EVALUATION OF THE MORPHOLOGICAL, MOLECULAR AND PATHOGENIC VARIABILITY OF THE BLACKPOD PATHOGEN (*Phytophthora* species) OF COCOA (*Theobroma cacao* Linn.) IN NIGERIA

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ABSTRACT

Blackpod of cocoa caused by *Phytophthora* species reduces cocoa production in Nigeria by 80%. Frequent resistance breakdown in cocoa genotypes is attributed to genetic diversity of the pathogen, a fact that needs to be ascertained in order to proffer an effective management strategy for the disease. A total of 152 isolates of *Phytophthora* species were collected from infected cocoa pods in 5 cocoa producing states of Nigeria in 2012/2013 and 2014/2015 cropping seasons. Samples were evaluated using morphological, molecular and pathogenic variability techniques. Morphological characterization consisted of visual and microscopic examinations of 4- and 10-day old axenic cultures of the isolates on carrot and potato dextrose agar media to determine colony and sporangia characteristics. Molecular characterizations were done by amplification of Polymerase Chain Reaction (PCR) products of the *Phytophthora* isolates and sequencing of the Internal Transcribed Spacer (ITS) region of Ribosomal Deoxyribonucleic acid. Pathogenic variability was evaluated on two susceptible cocoa clones (N38 and ICS1) and two resistant cocoa clones (PA150 and IMC47) using the Leaf Discs (LD) test method in a Completely Randomized Design with three replications. Data were obtained on pedicel length, sporangia length-breadth ratio, lesion score and disease incidence (DI; %) on LD and subjected to Analysis of Variance. Mean values were separated using Duncan Multiple Range Test. Morphological studies revealed that three *Phytophthora* species (*P. megakarya* (Pm), *P. palmivora* (Pp) and *P. capsici* (Pc)) were associated with blackpod symptoms. Five groups of colony patterns formed by the isolates of Pm and Pp discriminated the *Phytophthora* species. Mean pedicel length ranged from 0.25 - 3.00 µm (Pp), 5.35 - 10.00 µm (Pm), and 12.50 - 18.75 µm (Pc) in 2012/2013 collections. In 2014/2015, pedicel length ranged from 1.10 - 4.80 µm (Pp), 5.00 - 29.60 µm (Pm) and 31.43 -

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94.22 µm (Pc). Length-breadth ratio ranged from 1.3 to 1.8 (Pp), 1.1 to 1.6 (Pm) and 1.8 to 1.9 (Pc) in 2012/2013 collections. In 2014/2015 collections, the length-breadth ratio ranged from 1.4 to 1.9 (Pp), 1.1 to 1.6 (Pm) and 1.5 to 1.9 (Pc). Principal component and Single linkage cluster analysis of the morphometric sporangia characters, colony diameter (4 days after plating) and disease severity differentiated a distinct species, Pc. Molecular analysis identified 58 of the 60 *Phytophthora* isolates as Pm. Mean lesion scores on LD showed that the reactions of the *Phytophthora* isolates differed significantly, with isolate PNON008 inducing highest lesion score of 2.40 and 48.0% DI in 2012/2013 collections. *Phytophthora* isolate PNOY071 induced the highest lesion score 4.84 and DI of 96.8% in 2014/2015 collections. Two *P. megakarya* isolates (PNCR015 and PNOY071) were highly virulent as they produced 97% DI on Leaf Discs of *cacao* genotypes. Of the 152 isolates, 107and 34 were Pm and Pp, respectively, while 11 belongs to a new species (Pc) found to be associated with cocoa in Nigeria. This study concluded that diversity exists in the *Phytophthora* population in Nigeria. Further studies should be devoted to elucidate the impact of the new species on cocoa.

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