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Testing the toxicity of the metabolites secreted by the pathogens in corchorus species (Jute): An Evaluation

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Abstract :
testing the toxicity of C. capsici f. capsularis, the change in permeability of the leaf tissue was adopted as criterion. As result, the electrical conductivity of the bathing conductivity water was considerably more in the inoculated leaf discs than the control. More electrical conductivity of the conductivity water due to inoculated leaf disc, indicated more denaturation of the plasmamembrane, a sign of toxicity.

Key Word : toxin, mechanism, pathogens, permeability, Inoculated

Introduction :

The genus Corchorus , commonly known as jute, includes more than 170 species, all of which are annual fi brous plants. Jute fi ber is totally biodegradable and compostable and therefore an extremely attractive renewable resource. While the cultivated species, C. olitorius L. and C. capsularis L., are economically important for fi bre production, the wild species are considered important genetic resources for biotic and abiotic stress tolerance and fi ne fi bre trait. However, there are some constraints in jute cultivation and research. The cultivation requires lot of watering which is often hampered due to late showering and low moisture content in the air. Jute is very prone to disease and pest attack. Although application of pesticides is a popular preventive measure it also raises the issue of biomagnifi cations of those harmful chemicals by entering the food chain of the ecosystem. In addition, the fibre processing disturbs the environment by causing water pollution during retting. Some other negative issues related to its cultivation are indoor air emissions from the products, and greenhouse gas emission due to using waste jute for energy.

Material and Methods :

secretion of toxin by pathogens

Toxins are the products secreted by microorganisms, are produced in vivo during host-pathogens interaction, which at low concentrations prove very harmful to the host. The pathogenic microorganisms produce one or more toxic substances and induce a part or whole of the symptoms of disease when applied to the plant. Highlighting the effect of toxin, Gaumann (1954) had strongly asserted that a microorganism connot be pathogenic unless it is toxigenic. Today it is belived that in most plant diseases some toxins are invariably involved. Thses have also been called antimetabolites because thay suppress the metabolic activity of host in various ways. Some of the toxins are host specific while others are non- host specific (Allen, 1953; Brian, 1955; Wheeler and Luke, 1963; Brown, 1965; Scheffer and Yoder, 1972; Patil, 1974; Scheffer, 1976; Rudolf, 1976 ; Durbin, 1981; Singh, 2002). The toxins may be exotoxins or endotoxins and are phytotoxic to metabolic activities of the host. Among these

is change in the cell permeability. Wheeler and Luke (1963) reported the permeability change as the first step in the functional disorder of the host due to pathogenesis. Some toxins kill plant cells by altering the permeabity of the plasmamembrane. This results in loss of water and the electrolyte from the cell and unrestricted entry of the substances like toxins. Potassium has been found to be the chief element being lost from the cell. The leakage of the electrolyte consisting cations such as K^{+}, Ca^{++}, Mg^{++}, Zn^{++}, Fe^{++}, Cu^{++} etc. is highly apprehended to disturab the chain of biochemical reactions in which these are used as co-factors.

The leakage of the cations disturb the balance of salts in the protoplasm causing increase in respiratory metabolism. The malfunctioning of the enzyme system ultimately results in death of the cell. Some toxin have been reported to interfere with growth physiology and stomatal dysfunction. The germination of radish seed after storage with Aspergillus flaves results in yellowing of cotyledonary leaves and their failure of expansion (Sao et at; 1989) indicating injurious effect on the synthesis of chlorophyll and suppression of cell division as well which is also evidenced by very short and curved radical and less mitotic index (Singh et al., 2009).

In the present chapter effect of the toxin produced by C. capsici f. capsularis will be observed on the alteration of permeability of the host leaf besides on the rate of elongation of the radicle of C. capsularis. The activity of pyruvic acid dehyodrogen and a - ketoglutaric acid dehydrogen has already been worked . It was augmented.

Change in permeability of diseased leaf

As mentioned earlier that the permeability change in the host cell is the first response of the effect of the toxin secreted by the pathogen, therefore, this change was taken as the parameter of secretion of the toxin by the said pathogen . The technique is based on Mahadevan and Sridhar (1996).

Procedure to detect the change in permeability of C. capsularis

The inoculated leaves of C.capsularis was cut as disc of 1 cm diameter with the help of sterilized cork borers. Such 5 discs were taken and first of all washed with distilled water and then with autoclaved conductivity water. Similar treatment was done to the 5 discs of healthy part of the leaves of the same age The discs of the inoculated and the control leaves were wrapped in single layer of autoclaved cheese cloth. The wrapped leaf discs were separately placed in 40 ml of conductivity water taken in conical task of 100 ml capacity. The flask was shaken five times each time for 1 min at an interval of 5 min. The electrical conductivity was measured three times at an interval of 30 min with conductivity bridge with dip electrode cell (K - 0.1).

Conductivity of the disease leaf disc (express es as 10^{-2} mhow unit)

	Time interval (in min)		
Inoculate/Control	**30**	**60**	**90**
Inoculated	**0.021**	**0.036**	**0.056**
Control	**0.008**	**0.012**	**0.018**

Results

It appears that the value of conductivity was more due to the inoculated leaf discs while considerably less due to the control.

measurement of permeability change by infiltration of the toxin

This is another method of estimating the change in permeability of the diseased leaf. The inoculated part of the leaf of C.capsularis showing the symptom of disease due to C.capsicif.capsularis was cut with the help of sterilized cook borer having 1 cm.diameter. 1 g of the discs were washed with distilled water and extracted with 5 ml of acetone two time. The acetone extract was centrifuged and the supernatant was separated and taken in a beaker. The acetone was removed by gushing with hot air from hair drier. "The residue adhering to

the wall of beaker was dissolved in 10 ml of conductivity water. Similar experiment was performed using leaf discs of healthy leaf (control). NOW two sets were prepared. In one set the toxin dissolved in 10 ml of conductivity was taken in small tube. In another only 10 ml of conductivity water was taken. Six discs of leaf of 1 cm diameter was cut with sharp cork borer and washed with distilled water and then containing toxin dissolved in 10 ml of conductivity water, and the remaining three leaf discs in another tube containing conductivity water only.

The two tubes were put in a container and the air was slowly sucked by exhaust pump for 10 min to infiltrate the liquid in the leaf discs. The permeability of the leaf discs was measured at an interval of 30 min and total for period of 90 min. The conductivity of the batting liquid conductivity water containg toxin and conductivity water only.

Result and Discussion

The toxin secreted by the pathogens prove phytotoxic to the host by altering their vital physiological and biochemical process, and the net result is the shattering of the biochemical process, leading it to halt and ultimately the death of the tissue especially at infection site. The possible mechanisms of phytotoxicity include the change in the permeability of the tissue, disruption of normal metabolic process and interference with growth regulatory system, stomatal dysfunction etc. In the present chapter only change in permeability of the host leaf has been worked out using inoculated leaf discs and by infiltration of the toxic compound extracted by acetone. In both the cases the bathing liquid has considerably higher conductivity than the control indicating damage of the plasmamembrane which has been reported to be the first step in functional disorder caused by the pathogenesis (Wheeler and Luke, 1963). The damage of the permeability of plasmamembrane permits the loss of water and the electrolytes and also unrestricted entry of substance like toxins. The change in permeability may adversely affect many physiological and biochemical processes of the host. Leakage of electrolyte cause disturbance in the balance of salts in the protoplasm resulting in rise in respiratory metabolism. The loss of water and other substances causes malfunctioning of the enzyme system resulting ultimately in drying of the tissue, organ. The blocking of the enzyme system may be affected by coagulation protoplasmic protein (Brain, 1955; wheeler and Luke, 1963;Brown, 1965; Wheeler and Hanchy, 1968; Scheffer and Yoder, 1972; Patil, 1974; Scheffer,1976; Wheeler, 1976).

conclusion:

conclusion of the article is toxins are the products secreted by microorganism in vivo during host-pathogens intraction, which at low concentration prove very harmful to the host. The toxins may be exotoxins or endotoxins and are phytotoxic to metabolic activities of the host. Some toxins kill plant cells by altering the permeabity of the plasmamembrane. This results in loss of water and the electrolyte from the cell and unrestricted entry of the substances like toxins. Potassium has been found to be the chief element being lost from the cell. The leakage of the electrolyte consisting cations such as K, Ca, Mg, Zn, Fert, Curt etc. is highly apprehended to disturab the chain of biochemical reactions in which these are used as co-factors.

Due to the leakage of electrolytes that comprises cations such as K, Ca, Mg, Zn, Fe,Cu, Mo, B amino such as and -PO2, -SO.2-, - CI, -NO3 etc. the host may suffer theirdeficiency and myriads of biochemical anomaly, as some of these serve as theframework element for protoplasm, cell wall, enzymes etc. Phosphate, bicarbonate andcarbonate may act as buffer and thus resist marked change in pH. The elements like K, Mg, Fe Cu, Zn, Mn etc act as catalyst in various enzyme reactions. Ca is essential fornormal mitosis. It helps in holding together nucleoprotein particles. Mg+ is the integralpart of chlorophyll molecule. It is also the activator of DNA and RNA polymerase. Thevast literature (Epstein, 1965; Evans and Sorge, 1966; Allan and Trewavas, 1987; Marschner, 1986; Buchanan and Gruissem, 2002) is available on the role of cations in the plant biochemistry and physiology, and there is

authentic conclusion that the leakage of these from the host is a potential factor in their disruption.

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