Antifungal Activity of Selected Crude Plant Extracts on Bean Rust *(Uromyces appendiculatus)* and Their Effects on Physiological Activities of French Beans

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ABSTRACT

Rust (*Uromyces appendiculatus*) is a major foliar disease that reduces yields and pod quality in beans. There is need to introduce effective and environmentally friendly pest control products. The objective of this study was to evaluate the performance of commercial fungicide (Kocide DF) and antifungal plant extracts in the control of this disease. A total of 9 plants belonging to different genera were selected from native flora of Eastern, Western and Rift Valley provinces in Kenya.

The antifungal activities against *U. appendiculatus* by the crude extracts of selected plants were studied *in vitro* and *in vivo* experiments. French bean (*Phaseolus vulgaris* L.) variety Amy that is susceptible to bean rust (*U. appendiculatus*) was used in evaluation. *In vitro* evaluations was performed on extracts from *Maesa lanceolata, Tithonia rotundifolia, Aloe secundiflora, Carisa edulis, Urtica dioica, Boscia angustifolia, Zanthoxylum chalybeum, Melea volkensii* and Kocide DF as treatments. A field trial was established at JKUAT-Kenya in a Completely Randomized Block Design replicated 4 times. The plots were 3 × 4 m with 0.5 m paths between plots and 1.5 m between blocks. Variety Amy was planted at a spacing of 30 × 10 cm within and between rows. Single plant extracts and combinations of *Boscia angustifolia, Zanthoxylum chalybeum* and *Melea volkensii* were used to evaluate their effect on *U. appendiculatus* in the field. The treatments were applied once in every week. Major carotenoids from the pods of French beans were isolated and profiled using High Performance Liquid Chromatography (HPLC) peaks to determine the consistency of the compounds in the pods.

Physiological responses such as carbon dioxide assimilation, Photosynthetic active radiation (PAR), Transpiration, Stomatal conductance (gs), leaf temperature and Photosynthetic rate (Pn) of French beans treatments were examined using Infrared gas analyzer (IRGA) in all treatments.

Differences were found between the inhibitory effects *in vitro* and *in vivo. B. angustifolia, Z. chalybeum* and *M. volkensii* inhibited efficiently spore germination of *U. appendiculatus.* Extracts of *B. angustifolia, Z. chalybeum* and *M. volkensii* showed significant levels ($P<0.05$) of disease inhibition activities against *U. appendiculatus* on bean leaves and pods. The most effective treatment was *M. volkensii* followed by *B. angustifolia- Z. chalybeum.* There were significant differences among treatments in

marketable yields. The high regressions between stomatal conductance and rate of transpiration in the all treatments indicated that stomatal conductance and rate of transpiration were interdependent and it was interpreted to mean that stomatal conductance enhanced rate of transpiration at different times of the day. A total of eight treatments were used in the study. A combination of *Z. chalybeum and M. volkensii* appeared to have caused reduction in bacterial population. *M. volkensii* and *B. angustifolia* - *Z. chalybeum* treatments caused significant increase in fungal population. In general, results revealed bioactive potential of the flora from *M. volkensii* and a combination between *B. angustifolia* and *Z. chalybeum* to produce metabolites with potential applications as botanical pesticides.