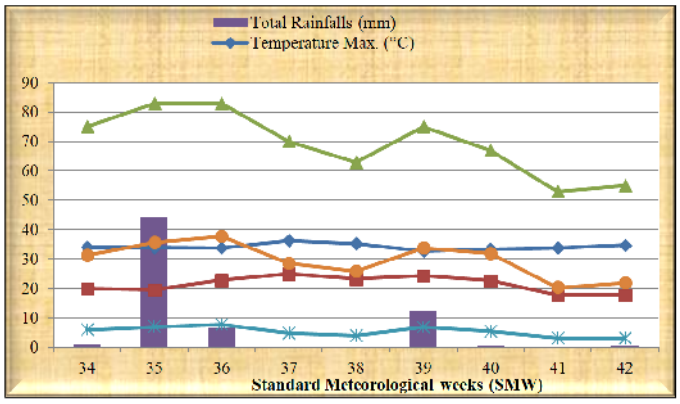

Fig. 2. Effect of climatic parameters on disease incidence of phyllody in sesame.

CONCLUSION

The incidence of sesame phyllody varied from village to village in the ten village of Jaipur district during survey and it was maximum in Bhutera village (26.05%) and minimum in village Dhani Boraj (17.90%). Typical symptoms of sesame phyllody under investigation were phyllody, virescence, witches' broom, stunting, yellowing and sterility.

Among the environmental factors effecting sesame phyllody were minimum temperature, relative humidity and rainfall that increase both leaf hopper population and per-cent disease incidence except maximum temperature which show non-significant negative correlation with disease incidence and leaf hopper population.

Acknowledgment. I would like to extend my heartfelt thanks to my Grand Guide Dr. G.S. Rathore emeritus Professor, Department of Plant Pathology, S.K.N. College of Agriculture, Jobner. I feel blessed and fortunate to have him as my director. With this I take this wonderful opportunity to express my gratitude, debt and sincere respect to him for his valuable and encouraging guidance, critical suggestions and his support and encouragement throughout my study. Thanks

again for providing me with all the necessary requirements for my research study.
I also extend my special thanks to my teammates, old and young. Finally, I owe my deepest gratitude and sense of responsibility to my dear husband (Kanhaiya Lal Yadav), my parents, brother and sister for their prayers, unconditional support, encouragement to pursue my interest and self-sacrifice, they have done for you. throughout my research and study.
Conflict of Interest. None.

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How to cite this article: Pinki Devi Yadav, G.S. Rathore, Ranjana Meena, Sunita Choudhary, Pooja Yadav and Mateti Gayithri (2022). Survey and Epidemiological Studies of Sesame Phyllody Diseases. *Biological Forum – An International Journal*, *14*(1): 1596-1600.