Occurrence of *Alternaria alternata* causing leaf spot in Buckwheat (*Fagopyrum esculentum*) in Prayagraj area of Uttar Pradesh, India

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Received:- 06 June 2021/ Revised:- 18 June 2021/ Accepted:- 22 June 2021/ Published: 30-06-2021

Abstract— *Among the pseudo-cereals grown in India, Fagopyrum esculentum Moench is known as Common buckwheat and the most cultivated species in the hilly region of India. This is a short duration, multipurpose and nutritious crop which can withstand changing climatic conditions and fit well in multiple cropping systems. At remote locations of mountain ecosystems, buckwheat is a livelihood driven crop for small and marginal farmers. Buckwheat grains are primarily used for human consumption and also for livestock, poultry and piggery feeds. Rural population of hilly region of India use buckwheat sprouts and as pancakes especially in breakfast however, the recommended intake of buckwheat sprouts are less than 40 g/day. Furthermore, it is also grown as cover crop, green manure crop, fodder crop, fertility restoring crop, honey crop and medicinal plant. The crop is also a good source of Rutin (quercetin-3-rutinosid) and Fagopyrin that are known to be used in preventing various human disorders. In January 2020 occurrence of disease on buckwheat (Fagopyrum esculentum) in the research field of SHUATS, Prayagraj Uttar Pradesh in India was observed. Black spot symptoms were noted on leaves with an approximate incidence of 50%. The disease symptoms are chlorotic leaf spots caused by Alternaria alternata uniformly distributed and having concentric margins. They are circular, oval or oblong in shape. Each spot has gray centre and brownish margin.*

Keywords— Alternaria alternata, Buckwheat, Leaf spot.

I. INTRODUCTION

Buckwheat perform multitude functions as a break crop (breaks the life cycle of insect, pests and diseases), green manure crop, smother crop (suppress weeds), nutrient conserving crop (enhanced nutrients uptake, reduces nutrients leaching and immobilization), gourd crop (protecting main crop from wild animal), cover crops (soil protection against water and wind erosions) and as land reclamation crop. Buckwheat is an ephemeral green manure crop which germinates in 3–5 days, flowers within 30–45 days and matures completely within 90–110 days. (Babu *et al.*, 2018; Ezra *et al*., 2010).

The occurrence of buckwheat ranged from Jammu Kashmir in north to Arunachal Pradesh in east and Tamil Nadu in the south. However, Jammu Kashmir, Himachal Pradesh, Uttarakhand, West Bengal (Kalimpong, Coochbehar, New Jalpaiguri and Darjeeling region), Sikkim, Assam (Upper Assam), Arunachal Pradesh, Nagaland, Meghalaya (Higher elevation region), Manipur, Kerala Tamil Nadu (Nilgiris and Palani hills) and Chhattisgarh are the major buckwheat growing areas in India.

The seed is also used in a number of culinary preparations as well as alcoholic drinks. Buckwheat flour is known as *Kuttu ka Atta* in northern part of India and mainly eaten during religious *Upvas* (fast) when cereals and pulses are not permitted to eat. The protein content (11-14%) in buckwheat seed is of high quality due to its balanced amino acid composition and rich in lysine (5.5-6%) and arginine (9.2–10%) which are generally deficit in cereals. Similarly, its grains has high content of minerals especially Ca (110 mg/100 g), Mg (390 mg/100 g), P (330 mg/00 g), K (450 mg/100 g), Fe (4 mg/ 100 g), Mn (3.37 mg/100 g), Cu (0.95 mg/100 g) and Zn (0.87 mg/100 g) and biologically active compounds like rutin, fagopyrin etc. It is a

good dietary food crop as it has high nutritional value owing to bioactive compounds like vitamins, macro and micro elements and enzymes. Further, buckwheat flour is free from gluten and can be safely consumed by people with coeliac disease. Therefore, it may be an important alternative industrial food crop in agriculture.

Several pathogenic disorders have also been reported in buckwheat. These include: aster yellows caused by *Mycoplasma;* stern rot due to *Botrytis cinerea;* root rots due to *Fusarium* spp., *Botrytis* spp.; and *Rhizoclonia* spp.; chlorotic leaf spot due to *Alternaria allernals;* stipple spot disease caused by *Bipolaris sorokiniana;* blight due to *Phyloplhora parasilka* and downy mildew caused by *Peronospora* spp. Attacks of several viruses also cause reduction in plant height and losses in grain yield. (Madhukar and Reddy 1988).

An investigation was carried out for occurrence of disease on buckwheat *(Fagopyrum esculentum)* in the research field of SHUATS, Prayagraj Uttar Pradesh in India. Black spot symptoms were noted on leaves with an approximate incidence of 50%. The disease symptoms are chlorotic leaf spots, uniformly distributed, having concentric margins. Hence the isolation of the pathogen was done in the present study by even following Koch's postulates.

II. MATERIALS AND METHODS

For isolation, surface sterilized leaves were cut from lesion edges and incubated at 25°C on Potato dextrose agar medium amended with 12 mg/l tetracycline for 7 days. Fungal colonies appeared on the plates were fast-growing, brownish, and cottony emerging from tissues had morphology and conidia typical of *Alternaria alternata*. (Vander Waals, *et al.*, 2011)

To confirm Pathogenicity 8-10 days old seedlings of buckwheat were grown in pots in three replications. (5 plants/pots) Conidial suspension of *Alternaria sp.* was prepared from 7 days old culture grown on Potato dextrose broth (PDB). Seedlings were sprayed with suspension of 10^5 conidia per ml and covered with polythene covers and incubated at 28 $\pm$ 1^0C and 12h photo period. Un-inoculated pots served as control. Polythene covers were removed after 48hrs. Plants were regularly watered and monitored for disease development.

III. RESULT

This is the first report of *A. alternata* causing leaf spot disease of Buckwheat in Prayagraj area of U.P, India. Symptoms observed on the plants were chlorotic leaf spots, concentric rings of brownish to black in color. Morphological identifications confirmed the isolation of *A. alternata*. The initial symptoms were round to be irregular (1-4 mm) on leaves. Each spot consisted of a greenish-yellow halo surrounding a necrotic lesion. Symptoms were small, brown lesions on leaves with concentric rings coalescing into larger lesions. For further study, infected leaves were collected. Conidia were greenish brown, catenate, obclavate, multi-celled, with 2-6 transverse septa, 1-2 longitudinal septa, 10-30 × 6-12 µm in size. (Fig 1 to 5)

FIGURE 1: Pure culture of *Alternaria alternata*

FIGURE 2: Microscopic view of *Alternaira alternate*

FIGURE 3: Infected leaves of buckwheat

FIGURE 4: Pure culture of *Alternaria alternata*

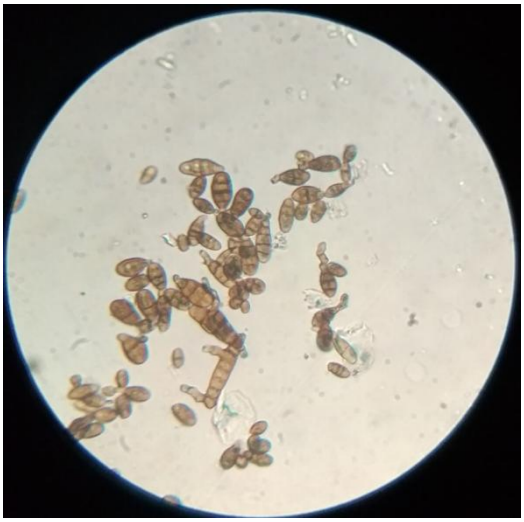

FIGURE 5: Microscopic view of *Alternaira alternata*

As regards Pathogenicity test the pathogen proved pathogenic on Buckwheat and identical disease symptoms as observed in the field symptoms on leaves were small, circular, necrotic spots that developed quickly forming typical concentric rings. Later these spots coalesced and caused blighting of leaves. Spots were initially light brown and later turned dark brown was observed 10 days after inoculation. However, no symptoms was observed on control plants. The pathogenicity was verified with Koch's postulates.

IV. CONCLUSION

It is, thus, desirable that buckwheat should be an integral crop of agricultural production systems of mountain agriculture in order to maintain nutritional standards of small and marginal farmers. Resources requirement for buckwheat cultivation is very less as compared to others cereals, hence it is a good candidate crop for rainfed ecosystems, organic farming, zero budget farming and for jhum areas in north-east India. Therefore, this crop could become an important component of the agriculture system of hill region for achieving nutrients self-sufficiency.

REFERENCES

[1] Babu, S., Yadav, G. S., Singh, R., Avasthe, R. K., Das, A., Mohapatra, K. P., Tahashildar, M., Kumar, K., Prabha, M., Devi, M. T., Rana, D. S., Pande, P. and Prakash, N. (2018) Production technology and multifarious uses of buckwheat (*Fagopyrum* spp.): A review. *Indian Journal of Agronomy* **63**: 415-427.

[2] Ezra, D., Gat, T., Skovorodnikova, Y., Vardi, Y. and Kosto, I. (2010) First report of *Alternaria* black spot of Pomegranate caused by *Alternaria alternata* in Israel. *Australasian Plant Disease Notes*, **5**, 1-2.

[3] Madhukar and Reddy (1988) Some new leaf spot diseases of Pomegranate. *Indian Journal of Mycology and Plant Pathology*, **18**, 171-172.

[4] Vander-Waals, J. E., Pitsi, B. E., Marais, C. and Wairuri, C. K. (2011) First report of *Alternaria alternata* causing brown leaf spot of Potatoes in South Africa. *Plant Disease*, 95: 363-366.