



FACTORS AFFECTING CONIDIAL GERMINATION OF *ERYSIPHE POLYGONI* CAUSING POWDERY MILDEW OF FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM* L.)

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Abstract- The study was conducted to determine the factors affecting conidial germination of *Erysiphe polygoni* causing powdery mildew in fenugreek under controlled conditions. Result showed that maximum conidial germination of *Erysiphe polygoni* was recorded at 24°C temperature, whereas at lower and higher than optimum temperature conidial germination was decreased significantly. All the levels of relative humidity favoured the conidial germination and maximum conidial germination was recorded at 90 per cent relative humidity. Combination of 24°C temperature and 90 per cent relative humidity was best for maximum conidial germination. Maximum per cent conidial germination was recorded at 24°C temperatures after 24 hours of incubation periods. Effect of darkness and light on conidial germination, highest per cent conidial germination was recorded in 10: 14 hours of darkness and light at 24°C after 24 hours of incubation period.

Keywords- Temperature, relative humidity, incubation periods, darkness and light, powdery mildew, fenugreek, conidial germination, *Erysiphe polygoni*.

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Introduction

Spices are the low volume, high value and export oriented commodity crops. Fenugreek (*Trigonella foenum-græcum* L.) is an important seed spice crop belongs to family *Fabaceae* cultivated in India. The importance of this crop has increased due to its medicinal value and presence of diosgenin that is used for the synthesis of sex hormone and oral contraceptive. Fenugreek seed are rich source of protein [1] and leaves are rich in minerals, proteins, vitamin A and C. In industry, seeds are used for dye making and for extraction of alkaloids and steroids. The dried leaves and flowers are used for flavouring vegetable curries [2]. Fenugreek can be grown in all types of soils provided that they are rich in organic matter with good drainage.

Fenugreek is attacked by a number of diseases. Powdery mildew of fenugreek is an important and serious disease especially during flowering and pod formation stage of the crop and cause significant losses (33.27 per cent) in grain quality as well as quantity [3].

In Rajasthan, powdery mildew disease caused by *Erysiphe polygoni* appeared in first week of January and reaches at peak in March. The disease is characterized as white floury patches appear on both sides of leaves as well as tendrils, stems, pods etc. As the plant become older, the powdery growth almost covers the entire plant, become more or less grayish brown and the infected part impart dirty appearance. Later stage, powdery growth also covers the pods. The seed in pods do not either set or remain very small.

The present study was undertaken to know the effect of temperature, relative humidity, incubation periods and dark & light conditions on conidial germination of *Erysiphe polygoni* causing powdery mildew of fenugreek.

Materials and Methods

The inoculum of *Erysiphe polygoni* causing powdery mildew of fenugreek was collected very early in the morning (8.00 AM) from the infected leaves showing characteristic disease symptoms. The powdery mildew colonies from upper

surface of the infected leaves were picked up gently with the help of cotton pad, camel's hair brush in sterilized buffer solution (pH 7.0) in double distilled water. This suspension was shaken to disperse the conidia and adjusted to give a final concentration of 5000 conidia ml⁻¹ to enhance the germination of conidia for 24 hours [4].

Effect of Temperature: To determine the effect of temperature on conidial germination a drop of conidial suspension was put on the sterilized cavity slide supported on glass rods inside the Petri plates. Both halves of the Petri plates were covered with sterilized filter paper atomized with sterilized water to retain moisture [5]. Instead of simple glass slide, cavity slide was used to avoid drying of droplet. Conidial germination experiments were performed according to the procedures recommended by the committee on standardization of fungicides test of American Phytopathological Society (1943) and by incubating them [4]. The conidial suspension was incubated at 15, 18, 21, 24 and 27°C in digital B.O.D. incubator in laboratory.

The conidial suspension contained approximately 20 conidia per low power microscopic field for 10 x 10 magnifications. Three replications were maintained for each treatment. After 24 hours of incubation, the slides were taken out and a drop of lactophenol was added immediately to arrest further germination of the conidia. Per cent conidial germination was calculated by formulae given below.

$$\text{Per cent spore germination} = \frac{\text{No. of spore germinated}}{\text{Total no. of spores observed}} \times 100$$

Effect of Relative humidity: To study the effect of relative humidity on conidial germination, the conidia of *Erysiphe polygoni* were collected and picked as

method described above. Five different levels of relative humidity i.e. 60, 70, 80, 90 and 100 per cent were created in desiccators by dissolving concentrate sulphuric acid and sterilized double distilled water in different proportion by the method suggested [6].

The desiccators were incubated on different temperatures viz., 15, 18, 21, 24 and 27°C in separated digital B.O.D. incubator. A drop of conidial suspension collected as above was placed on cavity slides as above but Petriplate was not covered. These Petri plates were put in sealed desiccators maintaining different relative humidity. After 24 hours, observation on conidial germination was recorded as formula given above.

Effect of Incubation period: The experiment was conducted to measure the effect of different incubation periods on conidial germination of *Erysiphe polygoni*. Conidia were incubated for 4, 6, 8, 10 and 24 hours at 15, 18, 21, 24 and 27°C in digital B.O.D. incubator. The conidial suspension placed in Petriplates as per method describe above. After completion of incubation period germination per cent was recorded under binocular microscope.

Effect of Darkness and light: To know the effect of dark and light on conidial germination of *Erysiphe polygoni*, the experiment was carried out for dark: light for 12: 12, 16: 8, 14: 8 and 10: 14 hrs respectively. The conidia were picked up as per procedure describe above. For observing the effect of different light and dark periods on conidial germination, the Petriplates containing conidial suspension were incubated at 15, 18, 21, 24 and 27°C and after 24 hrs of incubation conidial germination was recorded.

Result and discussion

Effect of temperature: The percent conidial germination of *Erysiphe polygoni* was greatly affected by atmospheric temperature. It is evident from the [Table-1] & [Fig-1] that maximum conidial germination 77.78 per cent was recorded when conidia were incubated at 24°C followed by 52.22 per cent and 46.67 per cent at 21°C temperature and 27°C temperature respectively. The minimum of 31.10 per cent conidial germination was recorded at 15°C temperature. Temperature 24°C was found optimum for maximum conidial germination of *Erysiphe polygoni*. It is also evident that temperature below and above 24°C significantly reduced conidial germination of *Erysiphe polygoni*.

Table-1 Effect of temperature on conidial germination of *Erysiphe polygoni* of fenugreek

| Temperature (°C) | Per cent conidial germination* |
|------------------|--------------------------------|
| 15 | 31.10 (33.90) |
| 18 | 37.78 (37.93) |
| 21 | 52.22 (46.27) |
| 24 | 77.78 (61.88) |
| 27 | 46.67 (43.09) |
| SEm± | 1.17 |
| CD (P=0.05) | 3.61 |
| CV | 4.55 |

*Average of three replications

Figures in parentheses are angular transformed values

Kumar and Gupta (2006) [7] observed temperature ranged from 10-35°C most favourable for maximum conidial germination of powdery mildew pathogen. Verma and Kaur (1996) [8] while working with powdery mildew of mango found that 25°C was optimum for conidial germination. Prakash and Saharan (2000) [9] reported that temperature range varied from 19 to 23°C favourable for the conidial germination of *Erysiphe polygoni*. Rakhonde *et al.*, (2011) [10] reported that conidial germination was optimum at 25°C and minimum at 10°C temperature.

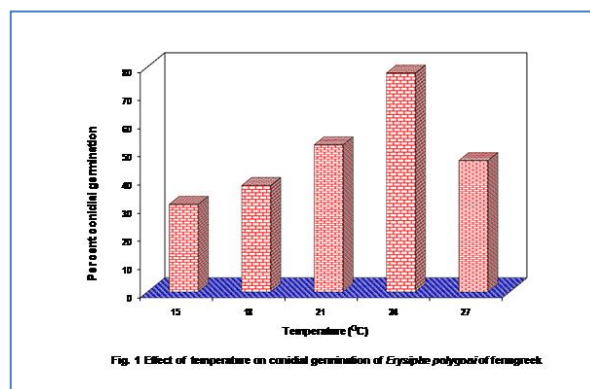


Fig-1 Effect of temperature on conidial germination of *Erysiphe polygoni* of fenugreek

Effect of relative humidity: The effect of various combinations of relative humidity and temperatures on conidial germination of *Erysiphe polygoni* was studied [Table-2] & [Fig-2]. At 60 per cent relative humidity, maximum conidial germination of 66.67 per cent was obtained at 24°C followed by 41.11 per cent at 21°C temperature.

Table-2 Effect of relative humidity on conidial germination of *Erysiphe polygoni* at different temperatures

| Relative humidity (%) | Temperature (°C) | | | | |
|-----------------------|--------------------------------|------------------|------------------|------------------|------------------|
| | 15°C | 18°C | 21°C | 24°C | 27°C |
| | Per cent conidial germination* | | | | |
| 60 | 23.33 (28.88) | 27.78 (31.81) | 41.11 (39.88) | 66.67 (54.74) | 36.66 (37.26) |
| 70 | 26.67 (31.09) | 29.99 (33.20) | 44.44 (41.81) | 69.99 (56.78) | 40.00 (39.23) |
| 80 | 30.00 (33.21) | 32.22 (34.58) | 48.89 (44.36) | 74.44 (59.63) | 44.44 (41.81) |
| 90 | 32.22 (34.58) | 34.44 (35.93) | 51.10 (45.63) | 76.66 (61.11) | 45.55 (42.45) |
| 100 | 28.89 (32.51) | 31.10 (33.90) | 45.56 (42.45) | 72.21 (58.19) | 41.10 (39.87) |

SEm± = 0.78

CD (P = 0.05) Temperature = 2.16 Relative humidity = 2.16

Temperature x Relative humidity = 4.82

CV% = 9.41

*Average of three replications

Figures in parentheses are angular transformed values

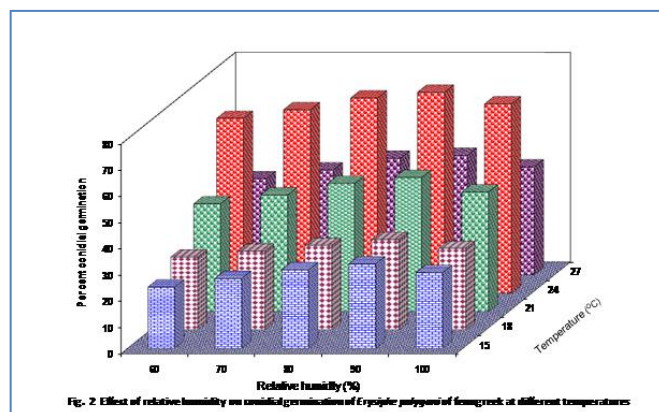


Fig-2 Effect of relative humidity on conidial germination of *Erysiphe polygoni* of fenugreek at different temperatures

When incubated at 70 per cent relative humidity the maximum percentage of conidial germination was 69.99 at 24°C. Similarly, at 80 per cent relative humidity, the maximum conidial germination obtained was 74.44 at 24°C temperature. At 90 per cent relative humidity, the maximum conidial germination 76.66 per cent was obtained at 24°C followed by 51.10 per cent at 21°C temperature.

At 100 per cent relative humidity, maximum conidial germination of 72.21 per cent was obtained at 24°C temperature followed by 45.56 per cent at 21°C temperature. The maximum conidial germination was obtained at 24°C temperature over other temperature on all five relative humidity levels tested.

It is also evident that the combination of 24°C temperature and 90 per cent relative humidity gave maximum conidial germination of 76.66 per cent indicating most favourable combination. Vikas and Ratnoo (2011) [11] reported that relative humidity of 60 to 80 per cent was optimum for conidial germination of *Erysiphe polygoni* on fenugreek. Rakhonde *et al.*, (2011) [10] reported percent conidial germination was maximum at 80 to 90 per cent relative humidity. Saxena and Ahmad (1981) [12] observed that conidia of *Erysiphe polygoni* on fenugreek germinated between 0 to 90 per cent relative humidity. Verma and Kaur (1996) [8] also reported that germination and appressorial formation of *Oidium mangiferae* occurred at all levels of relative humidity with maximum germination and appressorial formation accruing at 92 per cent relative humidity.

Effect of incubation period: The effect of incubation period on conidial germination of *Erysiphe polygoni* was studied by keeping conidia in buffer solution for 4, 6, 8, 10 and 24 hours at 15, 18, 21, 24 and 27°C temperature with 90 per cent relative humidity. Results [Table-3] & [Fig-3] revealed that conidial germination started after 4 hours of incubation. The conidial germination percentage was increased after 4 hours of incubation at all the temperatures used. With the increase in incubation period, percent conidial germination also increased. Maximum 75.55 per cent conidial germination was recorded at 24°C after 24 hours of incubation and was better than other temperatures. Our observations was also supported by observations of Prakash and Saharan (2000) [9] worked with *Erysiphe polygoni* causing powdery mildew of fenugreek and observed optimum conidial germination after 24 hours of incubation. Coyier (1968) [13] also reported maximum conidial germination of *Podospora leucotricha* at 24 hour of incubation.

Table-3 Effect of incubation period on conidial germination of *Erysiphe polygoni* of fenugreek at different temperatures

| Incubation periods (In hours) | Temperature (°C) | | | | |
|-------------------------------|--------------------------------|------------------|------------------|------------------|------------------|
| | 15°C | 18°C | 21°C | 24°C | 27°C |
| | Per cent conidial germination* | | | | |
| 4 | 1.11 (6.05) | 3.33 (10.51) | 14.44 (22.33) | 22.22 (28.12) | 12.21 (20.45) |
| 6 | 3.33 (10.51) | 5.55 (13.63) | 20.00 (26.57) | 32.10 (34.51) | 17.78 (24.94) |
| 8 | 8.88 (17.34) | 15.55 (23.22) | 27.77 (31.80) | 46.66 (43.08) | 23.11 (28.73) |
| 10 | 15.55 (23.22) | 18.88 (25.75) | 33.22 (35.20) | 61.11 (51.42) | 31.11 (33.90) |
| 24 | 27.77 (31.80) | 36.55 (37.20) | 50.00 (45.00) | 75.55 (60.37) | 46.44 (42.96) |

SEm± = 0.85

CD (P = 0.05) Temperature = 2.36 Relative humidity = 2.36

Temperature x Relative humidity = 3.05

CV% = 6.51

*Average of three replications

Figures in parentheses are angular transformed values

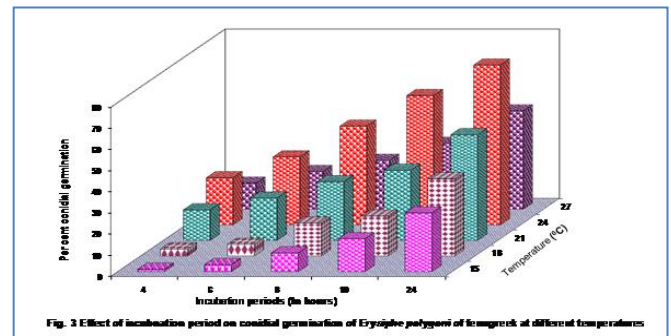


Fig-3 Effect of incubation period on conidial germination of *Erysiphe polygoni* of fenugreek at different temperatures

Effect of darkness and light: The effect of combination of different duration of darkness and light on the conidial germination of *Erysiphe polygoni* was studied at 15, 18, 21, 24 and 27°C temperature. The result revealed that maximum 64.44 per cent conidial germination was recorded in 10: 14 hrs of darkness and light at 24°C followed by 54.55 per cent at 21°C. Both 16: 8 and 14: 10 hours of darkness and light were recorded minimum conidial germination at all temperature studies. In 12: 12 hrs of darkness and light, 50.00 per cent conidial germination was recorded [Table-4] & [Fig-4].

Table-4 Effect of darkness and light on conidial germination of *Erysiphe polygoni* of fenugreek at different temperatures

| Dark : Light (In hours) | Temperature (°C) | | | | |
|-------------------------|--------------------------------|------------------|------------------|------------------|------------------|
| | 15°C | 18°C | 21°C | 24°C | 27°C |
| | Per cent conidial germination* | | | | |
| 12:12 | 27.77 (31.80) | 30.00 (33.21) | 41.11 (39.88) | 50.00 (45.00) | 34.44 (35.93) |
| 16:8 | 20.00 (26.57) | 23.33 (28.88) | 32.22 (34.58) | 40.00 (39.23) | 25.55 (30.36) |
| 14:10 | 24.44 (29.63) | 26.67 (31.09) | 35.67 (36.67) | 43.33 (41.17) | 28.89 (32.51) |
| 10:14 | 33.00 (35.06) | 38.33 (38.25) | 54.55 (47.61) | 64.44 (53.29) | 41.10 (39.87) |

SEm± = 0.84

CD (P = 0.05) Temperature = 1.05 Dark : Light = 0.94

Temperature x Incubation period = 3.35

CV% = 5.99

*Average of three replications

Figures in parentheses are angular transformed values

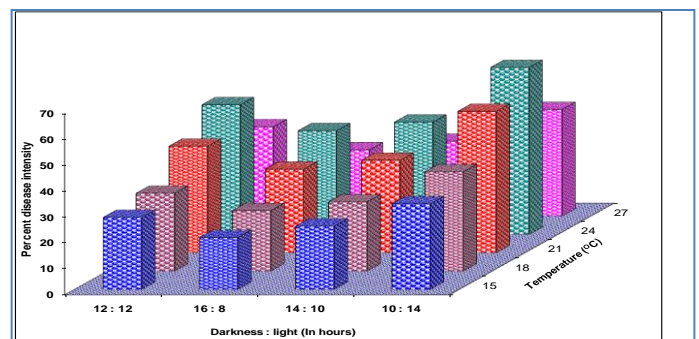


Fig-4 Effect of darkness and light on conidial germination of *Erysiphe polygoni* of fenugreek at different temperature

Fig-4 Effect of darkness and light on conidial germination of *Erysiphe polygoni* of fenugreek at different temperatures

It was evident from result that light clearly had a stimulatory effect on conidial germination of *Erysiphe polygoni*. Whereas, with the increased exposure of conidia to dark hours, the conidial germination was reduced or we can concluded

that exposure of conidia to dark showed inhibitory effects. Cherewick (1944) [14] observed 95 per cent conidial germination of the *Erysiphe graminis* f. sp. *tritici* in light. Prakash and Saharan (2000) [9] also observed conidial germination of *Erysiphe polygoni* on fenugreek stimulated in light and inhibited in darkness. Rekhonde *et al.* (2011) [10] also reported that light of 24 hours was found to be most favourable for conidial germination of *Erysiphe polygoni* in green gram.

Conflict of Interest: None declared

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