ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2020; 6(7): 13-16
www.allresearchjournal.com
Received: 07-05-2020
Accepted: 09-06-2020

Poonam Kumari
Ph.D. Scholars, Department of Plant Pathology, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Shivam Maurya
Ph.D. Scholars, Department of Plant Pathology, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Sunil Kumar
Ph.D. Scholars Department of Plant Pathology, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Lokesh Kumar
Ph.D. Scholar Department of Extension Education, Rajasthan College of Agriculture (MPUAT), Udaipur, Rajasthan, India

Corresponding Author:
Poonam Kumari
Ph.D. Scholars Department of Plant Pathology, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan, India

Major role of epidemiological study in management of powdery mildew of blackgram: A review

Poonam Kumari, Shivam Maurya, Sunil Kumar and Lokesh Kumar

Abstract
Black gram, (*Vigna mungo* L.) is an important short duration pulse crop grown throughout the year in India under different agro climatic conditions. In India the total production of black gram is 1.74 million tonnes from an area of 3.26 million ha with a productivity of 534 kg/ha (Anonymous, 2012). The diseases powdery mildew caused by Erysiphe polygoni is one of the economically important disease in black gram which occurs at later stages of crop growth causing an yield loss of 20 per cent (Singh, 1995). Environmental factors have major role in disease development so epidemiological study is necessary for management disease.

Keywords: Black gram, *Erysiphe polygoni*, obligate parasite epidemiology

Introduction
The black gram [*Vigna mungo* L.; Fabaceae) is one of the most highly prized pulses in tropical countries especially in India. The green pods are eaten as vegetable and they are highly nutritious (Nilanthi D., 2014) [14]. Black gram cultivation is suitable for moist and hot weather condition. The temperature in between 25 to 35 ^{0}C is perfect for the black gram cultivation in India. Black gram is rich in easily digestible protein 25.21 per cent, contains about 58 per cent of carbohydrate, 2 per cent of fat, 0.273 mg of vitamin B_1, 0.254 mg of vitamin B_2, 1.447 mg of vitamin Niacin, 138 mg of calcium, 379 mg of phosphorus, 7.57mg of iron per 100 gram of seeds (USDA National Nutrient data base).
It is cultivated extensively in India, Burma and Thailand regions of Asia. India is the world's largest producer as well as consumer of black gram. It is the third most important pulse crop in India as it produces about 21.99 lakh tonnes of black gram annually from about 40.19 lakh hectares of area, with an average productivity of 547 kg per hectare. The major black gram growing states of the country are Maharashtra, Andhra Pradesh, Rajasthan, Orissa, Tamil nadu, Karnataka and Bihar. In Rajasthan, Black gram occupy 2.99 lakh hectares area with a production of 1.15 lakh tones. However, the productivity of gram is low in Rajasthan (384 kg/ha). It is mainly cultivated in arid and semi black arid districts including Chittorgarh, Udaipur, Ajmer, Jhalawar, Kota, Bundi and Baran etc. (Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare 2016).
The black gram is attacked by several diseases like- Anthracnose- *Colletotrichum lindemuthianum* (Sacc. and Magnus) Briosi and Cavara, Bacterial leaf blight- *Xanthomonas phaseoli* Dowson, *Cercospora* leaf spot- *Cercospora canescens*, Powdery mildew- *Erysiphe polygoni*, Root rot and leaf blight- *Rhizoctonia solani* J.G. Kuhn, Rust- *Uromyce sphaseoli* G. Winter, *Macrophomina* blight- *Macrophomina phaseolina* (Tassi) Goid., Yellow mosaic disease- *Mungbean yellow mosaic virus*, Leaf crinkle disease - *Leaf crinkle virus.* The Powdery mildew of black gram caused by *Erysiphe polygoni* is one of the major constraint in the production of black gram, which causes both qualitative and quantitative loss of grains.

The disease
Powdery mildew has long been known as obligate parasite of plants in all parts of the world. In ancient time Linnaeus 1753, established a genus *Erysiphe* later De Candolle (1802) described many species of the genus. The powdery mildew of green gram caused by *Erysiphe polygoni* seems to be first reported from India (Butler, 1918) [4]

The disease appears almost at all the stages of crops growth and particularly severe in late sown *kharif* crop and under favourable conditions, it occurs throughout the year. Its life cycle presented by diagramatically (Fig 1). The reduction in photosynthetic activity and physiological changes are considerable, which leads to high reduction in yield (20-40 per cent) depending on stage and time at which the disease appears (Legapsi *et al*., 1978) [10]. However, the disease has favourable in warm and humid weather. In the powdery mildew disease white, powdery patches appear on leaves and other green parts and later become dull in colour. These patches gradually increase in size and become circular, covering the lower surfaces as well. Severely affected parts become shrivelled and distorted. In severe infections, foliage turns yellow, causing premature defoliation. The disease also forces maturity of the infected plants, which results in heavy yield losses.

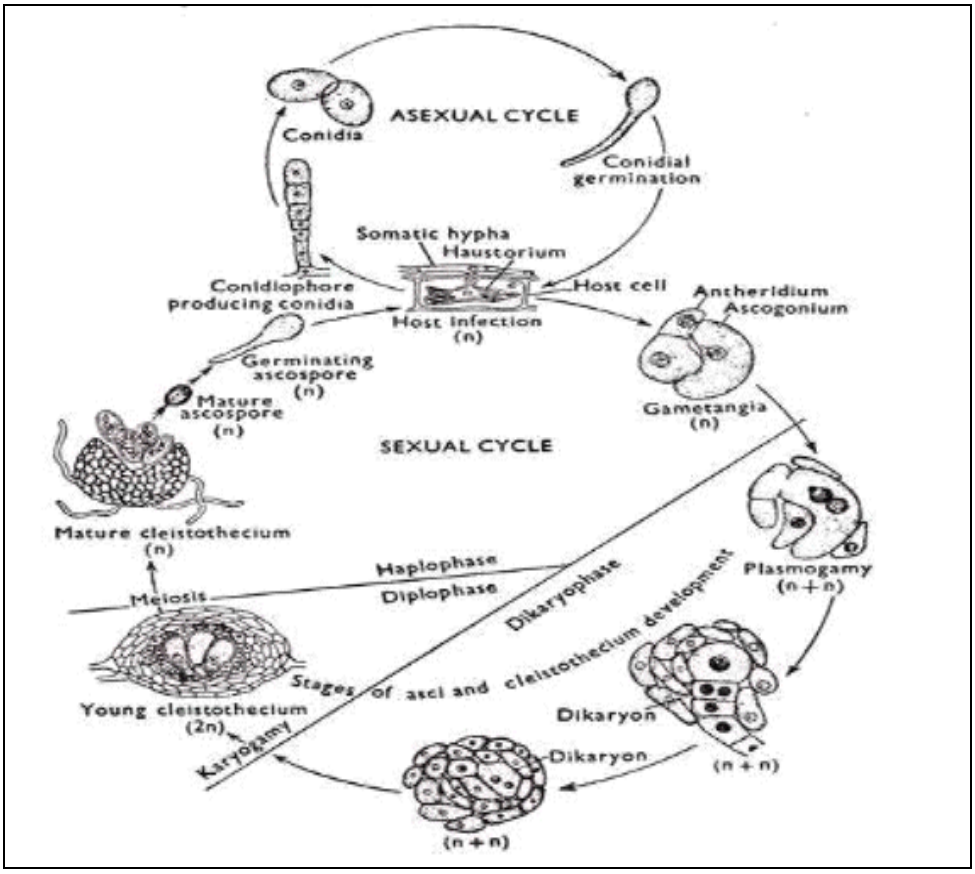

Fig 1: Life cycle of *Erysiphe polygoni.*

Erysiphe polygoni, the fungus that causes powdery mildew on black gram, is an obligate parasite that needs living host tissue to grow and reproduce. The pathogen is disseminated as spores carried in the wind.

Symptoms

The symptoms produced by *Erysiphe polygoni* on black gram as chlorotic, circular to oval shape on leaves with diffuse margins (Fig 2). Chemical control is highly recommended because powdery mildew is an aggressive and destructive disease and satisfactory control without the use of fungicide is unlikely.

Fig 2: Symptoms produced by *Erysiphe polygoni*

Many systemic and non-systemic fungicides were reported to manage the powdery mildew of black gram. However, application of chemicals are cause environmental pollution and injurious to soil ecosystem. The information on the efficacy of new comb fungicide, botanical and organic amendment against powdery mildew of black gram is insufficient. Hence, the disease caused by an obligate pathogen (*Erysiphe polygoni*) and its incidence and severity depends on environmental factors. Thus to management powdery mildew of blackgram epidemiological study is necessary.

Incidence of powdery mildew

Channaveeresh and Kulkarni (2017) [5] conducted a survey to know the severity of black gram powdery mildew in five districts of northern Karnataka *viz*., Belgaum, Dharwad, Gadag, Haveri and Uttara Kannada districts during *Kharif* and *Rabi* season of 2012-13.The severity was more in Belgaum district (68.72% of PDI) followed by Dharwad (PDI- 59.73%) and Haveri (PDI- 52.10%). The disease severity was less in Uttara Kannada (PDI- 44.59%). Whereas, it was lowest in Gadag district (20.23%).

Jyothi U (2012) [9] conducted a survey in Northern Karnataka districts *viz.*, Bagalkot, Belgaum, Dharwad and Gulbarga during *Kharif* 2011. The survey data revealed that in Dharwad district had maximum (76.80 PDI) severity of powdery mildew followed by Belgaum (71.93 PDI) where as minimum PDI was noticed in Gulbarga district (37.39%).

Tulasi (2016) [22] conducted a survey during 2015-16 *rabi* season in major *urd bean* growing mandals of Guntur district, Andhra Pradesh. In Guntur district, a total of 16 fields of eight villages *viz.*, Kantheru, Ponnekalu, Kothapalem, Manchala, Vargani, Nagalupadu, Bhallupadu and Appapuram, belonging to four mandals *viz.*, Tadikonda, Veticherukuru, Pedanandipadu and Kakumanu were surveyed. Incidence was ranged from of 13.69% (Pedanandipadu mandal) to 87.01% (Tadikonda mandal) and severity were ranged from 11.61% (Kakumanu mandal) to 88.08% (Tadikonda mandal), respectively.

Role of weather parameters on disease development

The weather elements temperature, relative humidity and rainfall play an important role on the development of powdery mildew on various crop plants. Several workers worked out on this aspects:

Bhattacharya (2002) [3] studied the per cent severity of *Erysiphe pisi* DC on *Pisum sativum* var. Type 163 leaves at three seedling dates under irrigated and rainfed conditons. Severity was higher under rainfed. Path analysis and per cent association estimation showed that severity is affected by minimum environmental temperature and maximum relative humidity. Under irrigated condition, maximum disease severity was under 37.4 °C, 19.4 °C, 53.0%, 25.0% and 11.8 h, while under rainfed condition. It was under 37.0 °C. 23.8 °C 51.4%, 25.0% and 11.9 h (for maximum temperature minimum temperature, maximum relative humidity, minimum relative humidity and sunshine duration, respectively).

Mishra and Shirsole (2017) [12] conducted a field experiment at IGKV, Raipur, during the *Rabi* seasons of 2009-2010. The correlation study between powdery mildew disease severity and meteorological parameters revealed that the disease severity was positively and significantly correlated with maximum temperature and sunshine hours. The correlation was non-significant with minimum temperature and relative humidity.

Nayak (2007) [15] studied on powdery mildew (*Erysiphe polygoni* DC) of black gram and reported that development of powdery mildew exhibited a negative correlation with minimum temperature, relative humidity and total rain fall whereas a positive correlation with maximum temperature was observed. That revealed higher maximum temperature (27.6 °C to 30.9 °C) coupled with lower minimum temperature (22.5 °C to 23.0 °C), low rainfall (27.0 to 48.9 mm) and low relative humidity (92.0%) favoured powdery mildew development.

Nag and Khare (2017) [13], studied the epidemiology of pea powdery mildew caused by *Erysiphe pisi* DC during 2013-14 winter/spring season. The results revealed that PDI was increased with maximum temperature ranges from 28.5-30.0 ^{0}C (maximum) and 13.1-14.2 ^{0}C (minimum) temperature, wind velocity 1.6 Kmph and 68% average relative humidity. A positive correlation occurred between powdery mildew severity and temperatures, wind velocity in the varieties. However, the correlation with relative humidity was negative.

Vikas and Ratnoo (2013) [24], conducted an experiment to find out the effect of environmental factors on the development of powdery mildew disease on fenugreek (*Erysiphe polygoni* DC) in *Rabi*, 2009-10 at Department of Plant Pathology, RCA, Udaipur. Powdery mildew was high during the 11th to 17th week of January 15 to March 04 when maximum temperature was (25.1- 33.1 ^{0}C), minimum temperature (5.9- 14.1 ^{0}C), maximum relative humidity (82.0- 60.0%) and minimum relative humidity (20.2-26.0%) existed in the environment. It became severe in cool and humid weather of January and February months.

Management

Chavan *et al*., (2014) [6] conducted an experiment to evaluate six fungicides, two bioagents and one botanicals at Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra. The least per cent disease intensity 8.10% was observed by application of tridemorph. The second and third best fungicides were Tridemefon (9.06% Mean PDI) and Sulphur WP (10.57% Mean PDI) and both of were at par. This was followed by the fungicides Carbendazim (12.73% mean PDI), Propiconazole (12.37% mean PDI) both of which were found at par, NSKE (Neem seed kernel extract), *Trichoderma viride* and *Pseudomonas fluorescens* also recorded significantly less disease intensity of 14.01%, 21.15% and 23.19%, respectively over control.

Jayasekhar and Ebenezar (2016) [8] conducted field trials during rabi 2012 – 13 and 2013-14 at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Killikulam, to test the bio efficiency of plant products, bio control agents and fungicides for management of powdery mildew in black gram. The mean per cent disease incidence was ranged from 15.80 to 47.70 in different experimental treatments. The maximum reduction of disease incidence was recorded in wettable sulphur 0.25% (PDI-15.80%) followed by carbendazim 0.1% (PDI-19.60%) and Neem seed kernel extract 5% (PDI-32.30%).

Prakash (2016) [16] conducted a field experiment for testing of fungicides and botanicals at IGKV, Raipur during *rabi*, 2015 for the management of powdery mildew of black gram. The studies revealed that tebuconazole @ 0.1% found more effective with 19.77% disease intensity followed by

propiconazole 0.05% (PDI-27.06%) and wettable sulphur 0.3% (PDI-29.06%). Among the botanicals tested, neem leaf extract was most effective with minimum disease severity (PDI-28.04%) which was at par with garlic bulb extract (PDI-29.29%) followed by the botanicals ginger (PDI-37.53%), karanj (PDI-45.11%), datura (PDI-50.63%) and bioagent *Trichoderma* (PDI-54.40%).

Sharma *et al*., (2017) conduted a field experiment at farmers field of Gariyaband district of Chhattisgarh during *Kharif* 2013 and 2014 to evaluate the efficacy of three fungicides against powdery mildew disease of black gram. Tridemorph 75 EC @ 500 ml/ha treated plots showed maximum powdery mildew disease incidence 14.60 and 17.40% in experimental year of 2013 and 2014, respectively. Spraying of karathane 48 EC @ 500 ml/ha recorded 7.62 and 5.24 per cent powdery mildew disease incidence and taqat 75 WP @750 gm/ha recorded 0.95 and 201 per cent powdery mildew disease incidence in both consecutive experimental year of *Kharif* 2013 and 2014, respectively. Taqat 75 WP was found highly effective in suppressing the disease incidence of powdery mildew in black gram and was found significantly superior over all other tested fungicides. Taqat 75 WP is a new combination product of captan 70% (contact fungicide) and hexaconazole 5% (Systemic fungicide).

Rettinassababady *et al*., (2000) [17], conducted a pot culture experiment to find out the efficacy of various plants extracts in comparision with conventional fungicides against powdery mildew of black gram caused by *Erysiphe polygoni* and reported that three neem extracts (neem seed kernel extracts, neem oil and neem cake extract), leaf extracts of prosophis (*Prosophis juliflora)* and Ipomea (*Ipomea carnea)* and fu Among the plants extracts tested Neem seed kernel extract (5%) was found to be superior in containing the powdery mildew disease and increasing the grain yield of black gram under pot culture experiment.

Reference

1. Anonymous. Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, 2016.
2. Anonymous. Project coordinators Report of AICRP on MULLaRP. Indian Institute of Pulses Research, Kanpur, India, 2012.
3. Bhattacharya A, Shukla P. Effect of environment factors on powdery mildew in field pea under irrigated and rainfed conditions. Indian Journal of Agricultural Research. 2002; 36:149-155.
4. Butler EJ. Fungi and diseases in plants. Thacker Spink and Co. Calcutta, 1918, 547.
5. Channaveeresh TS, Kulkarni S. Survey for the powdery mildew of black gram [*Vigna mungo* (L.) Hepper] in parts of Northern Karnataka. International Journal of Bioassays. 2017; 6(03):5309-5312.
6. Chavan SS, Dhutraj DN, Thombre PA, Dey U. Evaluation of Fungicides, Botanicals and Bioagents against Powdery Mildew of Cowpea. Journal of Plant Disease Science. 2014; 9:253-256.
7. De Candolle. History and Taxonomy. The Powdery Mildew. Ed. Spencer, D. M., Academic Press, London, 1802, 3-15.
8. Jayasekhar M, Ebenezar EG. Management of powdery mildew of black gram (*Vigna mungo*) caused by *Erysiphe polygoni.* Agricultural Science Digest. 2016; 36:72-74.
9. Jyothi U, Divya. Epidemiology and management of powdery mildew of Green gram caused by *Erysiphe polygoni* DC. Department of Plant Pathology, College of Agriculture, Dharwad, University of Agricultural Sciences, Dharwad, 2012.
10. Legapsi BM, Capiton EM, Hubbell JN. AVRDC. Phillipines, programme studies. First International Symposium on Mungbean. 1978, 220-223.
11. Linnaeus C. History and taxonomy. The Powdery Mildew. Ed. Spencer, D.M., Academic Press, London. 1767, 16-25.
12. Mishra T, Shirsole SS. Epidemiological Studies on Powdery Mildew of Pea. International Journal of Current Microbiology and Applied Sciences. 2017; 6:3276-3279.
13. Nag UK, Khare CP. Epidemiological studies on powdery mildew of vegetable pea. Plant Archives. 2017; 17:171-176.
14. Nilanthi D, Ranawake AL, Senadhipathy DD. Effects of Water Stress on the Growth and Reproduction of Black Gram (*Vigna mungo* L.). Tropical Agricultural Research & Extension. 2014, 17(1).
15. Nayak S. Studies on powdery mildew (Erysiphe polygoni DC) of black gram. M.Sc. (Agri) Thesis, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, 2007.
16. Prakash PK. Environmental relationship of powdery mildew of black gram, its management and documentation of powdery mildew fungi in Chhattisgarh. M.Sc. Thesis, Indira Gandhi Krishi Vishwavidhalaya, Raipur (Chhattisgarh), 2016.
17. Rettinassababady C, Ramadosss, Thrumeni S. Effect of plantextracts in control of powdery mildew of blackgram (*Erysiphe polygoni* DC). Agricultural Science Digest. 2000; 20:193- 194.
18. Sandhya Nayak. Studies on powdery mildew (*Erysiphe polygoni* DC) of black gram. M.Sc. Thesis. Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, 2007.
19. Sharma RL, Mishra T, Bhagat R, Swarnkar VK. Field evaluation of different fungicides against rust and powdery mildew disease of blackgram (*Vigna mungo* L.). International Journal of Agricultural Sciences. 2017; 13:249-253.
20. Singh DP. Breeding for resistance in pulse crop. In Genetic Research and Education: Current Trends and Fifty, 1995.
21. Years (Sharma, B., ed.). Indian Society of Genetics and Plant Breeding, New Delhi. 339-420.
22. Tulasi K. Studies on powdery mildew (Erysiphe polygoni DC) of urd bean [*Vigna mungo* (L.) Hepper] in relation to weather, host plant resistance and management, 2016.
23. M.Sc. (Agri) Thesis, Acharya N. G. Ranga Agricultural University, Guntur, Andhra Pradesh.
24. Vikas, Ratnoo RS. Effect of different weather parameters of progression of Powdery mildew (*Erysiphe polygoni*) on Fenugreek. Journal of plant disease science. 2013; 8:218-220.