Effect of Nutritonal Factors on Toxin Production in *Alternaria triticina* : A foliar Pathogen of Wheat

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ABSTRACT

Different media, carbon and nitrogen sources influenced the production of toxic mtabolites by *Alternaria triticina*. Maximum toxin production was recorded from RI medium. Sucrose as carbon source and glutamic acid as organic nitrogen sources were the best for toxin production.

Key words : *Alternaria triticina,* Nutritional factor, Toxin, Wheat

Pathogenic micro-organisms release toxic substances which are related to post-specificity. Toxin seems to play an important role in host recognition at the site of initial contact of the germinating spores on host surface thus, enabling the pathogen in establishing the disease (Kohmoto *et al.*, 1976; Yamamoto *et al.* 1984). Ueno *et al.* (1982) reported production of toxic substances by *Alternaria* and *Helminthosporium* species. In the present study, effect of different nutritional factors on production of toxin *in vitro* by *Alternaria triticina* was studied.

Materials and Methods

Isolation of crude toxin and bioassay : A virulent strain of *A. triticina* isolated from the leaves of susceptible wheat, Raj 1482, maintained on PDA was used. Fungal metabolites were isolated according to Janardhanan and Hussain (1974). The growth inhibiting activity of crude toxin from culture filtrate was bioassayed following Pringle and Braun (1957).

Effect of different media on toxin production : *A. triticina* cultures were raised on five media *viz.*, Asthana and Hawker (AH), Brown (Br), Glucose glutamic acid (GGA), Potato dextrose (PD) and Richard's (RI).

Effect of different carbon sources : Effect of carbon sources like sucrose (S), glucose (G) and dextrose (D) was incorporated in GGA medium (each 30 g/l). Equimolar concentration (0.1 M) of carbon sources (sucrose, 34.23; glucose, 18.01 and mannitol, 18.21) was used to study their influence on toxin production. Control was devoid of carbon sources.

Effect of nitrogen sources : Effect of different organic nitrogen sources like glutamic acid (GA), asparagine (A) and leucine (L) was studied (Each added in GGA medium 1 g/L). In control, nitrogen source was not added in GGA medium.

Results and Discussion

The crude toxin induced a complete inhibition of germination of wheat seed at 0.1 μg/ml concentration. Inhibition of root growth was detected upto 0.002 μg/ml concentration, besides this, the shoot length was inhibited in all the concentration of toxin. Inhibition in seedling growth and root number was observed even at 0.001 μg/ml (1:1000) concentration but slight increased in root length was also observed (Fig 1A and B).

Maximum toxin production was recorded from RI (49 μg/ml) followed by GGA (38 μg/ml), PD (7 μg/ml), AH (3 μg/ml) and Br (1 μg/ml) media (Fig. 2). The physical nature of isolated crude toxin from different media was also different. Crystals (needle and cube like) was obtained from AH medium and needle like from RI and cube like from Br media respectively.

Maximum toxin production was recorded from medium that contained sucrose (30 μg/ml) followed by glucose (22 μg/ml) and dextrose (15 μg/ml) (Fig. 3). In organic nitrogen sources, glutamic acid proved to be the best nitrogen source for toxin production (15 μg/ml) followed by leucine (8 μg/ml) and asparagine (3 μg/ml) (Fig. 4).

Toxin production was related to carbon and nitrogen and composition of the medium. Maximum toxin production was recorded in Richard's medium which indicated high

1A

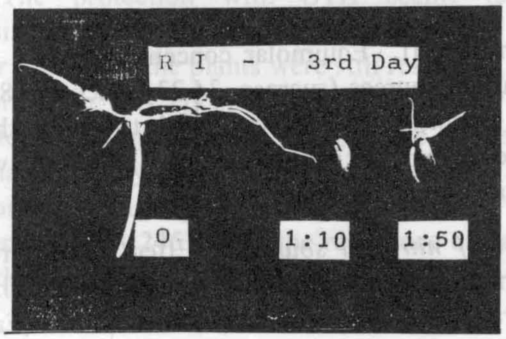

Fig. 1A. Effect of different concentration of toxin (0 to 1:50) on root and seedling growth of wheat seeds (left to right)

1B

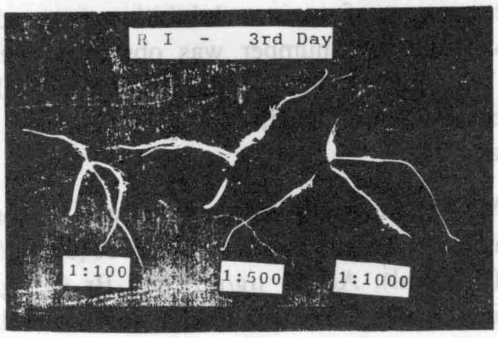

Fig. 1B. Effect of different concentration of toxin (1:100 to 1:1000) on root and seedling growth of wheat seeds (left to right)

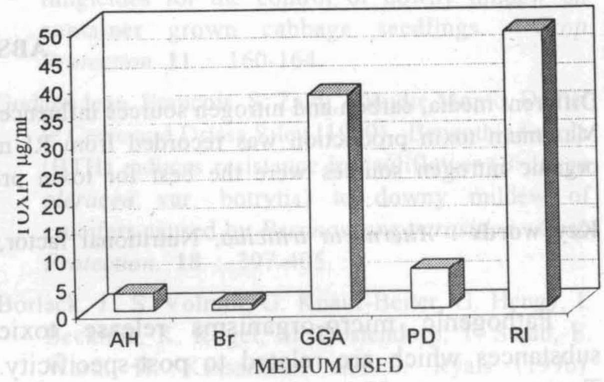

Fig. 2 Effect of differnt media on toxin production

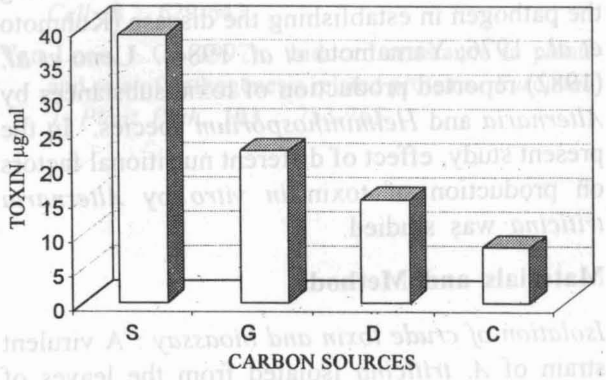

Fig. 3 Effect of differnt carbon sources on toxin production

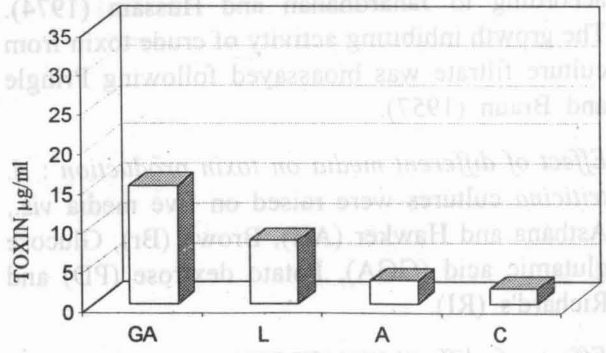

Fig. 4 Effect of nitrogen sources on toxin production

carbohydrate requirement for toxin production because RI medium contained high amount of sucrose (50 g/L) as compared to other media. However, when glucose was replaced with sucrose in the glucose glutamic acid medium, the toxin production comparable to Richard's medium was achieved. This indicated positive requirement of sugars along with suitable nitrogen source for increased toxin production. Probably high supply of carbohydrate was essential for utilization of high amount of nitrogen supplied in the form of KNO_3 (10 g/L). Apparently, glutamic acid at its higher concentration was probably not utilised as the carbohydrate supply may become a limiting factor with glucose as a source of carbon. Reduction in seed germination, root and seedling growth was observed as a consequence of toxin treatment (Janardhanan & Husain, 1974). During the present investigations, inhibition of seed germination and reduction in root and seedling growth was observed upto dilution 1:500 and beyond that toxin promoted root elongation over the control.

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