

Serological differentiation of three species of *Phytophthora* causing black pod disease of cocoa

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ABSTRACT : The extent of serological diversity in isolates of three species of *Phytophthora* viz., *P. palmivora*, *P. capsici* and *P. citrophthora* causing black pod disease of cocoa in India was studied by immunodiffusion test. The three species of *Phytophthora* exhibited serological variation in their reaction with antiserum to either *P. capsici* or *P. citrophthora* in the agar double diffusion test. The serological reactions revealed that all the isolates of *P. palmivora*, *P. capsici* and *P. citrophthora* shared at least one common antigen. Two subgroups were distinguished among the isolates of *P. capsici* whereas all the isolates of *P. citrophthora* formed a homogeneous serological group. Thus, the results showed that serological technique can be used as additional criterion in distinguishing the three species of *Phytophthora* in support of morphological criteria.

Key words : Cocoa, blackpod, *Phytophthora* spp, serology, differentiation

Black pod disease of cocoa (*Theobroma cacao* L.) caused by *Phytophthora* spp. is a major disease of cocoa in South India. Three species of *Phytophthora* viz., *P. palmivora*, *P. capsici* and *P. citrophthora* have been identified as causal agents of this disease based on morphological criteria (Chowdappa, 1995). Variation in morphology is often too wide for correct identification *Phytophthora* spp. Further, all these species cause similar symptoms on cocoa. Serological techniques have been advocated in *Phytophthora* systematics (Gallegly, 1983). The use of serology in *Phytophthora* taxonomy was demonstrated by Merz *et al.* (1969). The object of the present study is to investigate on the serological diversity between three species of *Phytophthora* and to determine their utility in identification as an additional criterion in support of morphological criteria.

MATERIALS AND METHODS

Eleven selected isolates of *P. palmivora* (I-CP/122), *P. capsici* (I-CP/23, I-CP/25, I-CP/27, I-CP/76 and I-CP/89) and *P. citrophthora* (I-CP/26, I-CP/76, I-CP/92, I-CP/93 and I-CP/96) were used in the present study. Healthy, female, albino rabbits (10 months old) weighing 2.5 kg were used for raising antiserum against the test antigens of *P. capsici* (I-CP/23) and *P. citrophthora* (I-CP/92). For serological studies, the method of Merz *et al.* (1969) was followed with slight modifications (Chowdappa, 1995). The antigenic constituents of isolates of *Phytophthora* species were compared by agar double diffusion test.

RESULTS

The three species of *Phytophthora* showed serological variation in their reactions with antiserum to either *P. capsici* or *P. citrophthora*. Antiserum to *P. capsici* reacted with its homologous antigens of five isolates of *P. capsici* and formed three precipitin lines: Two thin sharp lines (A and B) and one thick line (D). Antiserum to *P. capsici* reacted with heterologous antigens of five isolates of *P. citrophthora* and produced only two thin sharp lines (A and B). Antiserum to *P. capsici* reacted with antigen of *P. palmivora* and formed only one thin sharp line (B) and line (A) was conspicuously absent. Antiserum to *P. citrophthora* produced two precipitin lines against its homologous antigens: One thick line (B) and another sharp line (A). In its reaction with heterologous antigens of *P. palmivora* and *P. capsici* it formed two thin sharp lines (A and C) against the former and three precipitin lines (A, B and D) against the later. All the isolates of *P. palmivora*, *P. capsici* and *P. citrophthora* shared at least one common antigen. Two groups were distinguished among five isolates of *P. capsici* based on serological reaction. The five isolates of *P. citrophthora* formed a single serological group.

DISCUSSION

From the serological studies on five closely related heterothallic species of *Phytophthora*, Merz *et*

al. (1969) concluded that *Phytophthora* species with morphological differences were serologically distinct. The present study also showed serological variations between *P. palmivora*, *P. capsici* and *P. citrophthora* of cocoa. The cross reaction between the species of *Phytophthora* was expected because the genus *Phytophthora* may have common antigens that is shared by all the species of *Phytophthora*. The antigens of *P. palmivora*, *P. capsici* and *P. citrophthora* formed more than one precipitin line either with antiserum to *P. citrophthora* or *P. capsici*. Such multiple precipitin lines were observed when crude protein extracts of six heterothallic *Phytophthora* were used (Merz *et al.*, 1969). Thus, serology can be used as an additional criterion for identification of a three species of

Phytophthora causing a black pod disease of cocoa in ~~support of morphological criteria~~

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