Research Application Summary pp: 313 - 316

Weeds as potential biopesticides in Taro leaf blight disease management

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Abstract

Weeds play an important role as biopesticides for the management of several field pests. An experiment was conducted in the Life Science Laboratories of the University of Buea in 2012 to assess the biopesticidal potential of aqueous extracts of *Mitracarpus villosus* (Sw.) DC. and *Ageratum conyzoides* L. in the management of leaf blight disease of Taro (*Colocasia esculenta* L. Schott). The weeds were screened at full strength concentration (100%). The positive control was a commercial fungicide (Mancozan, active ingredient mancozeb in the subclass dithiocarbamate pesticides) while the negative control was set up using blank agar plates containing only PDA (no extract or fungicide). Results revealed that at 7 and 10 days after exposure, crude extracts of both weed species and the fungicide significantly inhibited mycelia growth of the fungus compared to the untreated control (*P*d"0.05). However, *Mitracarpus villosus* was 64% more effective at inhibiting the fungal growth than *Ageratum conyzoides*, similar to the positive control which recorded complete inhibition. *Mitracarpus villosus* showed a promising anti-microbial activity and an indicator of a potential new chemical entity for the management of taro blight disease and should therefore be exploited for possible lead compound discovery pipeline.

Key words: Aqueous extracts, cocoyam, *Colocasia esculenta*, weeds

Résumé

Les mauvaises herbes jouent un rôle important en tant que biopesticides contre les organismes nuisible sur le champ. Une expérience a été menée au Laboratoire des Sciences de la Vie de l'Université de Buéa en 2012 à l'effet d'évaluer le potentiel biopesticidal des extraits gazeux du *Mitracarpus villosus* (Sw.) DC. et *Ageratum conyzoides L.* dans la gestion du dépérissement foliaire du taro. Le traitement s'est effectué en concentration maximale (100%). Le contrôle positif était un fongicide commercial (Mancozan, produit actif mancozèbe) tandis que le contrôle négatif n'avait ni extrait ni fongicide. Les résultats montrent que 7 à 10 jours après l'exposition, les extraits bruts des deux espèces d'herbe et le fongicide ont inhibé de manière significative la croissance mycélienne des champignons microscopiques en comparaison avec le contrôle non traité (*P*d"0.05). Toutefois, le *Mitracarpus villosus* s'est montré 64% plus efficace dans l'inhibition de la croissance fongique que l'*Ageratum*

conyzoides, à l'image du contrôle positif qui a enregistré une inhibition complète. Le *Mitracarpus villosus* a fait montre d'une activité anti-microbienne prometteuse et d'un indicateur d'une nouvelle entité chimique potentiellement efficace dans la gestion du dépérissement foliaire et devrait par conséquent faire l'objet d'une exploitation prioritaire dans le cadre de la recherche d'un traitement à la pathologie sus-évoquée.

Mots clés: Extraits gazeux, macabo, *Colocasia esculenta*, mauvaises herbes

Background

Food production in Africa should increase in order to keep up with the growing population. Taro is a key component of livelihoods for millions of people in developing countries especially in Africa and South East Asia. It is an economic crop in Cameroon which has gained a lot of popularity but recently its production has been seriously affected by leaf blight disease caused by *Phytophthora colocasiae*. The disease reduces corm yield by up to 50% (Singh *et al.*, 2006), leaf yield by 95% and causes post harvest biodeterioration of corms. Appropriate management methods that are cost effective and environmentally friendly need to be identified. The use of plant extracts as biopesticides offer farmers many benefits. Plant extracts are cheap, fast-acting, do not leave residues on food and are environmentally friendly. Weed Science has generated several innovations which have contributed significantly to food production and alleviation of hunger. Weeds are one of the major constraints limiting crop production in sub-Saharan Africa. Examples include congongrass (*Imperata cylindrica* L. Raeusch.), guinea grass (*Panicum maximum* Jacq.), and goatweed (*Ageratum conyzoides* L.). Studies have indicated that severe weed infestation causes 50–100% yield losses in some crops such as maize (*Zea mays*) (Chikoye *et al*., 2000). Weeds are also considered as 'hidden vectors of disease transmission' and promote over-seasoning of the diseases in the field. Although some species are poisonous and compete with crops, some have pesticidal properties and are easily biodegradable, and considered safe to handle and use on food products. The objective of this study was to determine the efficacy of aqueous leaf extracts of two weed species on leaf blight disease of Taro.

Study description

This study was conducted in the Life Science Laboratories of the University of Buea, in the South West Region of Cameroon. The treatments were aqueous crude extracts of *Mitracarpus villosus* (Sw.) DC and *Ageratum conyzoides* L. and; a negative control was set up using blank agar plates containing PDA with no extract while the positive control consisted of the fungicide Mancozan. The experimental design was a randomized complete block with three replications. The fungus was isolated from diseased taro leaves to produce axenic culture. The fungus was identified with the aid of a compound microscope and identification guides (Sulton, 1980). The medium used was potato dextrose agar. Crude extracts of the plants were prepared using the procedure described by Okigbo *et al*. (2009). The effect of the extracts on fungal growth was determined using the method of Sangoyomi (2004). The plates were incubated at room temperature immediately after inoculating the fungus and examined daily at 8:00 a.m. for the development of fungal growth. Radial growth

was measured at 7 and 10 days after exposure (DAE). Colony diameter was obtained as described by Okigbo et al. (2009). The percentage of inhibition was determined according to the method proposed by Suleiman and Emua (2009).

Research application

The study revealed the potential of crude extracts of both weeds in the management of leaf blight disease of Taro at 7 and 10 DAE (Figs. 1 and 2) The use of *Mitracarpus villosus* resulted in a higher inhibition of the fungal growth than *Ageratum conyzoides* by 66% at 7 DAE and 64% at 10 DAE. The fungicide Mancozan completely (100%) inhibited mycelia growth of the fungus up to 10 DAE and this was comparable to *Mitracarpus villosus* (95%). *Mitracarpus villosus* was effective in inhibiting growth of the fungus while *Ageratum conyzoides* was only moderately effective. This is a baseline preliminary study which has shown that *Mitracarpus villosus* is a potential biopesticide for lead compound discovery.

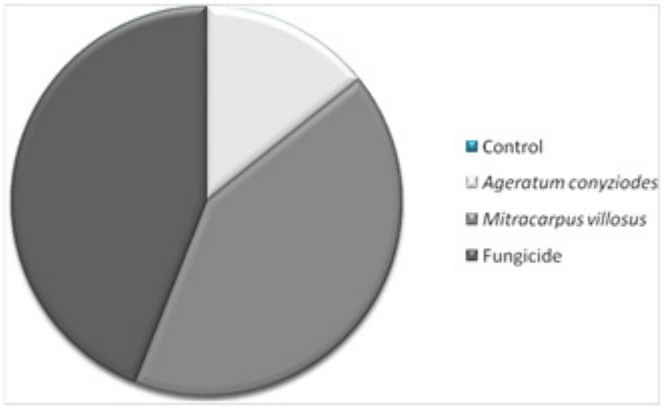

Figure 1. Antifungal effect of aqueous extracts of weed species at 7 days after exposure.

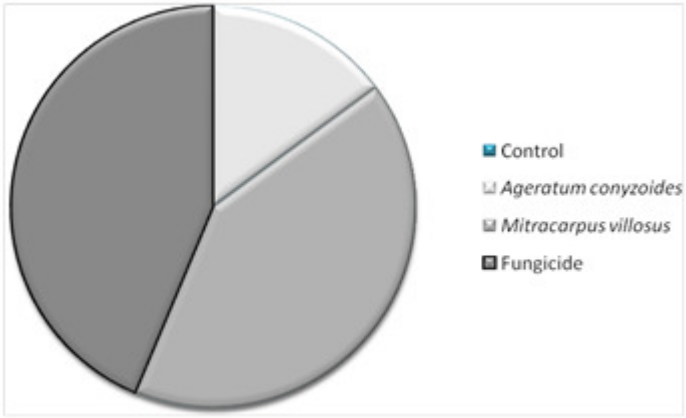

Figure 2. Antifungal effect of aqueous extracts of weed species at 10 days after exposure.

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