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TO STUDY THE EFFECT OF DIFFERENT LEVELS OF TEMPERATURE ON GROWTH AND SPORULATION OF *ALTERNARIA LINI*, BUNDELKHAND REGION, INDIA

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Abstract: Highest mycelial growth was obtained at 25°C temperature. Whereas lowest mycelial growth was achieved at 35°C, results revealed that a certain temperature can be applicable to inhibit the mycelial growth and sporulation of *Alternaria lini* to save Linseed crop from infection.

Keyword: *Alternaria Lini*, Effect of temperature, Linseed, Mycelial Growth and Sporulation

Introduction,

This study was carried out at the laboratory of department of pathology,BNPG College Rath, Hamirpur, Uttar Pradesh, India during *Rabi* season in the two successive years, *i.e.* 2013-14 and 2014-15. Survey was carried out from research farm of BNPG College Rath, Hamirpur and different fields of farmers at the villages namely Dhamna, Sarsai, Basela, from block Rath, and Bragarh, Rahank from block Gohand of district Hamirpur, Bundelkhand region (UP), for sample collection of disease. Analization of random samples was carried out in the laboratory of pathology at BNPG College Rath, Hamirpur.

Study area also comes at northern Bundelkhand region. Study area Hamirpur district specifically Rath is well known for rich agriculture sugar cane. Wheat, gram, Rapeseed and mustard, Lentil, and peas are very common crops of this area. Especially, linseed grown in large area in this district but due to fungal infection, the farmers of this area loses tones of linseed and linseed oil. Linseed is very common now a day as earlier it is to be said that it is the crop of poor community but now a day due to global warming and high pressure in daily life of people which are suffering from chronic disorders like high blood pressure, depression, Cancer Allergies, hair falling etc. It is also very important for breast cancer and prostrate Cancer.

Among the oilseed crops raised during the *Rabi* season's linseed is next in importance to rapeseed-mustard in area as well as in production. In technical oil production, it ranks first in the country. Each and every part of the linseed plant is utilized commercially, either directly or after processing. Seed contains 33 to 47% of oil. On a very small scale, the seed is directly used for edible purposes. About 20% of the total oil produced is used at farmer's level, and the rest 80% oil goes to industries in various forms, such as boiled oil, borated oil, eposidized oil, aluminated oil, urethane oil, isomerized oil etc. The oil is rich (> 66%) in linolenic acid, and is a perfect drying oil. Hence, it is utilized in the manufacture of paints, oil cloth, varnish, pad-ink, printed ink, linoleum etc (Kerkhi *et. al.*, 1999 and Pandey *et al.*, 2002).

Linseed (*Linum usitatissimum* L.) is primarily an industrial oil crop grown in India and abroad from ancient times, both for its fibre, which is known as flax. The plant is grown extensively in both temperate and tropical regions. The major linseed growing countries are Argentina, USSR, USA, Canada, India, Australia and Pakistan. India ranks third in area after Canada and Kazakhstan which is almost equivalent to but in production slides to fourth place after Canada, China and Kazakhstan. As far as productivity is concerned, our national average of 435 kg /ha is surpassed by almost all major linseed growing countries viz . Canada (1728 kg/ha), USA (1659 kg/ha), U.K. (1500 kg/ha) China (1000 kg/ha) and Ethiopia (933 kg/ha).India contributes about 14.88% and 6.57% to world area and production, respectively. The major part of linseed growing area lies in the states of MP , Chhattisgarh , UP,

Maharasthra , Bihar , Odisha , Jharkhand, Karnataka and Assam accounting for more than 97% of the total area Although , the area is reducing owing to unorganized market per cent intervenclon and socioeconomic compulsion attached to the crop, there is phenomenal improvement in productivity in the states of Rajasthan (1351 kg/ha), Bijar (850 kg/ha) and Nagaland (803 kg/ha) surpassing the productivity of Asia (728 kg/ha) as well as of world (986 kg/ ha) (Anonymous, 2014-2015).

Linseed or flax (*Linum usitatissimum* L.) is one of the most important oil seed crop of temperate and sub-tropical region of world (Sharma, *et al.*, 2015). Linseed (*Linum usitatissimum* L.) belongs to the family Linaceae. The plant is an erect annual herb, which attains a height of 1 to 1.2 m. Leaves are small, alternate, simple, linear or lanceolate, with smooth surface; margins entire. Upper part of the stem branched in a corymbose manner and the flowers are borne in cymes on their branches. Flowers are regular and hermaphrodite. Flowers are blue, violet, purple or pink in colour. Sepals 5, ovate, ciliate, acuminate and persistent. Petals 5, wedge-shaped, twisted in the bud, united at the base to a hypogynous disc, and they fall easily. Stamens 5; filaments expanded towards the base and fused in the hypogynous disc carpel 5, united. Ovary 5- celled; each locule more or less completely divided into two, by false septa; one ovule in each of the ultimate cells, styles 5, long, usually free, stigmas clavate or capital. Fruit are somewhat rounded capsule, surrounded by persistent sepals. It has 10 locules, each with 1 seed, light brown in colour, or may be yellow moltted, greenish yellow or nearly black. Seed shape oval, 4 to 6 mm long and 2 to 3 mm broad, compressed, and somewhat pointed at one end (Sen., 1996).

As Rath is on a sub soil plateau, the temperature here is extreme. Winters starts in October with end of monsoon and on peak in mid December. The average temperature of winter lies between 6 degrees at night and 24 degrees in the day on the Celsius scale. Spring seasons ends in February, making the ends of winter. Summer starts in April where the temperature lies between 34 and 46 degree Celsius in the Day. However the night in the summer is cool after mid night. The third week in June brings the rainy seasons where you find monsoon rains washing the center of India. These rains start weakening in the month of September, while the rainy season actually ends in the last week of September. The average temperature in the rainy session lies around 36^0 C while the average rainfall is about 35 inches a year (AICRP, Mauranipur, 2014).

Linseed can be raised on different kinds of soils, particularly on silt loam and silty clays. Sandy and badly drained heavy clay soils are, however, unsuitable for the crop. While in central and Peninsular India, it is found to do well on deep clayey black soils, in Indo-Gangetic plains, good crops are obtained on alluvial loams (Sharma *et al*., 2015).

The soils of Bundelkhand are mainly derived from gneisses. The formation consists of massive rocks traversed by quartz; stand stones, limestones and slates are also found. Bundelkhand soils can be categorized into red soil and black soil (Sharma RB, 2016).

Collected samples showing typical diseased symptoms were used for isolation of the pathogen. The infected leaves and buds were first thoroughly washed with distilled water.

Cross section of lesion was cut of 5 to 10 mm square, containing both the diseased and healthy looking tissues. Surfaces of the cut portions were sterilized by dipping in 0.1 % Mercuric chloride (Hg Cl_2) as surface sterilant solution for 30 seconds. The treated pieces were washed in three washes with sterile water and than dried on clean, sterile paper towels to remove the sterilant. Aseptically transferred the pieces onto sterilized Petri plates containing PDA media usually one piece per plate are inoculated. The inoculated plates were incubated in an inverted position at 25 ± 2° C for 3-5 days (Aneja, 1996).

The whitish mycelial growth appeared around the pieces placed in the Petri plates. Further the hyphal tips of mycelium were transferred aseptically in PDA culture tubes the culture obtained from different diseased pieces was subjected to preliminary microscopic examination, which revealed the presence of pathogen responsible for disease development. Finally the culture was purified by single spore technique to keep the fungus viable, active and fresh. Culture of the pathogens was multiplied by regular sub-culturing on PDA both in Petri plates and culture tubes, and was kept in a refrigerator.

After the incubation for 4 days, a temporary mount slide was prepared in cotton blue and lectophenol from various isolates collected from different location and examined under microscope for their shape and size of the pathogen. Effect of temperature on the growth of the pathogen was studied at seven different temperatures ranges *viz.* 10^0 C, 15^0 C, 20^0 C, 25 ^{0} C, 30 ^{0} C and 35 ^{0} C in BOD incubator.

The experiment was performed as; flasks of 150 ml volume were filled with 50 ml of culture media and sterilized in autoclave at 15 Ib/in^2 pressure for 20 minutes. The sterilized culture media was poured in seven Petri plates and labeled properly. These Petri plates were inoculated with equal amount of mycelial disc from actively growing culture of the fungus *(Alternaria lini)* cut with the help of sterilized cork borer in a laminar airflow.

Inoculated Petri plates were kept in incubators set at the temperatures (l0, 15, 20, 25, 30 & 35^0 C) for 7-10 days. Three replications were used for each treatment. The cultures were examined after 7 - 10 days of incubation for minimum growth, normal growth and maximum growth. The observation were recorded and tabulated as per standard procedures.

The study was carried out to evaluate the in vitro application of temperature in the control of *Alternaria lini*, contributing agent of blight disease in Linseed. *A. lini* was inoculated in Potato Dextrose Agar (PDA) media at variable temperature (10°C-35°C). Chemical control is costely and hazards for the plants and effected the chemical properties of crop and simultaneously

effected the soil properties. Hence, looking above, this study was carried out to observe the effect of temperature on growth and sporulation of *Alternaria lini. on linseed. This study deals that the best temperature range for growth and sporulation of fungi.*

Results and Discussions

The effect of temperature on growth and sporulation of alternaria lini was observed. The mean values were observed and shown in Table 1.

Table 1 Effects of Temperature on growth and sporulation of *Alternaria lini.*

S. No.	Temperature (^{0}C)	Radial growth of colony in mm	Sporulation
1	10	10	Poor
2	15	10.5	Poor
3	20	22	Good
4	25	36	Excellent
5	30	26	Good
6	35	11.00	Poor
		Av. = 19.25	

Table revealed that the temperature 25 ^{0}C is the best for growth and sporulation of *Alternaria lini followed by 30 ^{0}C. Minimum* growth and sporulation of *Alternaria lini was observed with the temperature 10 ^{0}C followed by 15 ^{0}C.*

This Study revealed that the effect of temperature on maximum growth and sporulation of *Alternaria lini was observed at the range of 25* $\pm$ 5 ^{0}C. Hence, It is *suggested to Linseed growing Farmers of this region to avoid this temperature range at that stage of crop when fungi cause the maximum diseases on the crop.*

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