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Evaluation of phytochemical and ethnomedicinal uses of *Bersama swinnyi* E. Phillips (Francoaceae)

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ABSTRACT

Bersama swinnyi is a small to medium-sized tree endemic to evergreen forests of the Eastern Cape and KwaZulu-Natal provinces of South Africa. The species is widely used as traditional medicine throughout its distributional range in the country. A systematic review of the literature studies was carried out to document the phytochemical and ethnomedicinal uses of *B. swinnyi*. The results of the current study are based on literature survey conducted using various search engines such as Web of Science, Elsevier, Pubmed, Google Scholar, Springer, Science Direct, Scopus, Taylor and Francis, and pre-electronic sources such as books, book chapters, scientific journals and other grey literature obtained from the University library. The bark and root extracts of *B. swinnyi* are mainly used as aphrodisiac, charm and ritual purposes, and traditional medicine for infertility, impotence, leprosy and menstrual problems. Chemical constituents identified from *B. swinnyi* include 23-hydroxy betulinaldehyde, 24-propylcholestan-7,15,20-triol, betunal, lupeol, oleanolic acid and swinniol. *Bersama swinnyi* is a valuable medicinal plant species and future research should focus on more exploratory research to gain a better understanding of the ethnopharmacological properties of the species. There is also a need for extensive toxicological evaluations of crude extracts and compounds isolated from the species since *B. swinnyi* contains potentially toxic compounds.

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INTRODUCTION

Bersama swinnyi E. Phillips is a small to medium-sized tree belonging to the Francoaceae family. Francoaceae is a small family consisting of about seven genera, namely *Balbisia* Cav., *Bersama* Fre-

sen., *Francoa* Cav., *Greyia* Hook. & Harv., *Melianthus* L., *Tetilla* DC. and *Viviania* Cav (Chase *et al.*, 2016). Several researchers in the past placed the genus *Bersama* in the Melianthaceae family (Phillips, 1922; Verdcourt, 1950). But numerous morphological characters such as habit and leaf form, inflorescence and floral characteristics, phytochemical constituents and molecular data supported placing of the genus *Bersama* in Francoaceae instead of Melianthaceae family (Chase *et al.*, 2016; Maroyi, 2020). The genus *Bersama* consists of shrubs and small trees recorded in the Afromontane vegetation, tropical lowland habitats and margins of evergreen forests in sub-Saharan Africa but conspicuously absent in the Congo basin (Decraene *et al.*, 2001; Linder, 2007). Seven species which include *B. abyssinica* Fresen., *B. lucens* (Hochst.) Szyszyl., *B. palustris* L. Touss., *B. swinnyi*, *B. swynnertonii* Baker f., *B. tysoniana* Oliv, and *B. yangambiensis* L., Touss.

are recognized within the *Bersama* genus (Verdcourt, 1957, 1989). The genus name *Bersama* refers to the Ethiopian name for this genus (Palmer and Pitman, 1972). The species name *swinnyi* is in honour of a British born South African forester and naturalist Henry Hutchinson Swinny (1876-1958) who claimed that the species consisted of two forms, one form growing up to 27 metres in height with a stem diameter of one metre and the second form characterized by a trunk diameter of 0.3 to 0.5 metres (Palmer and Pitman, 1972).

Bersama swinnyi is a small to medium-sized tree endemic to evergreen forests, forest margins and sandstone outcrops of the Eastern Cape and KwaZulu-Natal provinces of South Africa (White, 1966; White and Styles, 1986). The English common names of *B. swinnyi* include “bitter-bark”, “coast bersama”, “coastal bersama”, “coastal white ash” and “Swinny’s bersama” (Grace *et al.*, 2003; Grace, 2002). The stems are tall and slender reaching a height of 15 metres (Palgrave, 2002). The bark of *B. swinnyi* is brown, rough and furrowed, the branches velvety when young but becoming smooth with age. The leaves of *B. swinnyi* are compound, made up of 4 to 7 pairs of leaflets and a terminal leaflet, crowded towards the ends of the branches. The leaflets are opposite or nearly opposite, elliptic or oblong in shape, the tips rounded or pointed and sometimes notched. The base of the leaflet is rounded or slightly narrowed, untoothed, the midrib and lateral veins distinct, smooth, the common leaf stalk hairy when young and smooth when mature. The flowers are bisexual, in stout axillary racemes, clustered in spikes at the tips of branches, greenish white in colour, interspersed with silvery and silky bracts (Van Wyk and Van Wyk, 2007, 2013). The fruits are four-valved capsules, knobby, brown and woody, which split open when mature and partly enveloped by a yellowish aril. The seeds are oval in shape and red-brown in colour. *Bersama swinnyi* is sometimes confused with *B. tysoniana* Oliv. but the bark of the former species is characterized by a burning taste lacking in the later species. This burning taste is characteristic of *B. swinnyi* and is said to be very strong, and dull the taste for hours after the bark has been placed in the mouth (Palmer and Pitman, 1972; Palgrave, 2002). The harvested bark of *B. swinnyi* is readily diagnosed by the presence of calcium oxalate crystals, visible in the broken cross section of dried material (Cunningham, 2001; Grace *et al.*, 2003). The species has been recorded at an altitude ranging from 150 m to 1405 m above sea level (Germishuizen and Meyer, 2003).

The bark of *B. swinnyi* is traded in informal herbal medicine markets in the Gauteng (Williams

et al., 2001; Williams, 2003) and KwaZulu Natal provinces (Cunningham, 1993; Netshiluvhi, 1996) in South Africa. Research towards end of the 20th century and beginning of 21st century revealed that *B. swinnyi* population was declining in the KwaZulu-Natal province (Cunningham, 1988; Monkhe, 1997). *Bersama swinnyi* was heavily exploited as commercial source of bark products sold in informal herbal medicine markets in both the KwaZulu-Natal and Gauteng provinces. Over-exploitation of the species for commercial purposes led to the species becoming rare in the wild (Cunningham, 1988; Monkhe, 1997). Research by Ndawonde (2006) categorized *B. swinnyi* as a species facing an extremely high risk of extinction in the wild and in need of protection in the northern Zululand. Although several reports highlighted that *B. swinnyi* is threatened with extinction mainly because it is endemic and experiencing significant habitat loss and overexploited as herbal medicines, but the IUCN Red List Categories and Criteria version 3.1 of threatened species used to assess the conservation status of the species by Raimondo *et al.* (2009) revealed that the species is of Least Concern (LC) as the population numbers of the species stabilized over the years. *Bersama swinnyi* is listed as an important medicinal plant species in South Africa and the general characteristics of the species are outlined in the monograph “medicinal plants of South Africa” (Van Wyk *et al.*, 2013). Therefore, the aim of this review is to provide a comprehensive appraisal of the phytochemical and ethnomedicinal uses of *B. swinnyi*.

MATERIALS AND METHODS

Several electronic databases were searched which included Web of Science, Elsevier, Pubmed, Google Scholar, Springer, Science Direct, Scopus, Taylor and Francis. Additional information was obtained from pre-electronic sources such as books, book chapters, scientific journals and other grey literature obtained from the University library. The relevant terms *Bersama swinnyi* were paired with keywords such as “medicinal uses of *Bersama swinnyi*”, “phytochemicals of *Bersama swinnyi*”, “biological activities of *Bersama swinnyi*”, “ethnobotany of *Bersama swinnyi*”, and various other synonyms and common names of the plant species. The ultimate goal of this search was to explore articles that investigated the phytochemical and ethnomedicinal uses of *B. swinnyi*.

RESULTS AND DISCUSSION

Medicinal uses of *Bersama swinnyi*

The bark or root decoction or infusion of *B. swinnyi*

Table 1: Medicinal uses of *Bersama swinnyi*

Medicinal use	Part used	Reference
Aphrodisiac	Bark infusion taken orally	(Hutchings <i>et al.</i> , 1996; Ajao <i>et al.</i> , 2019)
Charm and ritual (protection against lightning)	Bark	(Zukulu <i>et al.</i> , 2012)
Headache	Bark and root infusion taken orally	(Koorbanally <i>et al.</i> , 2008)
Impotence	Bark decoction or infusion taken orally	(Bryant, 1966; Abdillahi and Staden, 2012)
Infertility	Bark and root decoction or infusion taken orally	(Watt and Breyer-Brandwijk, 1962; Hutchings <i>et al.</i> , 1996)
Leprosy	Bark and root infusion taken orally	(Hutchings <i>et al.</i> , 1996; Koorbanally <i>et al.</i> , 2008)
Menstrual problems	Bark and root decoction or infusion taken orally	(Watt and Breyer-Brandwijk, 1962; Cunningham and Davis, 1997)
Nervous disorders	Bark and root decoction taken orally	(Koorbanally <i>et al.</i> , 2008)
Strokes	Bark and root decoction taken orally	(Koorbanally <i>et al.</i> , 2008)

Table 2: Phytochemical compounds isolated from *Bersama swinnyi*

Phytochemical compound	Plant part	References
23-hydroxy betulinaldehyde	Bark	(Monkhe <i>et al.</i> , 1998; Monkhe, 1997)
24-propylcholestan-7,15,20-triol	Bark	(Koorbanally <i>et al.</i> , 2008)
Betunal	Bark	(Monkhe <i>et al.</i> , 1998; Monkhe, 1997)
Lupeol	Bark	(Monkhe <i>et al.</i> , 1998)
Oleanolic acid	Leaves	(Monkhe <i>et al.</i> , 1998; Monkhe, 1997)
Swinniol	Bark	(Monkhe <i>et al.</i> , 1998; Monkhe, 1997)

is mainly used as aphrodisiac, charm and ritual

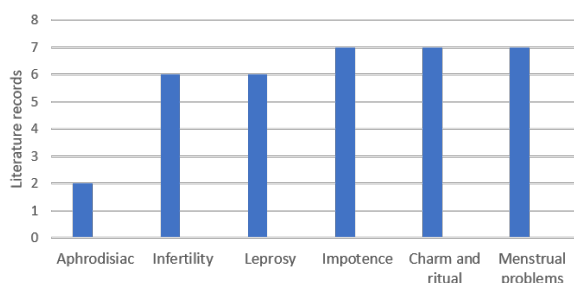


Figure 1: Medicinal uses of *Bersama swinnyi* based on literature records

purposes, and traditional medicine for infertility, impotence, leprosy and menstrual problems (Table 1; Figure 1). Other medicinal applications of the bark or root decoction or infusion of *B. swinnyi* include headache, nervous disorders and

stroke (Koorbanally *et al.*, 2008).

Phytochemistry of *Bersama swinnyi*

A variety of chemical compounds have been isolated and identified from *B. swinnyi* (Table 2; Figure 2). These phytochemical compounds identified from the bark and leaves of *B. swinnyi* include 23-hydroxy betulinaldehyde, 24-propylcholestan-7,15,20-triol, betunal, lupeol, oleanolic acid and swinniol. Research by Sharma *et al.* (2020) showed that lupeol and its derivatives are characterized by biological activities such as anti-inflammatory, immunomodulating, antimicrobial, anti-invasive, antiprotozoal, anti-angiogenic, cholesterol-lowering and anti-proliferative activities. Similarly, research by Ayeleso and Matumba (2017) showed that the compound oleanolic acid and its derivatives are characterized by anti-hypertensive, anti-tumour, anti-diabetic, anti-inflammatory, anti-cancer,

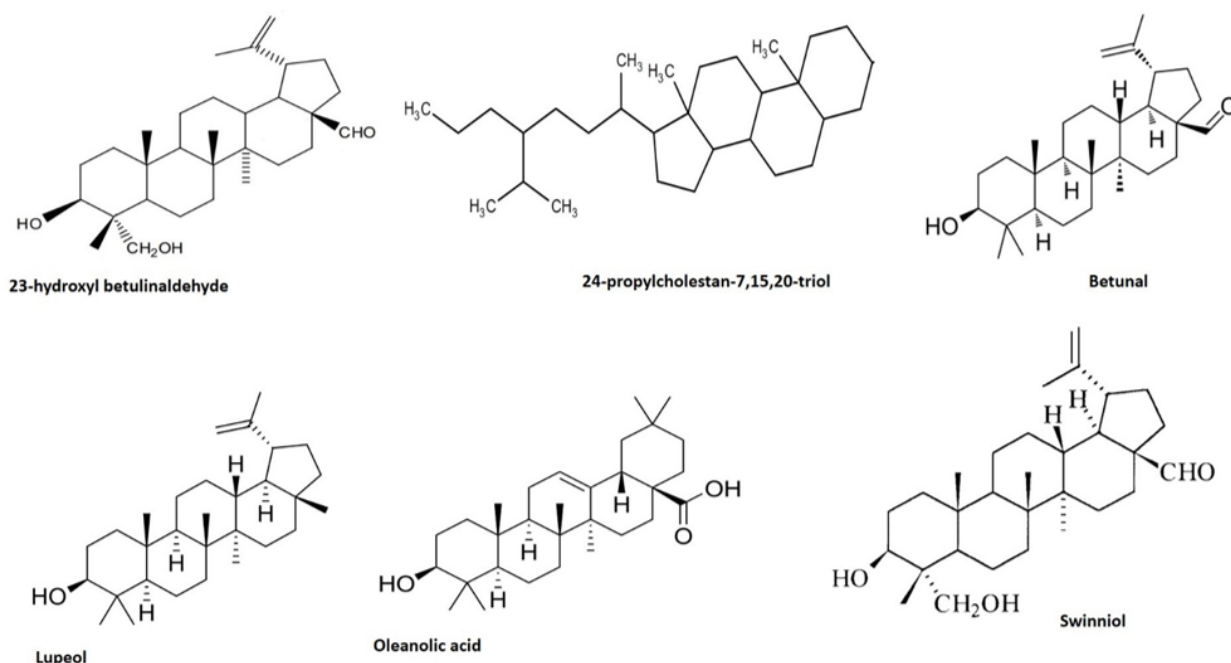


Figure 2: Chemical structures of phytochemical compounds isolated from the bark and leaves of *Bersama swinnyi*

antimicrobial, anti-parasitic, hepatoprotective and antioxidant activities. Therefore, the extracts of *B. swinnyi* and phytochemical compounds such as lupeol and oleanolic acid have potential to exhibit numerous pharmacological properties.

CONCLUSION

This review showed that *B. swinnyi* is widely used as herbal medicine and the species is characterized by several phytochemical compounds. Documentation of the medicinal uses, phytochemistry and pharmacological properties of *B. swinnyi* is crucial as this information forms the baseline data required for future research and development of health-promoting and pharmaceutical products. Findings from this study showed that there are still some research gaps in the phytochemistry, pharmacological and toxicological properties of the species. More rigorous research is required aimed at evaluating various plant parts used as herbal medicines, assessing their phytochemistry, pharmacological and toxicological properties.

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Conflict of Interest

The authors declare that there is no conflict of interest for this study.

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