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INVESTIGATION OF SYMPTOMS DUE TO ALTERNARIA AND NUTRITIONAL DEFICIENCY ON RADISH SEED CROP

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ABSTRACT

Radish seed crop cv. Tasaki Mula was used to investigate the *Alternaria* and nutritional deficiency symptoms during the period of 2004-2005 and 2005-2006. Leas spot caused by *Alternaria brassicae, A. brassicicola* and *Alternaria alternata* were light to dark colored, almost circular and enlarged gradually and varied up to 7.5-11 mm in diameter. Fungal growths were seen on the affected areas of leaves, stalks and pods. Maximum fungal growth was observed in the centre of the spot. Pooled data revealed that *Alternaria brassicae* was only the cause for leaf and pod blight (100%) at the early growth stage and observed up to 65-day old transplanted crop but at the later stage of 85-day old transplanted crop *Alternaria brassicae* appeared 93% and 90%, whereas *A. brassicicola* appeared 5.5% and 7.5% and *Alternaria alternata* 1.5% and 2.5% on leaf and pod, respectively. The nutritional deficiency symptoms were observed in seedbed. The crop was found more sensitive to nutrient element particularly boron, calcium, zinc, manganese and nitrogen which produced prominent symptoms in complex or typical form and caused overall profound weakness, poor and distorted growth with cup-shaped, dark green, light yellowing, necrosis on leave loss of coordination in physiology.

Key words: *Alternaria, nutritional, symptoms, radish seed crop*

INTRODUCTION

Radish (*Raphanus sativus* L.) is a popular and widely grown third most important vegetable next to potato and eggplant in Bangladesh belonging to the family Cruciferae. Now a day, this crop is being cultivated round the year. Seed production of radish is very specific in its climatic requirements. A tropical annual type variety named Tasaki Mula developed by the Bangladesh Agricultural Research Institute is capable of producing seeds abundantly under the local climatic conditions (Rashid *et. al*., 1985). Among the various constraints for low seed yield of the crop, plant diseases play a major role. Radish is subject to attack by a number of diseases in Bangladesh (Talukdar, 1974). Among them *Alternaria* blight caused by *Alternaria brassicae* and *A. brassicicola* are the most devastating ones which cause heavy production losses and major constraint for high quality radish seed production in Bangladesh (Mondal *et. al.* 1989). The pathogen can be transmitted as descendents by direct infection of development seeds in siliquae causing severe damage in seedlings (Kubota *et al.* 2003). Typical symptoms of the disease are dark brown spot on leaf, stem and siliquae, which begin as small brown or black spots that usually enlarge into concentric circles in later stage. Furthermore, they often show chlorotic margins and reduce the photosynthetic capacity of the infected plant and lead the premature senescence of the leaves (King, 1994). In an epidemiological study of *A. brassicicola and A. brassicae,* factors such as plant age, wetness period, inoculum concentration and incubation temperature affected the severity of leaf spot disease (Mridha

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and Wheeler, 1993; King, 1994; Hong *et al.* 1996). Meenu and Hundal (2004) reported that seed yield losses due to this disease about 46.48% and varied from year to year. Seed, the main infection source of *Alternaria brassicae* and *Alternaria brassicicola* of radish, serves as a substrate for pathogen survival, of destructive diseases for seed growers. The pathogens can shrivel seeds in the pods or kill the pod stalks before seed formation. In addition to destruction of a seed crop, the pathogens can live within the seed, spread the disease to other fields, and cause loss of seedlings (Rangel, 1945). It is fact that no significant research work has yet been conducted on the nature of damage and different kinds of symptoms on radish seed crop. Thus, the present research work was designed to find out the different kinds of symptoms produced by the different *Alternaria* species and by nutritional factors.

MATERIALS AND METHODS

Radish cv. Tasaki Mula was transplanted on 20 December, 2004 and 2005 in ten plots (4.5m×2m). The other cultural practices were followed the standard method. Two consecutive seasons were (2004-2005 and 2005-2006). The parameters were leaf symptoms, pod symptoms, stalk symptoms, average sot size and non-infectious disease symptoms. At the age of 40, 65 and 85-day old transplanted crop, 10 leaves were collected and studied the symptoms and sign. The disease symptoms were observed daily on three bottom leaves and ten pods from older flower stalks of five tagged plants in each plot. Data were taken everyday up to the possible counting number of spot beginning from first disease initiation. Infected leaves and pods of radish were collected for studying the symptoms and signs. The samples were brought to the laboratory. The symptoms and signs were studied in the same day of collection. The spot size was determined by taking 10 spots on three leaves in each of five tagged plants. The average spot size was measured by using a graduated scale in diameter (mm) where the data were averaged for two cropping seasons. The clean slide was prepared from typical symptoms considering the whole infected part by scraping method. The different symptoms caused by different *Alternaria* species were confirmed through studying the size and color of the spot and the diffierent *Alternaria* species were confirmed from microscopy (10x × 10x). The non-infectious symptoms were identified with naked eye observation consulting the soil scientist (Amin, 2005).

RESULTS AND DISCUSSION

The percent leaf & pod infection and spot size caused by *Alternaria* species on radish seed crop at different days after transplanting (DAT) at two consecutive cropping seasons of 2004-2005 and 2005-2006 were noted and presented in Table 1. In 2004-2005 cropping season, the leaf spot caused by *Alternaria brassicae*, *A. brassicicola* and *Alternaria alternata* were light to dark colored, almost circular and enlarge gradually and varied up to 8-12 mm in diameter. The symptoms of *Alternaria brassicae* was 100% on leaf at the early growth stage (40-65 DAT) but at the later stage of 85 DAT, leaf symptoms were 95% and pod were 90%, whereas *A. brassicicola* appeared 4% on leaf and 8% on pod and *Alternaria alternata* 1% on leaf and 2% on pod, respectively at 85 DAT. In 2005-2006 cropping season, the leaf spot caused by *Alternaria* species ranged 7 to 10 mm in diameter. The *Alternaria brassicae* symptoms appeared on leaf as of the first cropping season where 85% pod infection was observed at 65 DAT but *A. brassicicola* showed 15% on pod. At 85 DAT, 91% and 9o% infections were found on leaf and pod, respectively by *Alternaria brassicae* where 7% infections were of *A. brassicicola* on both of leaf and pod but only 2-3% infections were found in *Alternaria alternata*.

The pooled data of two cropping seasons revealed that the symptoms of *Alternaria brassicae* were found 92.5-100% on leaf and pod at the early growth stage (40-65 DAT) but at the later stage of 85 DAT, leaf symptoms were 93% and pod symptoms were 90%, whereas *A. brassicicola* appeared 5.5% on leaf and 7.5% on pod and *Alternaria alternata* appeared 1.5% on leaf and 2.5% on pod, respectively at 85 DAT. The overall infections were mostly caused by *Alternaria brassicae* as a major pathogen where *A. brassicicola* and *Alternaria alternata* were minor pathogens of radish seed crop. The *Alternaria brassicae* and *A. brassicicola* are causal fungi for Alternaria blight of

radish is supported by Mondal *et. al.* (1989) and *Alternaria alternata* is corroborated with Suhag *et al.*, (1985). Maximum fungal growth was observed in the centre of the spot. The leaf spot was turned into blight at severe infection. Initial infection was started from soil level on older leaves and gradually increased upward including petiole, flower stalk, pod, green and matured seed are agreement with the Kubota *et al.* (2003) and King (1994). The nutritional symptoms were observed in seedbed. Nutrient element particularly boron, calcium, magnesium, molybdenum and nitrogen were some extend more sensitive to the crop and produced prominent symptoms in complex or typical form and caused overall profound weakness, poor and distorted growth with cup-shaped, dark green, light yellowing, necrosis on leave exhibiting loss of coordination in physiology. The nutritional deficiency symptoms of radish in seedbed were identified by the

Table 1. Symptoms of *Alternaria* blight in radish seed crop

Plant parts	Symptoms
Leaf	First dot like necrotic dark brown spot appeared on upper surface of older leaf on first weak of January at 15-20-day old transplanted plant with almost surrounded by light green areas. This pinhead symptom enlarged to larger circular concentric spot that was surrounded by light yellow margin. The concentric ring alternated with depressed necrotic tissue with presence of conidiophore and conidia on raised ring. Shot hole was observed occasionally. Abundant numbers of conidia were found on upper surface of leaf. At the severe case the spots coalesced to form blight (Plate D).
Stalk	Linear to dot like dark brown to black color spot appeared on seed stalk. The symptoms appeared on stalk after few days of leaf infection and enlarged to produce oblong to linear and irregular lesion. In severe cases this symptom girdled the stalk with depressed necrotic areas. The severe infected seed-stalk breaks easily with even light weight and mild wind flow. Cracking of stems was observed occasionally. The progress of disease on stalk was slower than that on leaf. (Plate C)
Pod	Initial pin head or dot like symptom appeared on upper-half surface of the pod with brown to dark brown. The dot like symptom enlarged to produce larger and circular to irregular lesion. In severe cases, the lesion girdled the pod with depressed necrotic areas. In some cases, pod carried no seed and only mass of conidia. The concentric ring or bull's-eye symptom may be formed on tip of the pod. The percent increase of disease on pod was slower than on leaf (Plate E-H).
Seed	Dark brown to blackish discoloration appeared on infected seed. Mostly seed coat showed the clear symptom. Infected young green seed turned into light brown in color. Dark brown color linear spot appeared on germinating hypocotyls, dot like dark color spot on cotyledon and primary root (Plate A).
Stickling	Linear dark brown to pinhead black spot appeared on hypocotyl, primary root and cotyledons. The symptoms appeared on stickling after few days of germination. In severe cases, the cotyledon symptom enlarged to larger circular concentric dark brown spot and blighted it. The pre-and post emergence death (foot rot, stickling blight) was observed in some extend (Plate B).

Table 2. Symptoms of non-infectious diseases in seedbed

Deficiency	Symptoms
Boron	Poor growth and top necrosis of buds, poor growth and necrosis of leaf, browning with die back of inflorescence (racemes), reduced pod formation (Plate I).
Nitrogen	Stunted growth, light green color, yellowing of leaves beginning with oldest foliage (Plate J).
Calcium	Youngest foliage distorted, irregular, dark green leaves (Plate K-N).
Magnesium	Inter-vein yellowing, necrotic spot on leaves and cup-shaped (Plate K & N).
Molybdenum	Interveinal chlorosis with necrotic tissues (Plate L & M).
Zinc	Vein clearing, interveinal yellowing (Plate O).

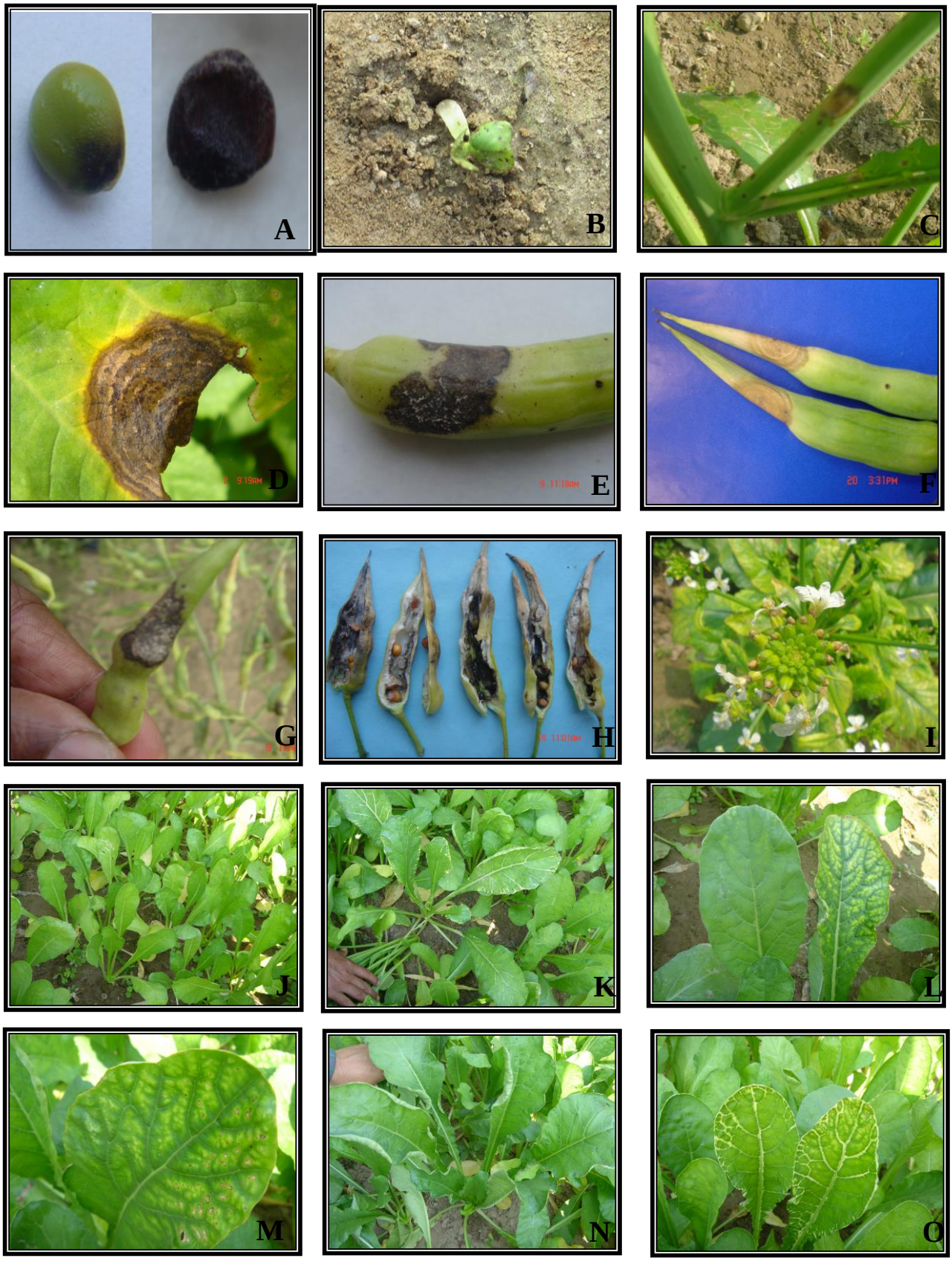

Figure 1. A-H *Alternaria* infection on seed, hypocotyls and cotyledons, flower stalk, leaf, pod, pod tip, lesion on pod, inside the pod, I. *Alternaria* infection and boron deficiency on flower buds, J) Nitrogen deficiency, K) Calcium and Magnesium deficiency L) Calcium and Molybdenum deficiency M) Molybdenum and Calcium deficiency N) Magnesium and Calcium deficiency O) Zinc deficiency

Table 3. Percent leaf & pod infection and spot size caused by *Alternaria* species at different days after transplanting (DAT) on radish seed crop during 2004-2005 and 2005-2006 cropping seasons

Alternaria species	Year 2004-2005						Year 2005-2006						Pooled data of two years					
	DAT						DAT						DAT					
	40	65		85		Spot size (mm)	40	65		85		Spot size (mm)	40	65		85		Average spot size (mm)
	Leaf	Leaf	Pod	Leaf	Pod		Leaf	Leaf	Pod	Leaf	Pod		Leaf	Leaf	Pod	Leaf	Pod	
A.brassicae	100	100	100	95	90	12	100	100	85	91	90	10	100	100	92.5	93	90	11
A.brassicicola	-	-	-	4	8	10	-	-	15	7	7	10	-	-	7.5	5.5	7.5	10
A. alternata	-	-	-	1	2	8	-	-	-	2	3	7	-	-	-	1.5	2.5	7.5

personal consultation with Amin, S. Professor, Department of Soil Science, Hajee Mohammad Danesh Science and Technology, University, Dinajpur, Bangladesh (2005). The detailed symptoms are stated and shown in the Table 2 and 3.

REFERENCES

Amin S. 2005. Personal contact. Professor, Department of Soil Science, Hajee Mohammad Danesh Science and Technology, University, Dinajpur, Bangladesh.

Hong CX, Fitt ED and Welham SJ. 1996. Effect of wetness period and temperature on development of dark pod spot (*Alternaria brassicae*) on oilseed rape (*Brassica napus*). Plant Path. 45: 1077-1089.

King SR. 1994. Screening, selection and genetics of resistance to Alternaria diseases in *Brassica oleracea*. Dissertation, Cornell University, Ithaka, New York.

Kubota M, Abiko K and Nishi K. 2003. Effect of cultivation conditions of cabbage plugs on sooty spot disease. Bulletin, The National Institute of Vegetable and Tea Science, Japan. 2: 1-8.

Meenu and Hundal SS. 2004. Effect of wetness period on development of *Alternaria* blight (*Alternaria brassicae*) on radish crop (*Raphanus sativus*). J. Agrometeorology, 6 (Special Issue). 141-143.

Mondal SN, Rashid MA, Monowar SM and Abdullah MA. 1989. Efficacy of fungicides in controlling Alternaria blight of radish seed crop. Thai J. Agric. Sci.. 22 (3): 191-196.

Mridha MAU and Wheeler BEJ. 1993. In vitro effects of temperature and wet periods on infection of oilseed rape by *Alternaria brassicae*. Plant Pathology. 42 (5): 671-675.

Rangel JF. 1945. Two *Alternaria* diseases of cruciferous plants. Phytopath. 35:1002-1007.

Rashid MA, Ahmed MS, Tasaki S, Miah MAA and Hossain AKMA. 1985. Development of tasaki mula, a high yielding radish cultivar through mass selection. Bangladesh Hort. 13 (1-2): 45-50.

Suhag LS, Singh R and Malik YS. 1985. Epidemiology of pod and leaf blight of radish seed crop caused by *Alternaria alternata*. Indian Phytopath. 38 (1): 148-149.

Talukdar MJ. 1974. Plant diseases in Bangladesh. Bangladesh J. Agric. Res. 1(1): 61-83.