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Chromolaena odorata (L.) R.M. King & H. Rob. (Asteraceae) in sub-Saharan Africa: A synthesis and review of its medicinal potential

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ABSTRACT

Ethnopharmacological relevance: Chromolaena odorata (L.) R.M. King & H. Rob. (Asteraceae) is a scrambling perennial shrub that originated in the Americas, but is now common in sub-Saharan Africa, Asia and Oceania, where it has become a serious weed. The species, particularly the biotype found in Asia and West Africa, has many ethnopharmacological uses, including treatment of malaria, wounds, diarrhoea, skin infection, toothache, dysentery, stomach ache, sore throat, convulsions, piles, coughs and colds. Furthermore, no attempt has been made to synthesise and review the available literature on the usefulness of the plant in the sub-Saharan African region, hence this paper examines the beneficial attributes of *C. odorata* in sub-Saharan Africa.

Material and methods: Published information on the species was gathered by the use of different database platforms, including Google Scholar, ScienceDirect, SciFinder and Scopus.

Results: Records indicate that two biotypes of *C. odorata* are present in sub-Saharan Africa *viz.* the more widespread Asian/West African *C. odorata* biotype (AWAB) and the southern African biotype (SAB). While the usefulness of the former is well elucidated in the literature, such information on the latter is still scarce. Although the importance of AWAB *C. odorata* as a fallow species and as a soil fertility improvement plant in the slash and burn rotation system of agriculture in West Africa is increasingly being recognised, its usage in traditional medicinal practice is far more appreciated. The species has a wide range of ethnopharmacological uses, possibly because of the presence of flavonoids, essential oils, phenolics, tannins and saponins. The plant is reported to have antibacterial, anti-inflammatory, antioxidant, anthelminthic, antifungal, cytotoxic, anticonvulsant, antiprotozoal, antispasmodic, antipyretic and analgesic properties.

Conclusion: While the results of this review suggest that the AWAB plant can be exploited as an alternative to other threatened plant species known to possess similar medicinal potential, the medicinal and pharmacological potential of the SAB plant remains to be established. Further studies on the phytochemistry and pharmacological properties of the SAB plants will not only advance our knowledge of ethnobotany and ethnomedicine, but may also improve the health and knowledge of the local people.

1. Introduction

Chromolaena odorata (=*Eupatorium odoratum*) (Asteraceae) is an invasive perennial shrub native to the Americas (McFadyen, 1989). It is considered to be a significant economic and ecological burden to many tropical and sub-tropical regions of the world where it impacts negatively on agriculture, biodiversity and livelihoods (Zachariades et al., 2009; Uyi and Igbinosa, 2013). Following its introduction into West Africa in the 1930s (Ivens, 1974) and South Africa in the 1940s (Zachariades et al., 2011), the species has spread into many sub-Saharan African countries (Timbilla et al., 2003; Uyi and Igbinosa, 2013; Zachariades et al., 2013). The biology of *C. odorata,* and aspects of its ecology, has been studied (Gautier, 1992; Witkowski and Wilson, 2001; Rambuda and Johnson, 2004) and reviewed in Timbilla et al. (2003) and Zachariades et al. (2009). The plant grows best in sunny or open areas such as roadsides, abandoned fields, pastures, and disturbed forests, but tolerates semi-shade conditions. A single shrub can produce as many as 80 000 seeds in one season (Witkowski and Wilson, 2001). The species has the tenacity to invade human-induced disturbed and undisturbed lands, posing a significant economic and ecological burden in many countries in its introduced ranges.

The status of *C. odorata* as an agricultural and environmental weed has been a subject of burgeoning concern in the past four

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decades in west and southern sub-Saharan Africa, probably because of its invasiveness in agro-ecosystems and conservation areas (Ivens, 1974, Lucas 1989; Goodall and Erasmus, 1996; Timbilla et al., 2003; Uyi et al., 2014). The invasive success of *C. odorata* is thought to depend upon a combination of several factors such as; (i) high reproductive capacity; (ii) high growth and net assimilation rates; (iii) its capacity to suppress native vegetation through competition for light and allelopathic properties; and (iv) its ability to grow in many soil types and in many climatic zones (Zachariades et al., 2009; Uyi et al., 2014).

While *C. odorata* has been declared a 'Category 1' weed under the Conservation of Agricultural Resources Act (CARA) and the National Environmental Management Biodiversity Act (NEMBA) on Alien and Invasive Species List in South Africa because of its invasiveness in the north-eastern parts of the country (Goodall and Erasmus, 1996; Nel et al., 2004; Zachariades et al., 2011), the situation in West Africa remains contentious despite numerous research reports and the perceived usefulness of the plant in the latter region (Uyi et al., 2014). In view of its coverage of large areas, and its invasive propensity, the use of chemical, mechanical and other conventional methods of controlling the weed have proven not to be sustainable (Timbilla et al., 2003; Zachariades et al., 2009; Uyi and Igbinosa, 2013). Hence, the use of biological control methods (using natural enemies to feed on the species) has been advocated as an important long-term management strategy for controlling the weed (Seibert, 1989).

Despite its invasive or weedy status, *C. odorata* is seen by locals in parts of Asia and sub-Saharan Africa as a plant with potential medicinal properties. The species has also been the subject of numerous ethnobotanical and ethnopharmacological investigations in some countries in West Africa and southeast Asia (Phan et al., 1998; Akinmoladun et al., 2007; Idu and Onyibe, 2007; Raina et al., 2008; Panda et al., 2010; Anyasor et al., 2011; Vijayaraghavan et al., 2013). While the negative impact of *C. odorata* has received considerable attention in sub-Saharan Africa (Ivens, 1974; Lucas, 1989; Goodall and Erasmus, 1996; Zachariades et al., 2011; Uyi and Igbinosa, 2013), no attempt has been made to synthesise or review literature on the medicinal potential of *C. odorata* in the sub-Saharan African countries. With the exception of the limited reviews on *C. odorata* by Chakraborty et al. (2011) and Vaisakh and Pandey (2012) in Asia, we are not aware of any study that has extensively reviewed the medicinal potential of this plant species worldwide. Furthermore, studies on the medicinal attributes of *C. odorata* in Africa are beginning to be explored and some important medicinal properties of the plant have been documented, supporting the necessity for a comprehensive evaluation of the species. This paper reviews the beneficial attributes of *C. odorata* in some sub-Saharan African countries and discusses the medicinal importance, phytochemistry and bioactivities of the plant.

2. Methods

Published information on *C. odorata* was gathered using different database platforms, including Google Scholar, ScienceDirect, SciFinder and Scopus. All papers that mention *C. odorata* and its weed status, distribution or beneficial attributes in any capacity (for example spread, medicinal potential and invasive status) were included in the selection process.

3. Results and discussion

3.1. Genetic and morphological dissimilarity in C. odorata

Two biotypes of *C. odorata* are known in their invasive range of distribution, *viz.* the Asian/West African biotype (AWAB) and the

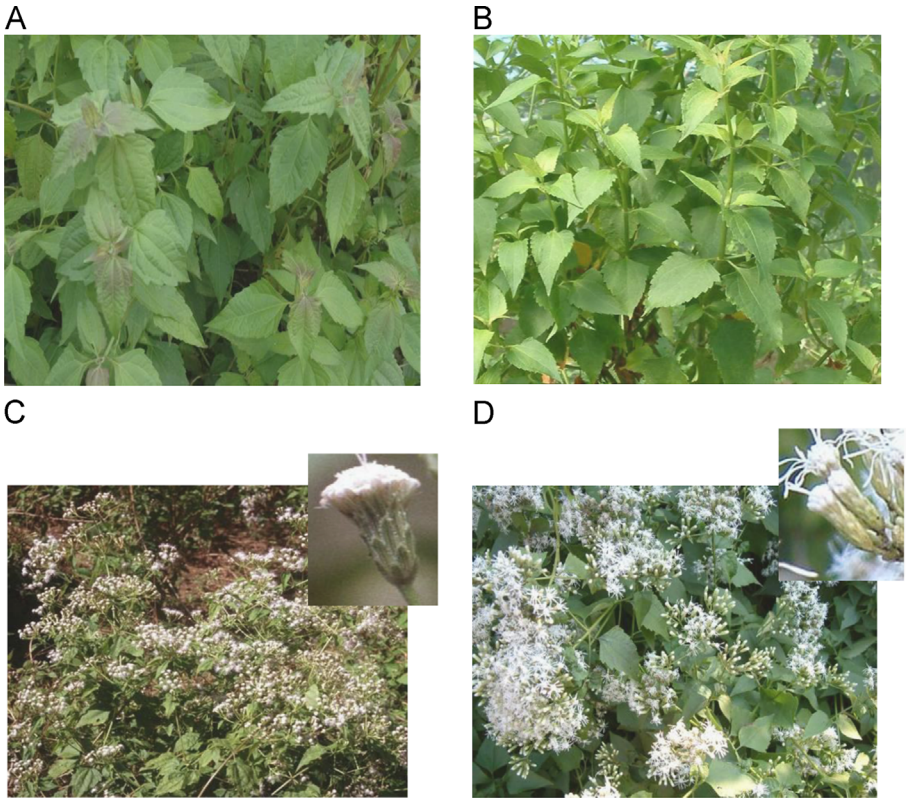

Fig. 1. (A and C) Leaves and Flowers of the Asian/West African Biotype. (B and D) Leaves and Flowers of the Southern African Biotype. (Fig. 1 A and C photos were taken by Colin Wilson, Parks and Wildlife Commission of the Northern Territory, Australia; Fig. 1B and D photos were taken by Costas Zachariades, ARC-Plant Protection Research Institute, South Africa).