



## NMR structural elucidation of channaine, an unusual alkaloid from *Scetium tortuosum*

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### ABSTRACT

Chemical interrogation of the *Scetium* genus of the Amaryllidaceae family of plants has yielded a diverse array of aryl-hydroindole containing alkaloids. Included in this class is channaine, which was tentatively identified, without comprehensive structural elucidation from *Scetium tortuosum* in 1957. Following its isolation from *S. strictum*, the structure of channaine was eventually resolved by X-ray crystallographic analysis, which revealed an unusual cage-like ring structure. At the interface of two aryl-hydroindole subunits. However, since this report in 1978, channaine has not reappeared in the literature. In this letter, the full NMR characterisation of channaine, isolated from *S. tortuosum* collected from St Helena in the Western Cape Province of South Africa, is reported for the first time.

### 1. Introduction

The genus *Scetium*, which is endemic to South Africa, has garnered significant interest as a plant for ethnopharmacological enquiry (Gericke and Viljoen, 2008; Harvey et al., 2011). Numerous related alkaloids have been isolated and characterised from the genus *Scetium*, and from the Amaryllidaceae family, which is richly represented in South Africa (Fig. 1). These alkaloids have complex core structures and their diverse biological activities have resulted in innumerable studies into their chemical synthesis and biosynthesis (Das et al., 2015; Denmark and Marcin, 1997; Jeffs, 1981; Jin, 2016, 2013, 2009, 2007, 2005). The most prominent alkaloids of this class, including mesembrone (1) and mesembrine (2) feature a distinct 3 ring aryl-hydroindole scaffold. However, several others, including the unnamed alkaloid (3) and scetium alkaloid A-4 (4), feature an additional fourth ring attached to the parent scaffold. Furthermore, more diverse alkaloids of this class such as maritidine (5) and crinine (6) feature a fused azabicyclicococaine ring, formed through a bond between the hydroindole nitrogen and position 6 of the respective aryl rings. Further diversity in

the ring systems is observed in the unusual gracilamine (7), which features an esterified methyl leucine residue at the 6 position of the aryl ring, which in turn, forms covalent bonds with 2 positions on the hydroindole to form a complex 6-ring system.

In 1957, Bodendorf and Krieger (1957) reported the isolation of a new alkaloid from *Scetium tortuosum*, with an empirical formula of  $C_{18}H_{18}N_2NO_2$ , of which the infrared spectrum contained both NH and OH functional groups, in the absence of corresponding carbonyl bands. This compound was assigned the trivial name channaine (8). This was followed by a review article by Popelak and Lettenbauer (1967), who had determined that channaine contained two veratrole rings, and was likely a dimer of two  $C_{14}H_{14}NO_2$  subunits. They also reported that channaine was racemic in nature.

Acknowledging that a dimer of this nature would likely result in the characterisation of a new ring system for this class, Jeffs and McPhail were interested in identifying channaine in their thorough exploration of *S. namaquense* (Capps et al., 1977; Jeffs et al., 1971). Although initially unsuccessful, Jeffs and McPhail did manage to isolate an alkaloid from *S. strictum* with spectral data and physical properties that matched

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