



Detection of toxic monofluoroacetate in *Palicourea* species

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ABSTRACT

Numerous plant species worldwide including some *Palicourea* (Rubiaceae), *Tanaecium* (Bignoniaceae), and *Amorimia* (Malpighiaceae) species in Brazil cause sudden death and are known to contain monofluoroacetate (MFA). Two species of *Palicourea*, *Palicourea aeneofusca* and *Palicourea marcgravii*, cause sudden death and are reported to contain MFA while other *Palicourea* species are reported to cause sudden death in livestock and are suspected to contain MFA due to the similarity in clinical signs. Using an HPLC–APCI–MS method to detect MFA, herbarium specimens representing 46 *Palicourea* taxa were screened for the presence of MFA. Additionally we screened five *Psychotria* taxa that are closely related to *Palicourea* species. Ten species of *Palicourea* were identified that contained MFA, two previously reported and eight newly reported here; these are closely related to each other, though some other related species did not contain MFA.

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1. Introduction

Numerous plant species worldwide cause sudden death syndrome in livestock (Burrows and Tyrl, 2013). Clinical signs associated with sudden death are loss of balance, ataxia, labored breathing, muscle tremors, and recumbency leading to death (Tokarnia et al., 1990, 2002, 2012; Vasconcelos et al., 2008; Riet-Correa et al., 2009). Several of these plant species are suspected or have been reported to contain the toxic organofluorine compound monofluoroacetate (MFA; Twigg et al., 1996). *Dichapetalum cymosum* (Dichapetalaceae) native to southern Africa (Marais, 1944), and *Acacia georginae* and *Gastrolobium* species (Fabaceae), including *Gastrolobium parviflorum* and *Gastrolobium grandiflorum* native to Australia (Alpin et al., 1983), all contain potentially lethal concentrations of MFA.

Additionally, several Brazilian taxa are reported to contain MFA. *Palicourea* species (Rubiaceae) including

Palicourea marcgravii (Oliveira, 1963; Moraes-Moreau et al., 1995; Lee et al., 2012) and *Palicourea aeneofusca* (Lee et al., 2012) contain MFA (Fig. 1). *P. marcgravii* represents the first poisonous plant studied in Brazil as well as the single most important toxic plant in Brazil due to its acute toxicity, palatability, and broad geographical distribution (Tokarnia et al., 2012). Some other *Palicourea* species are also significant poisonous plants but have a more limited distribution than *P. marcgravii*. For example, *P. aeneofusca* is found in the eastern coastal region of Pernambuco, Paraíba, and other neighboring states of Brazil (Tokarnia et al., 2012; Riet-Correa et al., 2009). Other Brazilian taxa that are known to contain MFA are *Tanaecium bilabiatum* (synonym *Arrabidaea bilabiata*; Bignoniaceae; Krebs et al., 1994) and several *Amorimia* species (previously *Mascagnia*; Malpighiaceae; Castro da Cunha et al., 2012; Lee et al., 2012).

Two other species, reported as *Palicourea grandiflora* and *Palicourea juruana*, that occur primarily in the Amazon region are reported to cause sudden death in livestock (Tokarnia et al., 2012). These two species are suspected to contain MFA due to the similarity of clinical signs in

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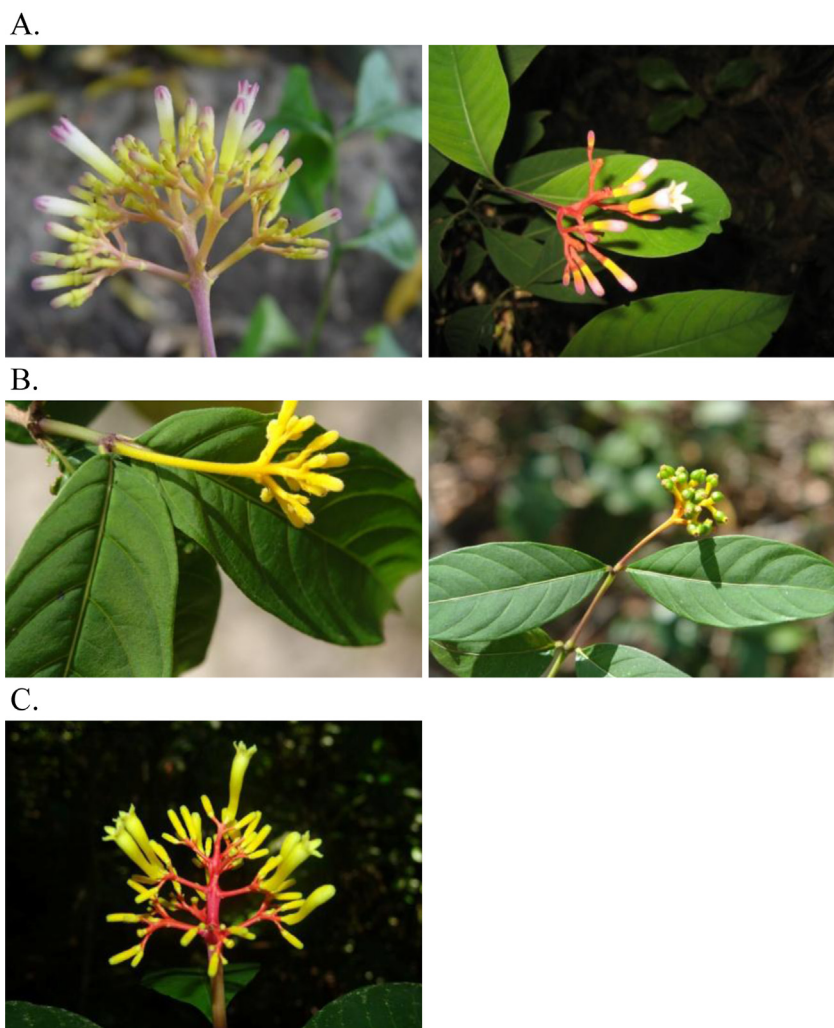


Fig. 1. Photos of A) *Palicourea marcgravii*, B) *Palicourea aeneofusca*, and C) *Palicourea grandiflora*.

herbivores when the plants are consumed, but the presence of MFA has not been verified (Tokarnia et al., 1981; Döbereiner and Tokarnia, 1982; Tokarnia and Döbereiner, 1982). In contrast, two other *Palicourea* species, *Palicourea crocea* and *Palicourea guianensis*, are found widely in the same region but have been reported not to cause sudden death, however the presence or absence of MFA in these other species has not been verified (Tokarnia et al., 2012).

At present, there is limited information about the distribution of MFA in *Palicourea* species; further, little is known about the potential use of MFA from these plants as a chemo-systematic marker. The use of MFA as a chemo-systematic marker in plant species could be valuable to distinguish species that are difficult to identify using traditional morphological methods. Therefore, the objective of this research was to screen a selected set of *Palicourea* taxa for the presence or absence of MFA. *Palicourea* taxa screened were from the subgenus *Palicourea* (Taylor, 1997) because at least some of these *Palicourea* species have been reported to contain MFA and/or cause

sudden death. Additionally we screened five *Psychotria* taxa (Rubiaceae) that are closely related to *Palicourea* species; the classification of *Psychotria* and *Palicourea* in the Neotropics is complex and not fully resolved, and some species currently classified in *Psychotria* are more closely related to *Palicourea* (Taylor, 1996; Taylor et al., 2010; Taylor, 2013).

2. Materials and methods

2.1. Plant material

Samples ($n = 288$) representing 46 *Palicourea* taxa and 5 *Psychotria* taxa were provided courtesy of the herbarium at the Missouri Botanical Garden (MO). The species of *Palicourea* sampled either have been reported to have MFA, or are classified as closely related species in which MFA has been reported. The species of *Psychotria* sampled provide a test for the presence of MFA in related taxa. Vegetative tissues were sampled from the specimens. The number of

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