ABSTRACT

HISTOPATHOLOGICAL AND BIOCHEMICAL STUDIES ON COCOA (*Theobroma cacao* L.) CANKER CAUSED BY *Phytophthora palmivora* (BUTL.) BUTLER.

EDWARD NTUI OKEY

Six genotypes (ICS 1, IMC 67, SCA 6, P18, TSH 1076 and TSH 1188) of cocoa (*Theobroma cacao* L.) were investigated for their resistance to stem canker caused by *Phytophthora palmivora* (Butl.) Butler. Cultivar resistance was evaluated by a field survey of natural infection as well as by artificial inoculations using zoospore suspensions (300,000 ml^{-1}) as the inoculum. Based on these assessments, the clones were categorized into three groups: resistant (IMC 67), moderately resistant (ICS 1 and TSH 1188) and susceptible (P 18, SCA 6 and TSH 1076).

Evaluations of extra-xylary (bark) tissue characteristics (thickness, hardness, moisture content and splitting) indicated that hardness and moisture content were related to canker resistance. The resistant clone (IMC 67) was found to have high bark hardness and low

moisture content, while the reverse was true for the susceptible clones (P 18, SCA 6 and TSH 1076). Bark thickness and splitting were poorly correlated with lesion size.

Histopathological investigations revealed that cells reacted to infection by increase in the thickness of cell walls. This increase was more pronounced in the resistant IMC 67 clone and was positively correlated with lignin concentration.

High activities of Peroxidase (PO), Polyphenoloxidase (PPO) and Phenylalanine ammonia lyase (PAL) were found to be associated with canker resistance. Wounded and infected stem tissues had higher activities as compared to healthy ones.

Stem and pod extracts showed differential inhibitory effects on the growth, zoospore production and germination of *P. palmivora*. Extracts of IMC 67 were more inhibitory compared to those of the other clones tested. Also, extracts from wounded and infected tissues showed more inhibition in contrast to those from healthy tissues. While stem extracts of IMC 67 were highly inhibitory those of pods were less inhibitory. On the other hand, pod extracts of SCA 6 were more inhibitory compared to stem extracts of the same clone.

Analysis of these extracts indicated the presence of phenolic compounds. While total phenols were found to be poorly correlated with lesion size, tannin and salicylic acid were associated with canker resistance. Tannin could serve an inhibitory function, while salicylic acid could have been acting as an internal signal that triggered off resistant reactions in relation with the synthesis of PR proteins.

For the evaluation of cacao germplasm against *Phytophthora* canker, assessments of wound-healing properties, salicylic acid and tannin contents are recommended.