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Major Volatile Constituents and Biological Activities of Plant *Chromolaena odorata* (L.) R.M. King & H. Rob

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Review Article

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ABSTRACT

Chromolaena odorata (L.) R.M. King & H. Rob. (Asteraceae) is a perennial herb, and used in traditional medicine. *C. odorata* has lead to identification of several compounds especially in the essential oils from various plant parts, and in this article the major compounds are compiled. The biological activities of the various extracts and essential oils are also discussed in brief.

INTRODUCTION

Chromolaena odorata (L.) R.M. King & H. Rob. (Syn: *Eupatorium odoratum* L.) (Asteraceae) is a perennial herb may reach up to 3 m. The leaves are opposite, deltoid ovate, triangular or lanceolate, achenes with 4 mm long, 4-5 ribbed, bristly on ribs and has many white hairy pappus. This plant is distributed throughout India, tropical Asia and Mexico. This plant is native from Florida through the West Indies and through Central and South America to Argentina [1-3]. The plant exhibited allelopathic effects and has been reported to cause livestock death [4]. Traditionally this plant is used in coughs and colds, treatment of skin diseases, wound healing and as a local antiseptic agent [5,6]. Extensive studies of the *C. odorata* have lead to identification of several compounds especially in essential oil from various plant parts. In this article, the major essential oil compounds reported from *C. odorata* over the past few years are compiled. The biological activities of the various extracts and essential oil are also discussed in brief.

MAJOR ESSENTIAL OIL CONSTITUENTS

The major chemical compositions of the essential oils of the aerial parts of *C. odorata* have been reported **(Figure 1).** α-pinene (1) and p-cymene (2) from Cameroon and Congo from Nigeria α-pinene (1), β-pinene (3), germacrene D (4), β-copaen-4α-ol (5), *β-caryophyllene* (6), geijerene (7) and pregeijerene (8), α-pinene (1), camphor (9), limonene (10), and β-caryophyllene (6) from Thailand pregeijerene (8), germacrene D (4), α-pinene (1), *β-caryophyllene* (6), vestitenone (11), *β-pinene* (3), δ-cadinene (12), geijerene (7), bulnesol (13), and *trans*-ocimene (14) from Ivory Coast α-pinene (1), geijerene (7), and pregeijerene (8) from India pregeijerene (8), *epi*-cubebol (15), cubebol (16) cis-sabinene hydrate (17), 10-*epi*-γ-eudesmol (18), germacrene-D-4-ol (19), δ-cadinene (12), germacrene D (4), geijerene (7), cyperene (20), α-muurolol (21), and khusimone (22) as the major constituents. The main compounds himachalol (23), 7-isopropyl-1,4-dimethyl-2-azulenol (24), andro encecalinol (25), and 2-methoxy-6-(1-methoxy-2-propenyl) naphthalene (26) have been reported from the roots of *C. odorata* [7-14].

BIOLOGICAL ACTIVITIES

C. odorata is a medicinal plant having diverse biological activities such as anthelmintic activity at 2.5 mg/ml concentration of extract against adult *Pheretima posthuma* [15]. Alcoholic (50%) extract of *C. odorata* was effective against *Neisseria gonorrhoeae*

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strains in vitro isolated from symptomatic patients. This plant is popularly used in Guatemala for the treatment of gonorrhoea [16]. The diuretic activity for the infusions of *C. odorata* was evaluated in albino rats. The extract showed a dose-dependent decrease diuretic effect and justifies the use of this plant as diuretic agent by the Malaysian traditional medicine [17]. Aqueous and methanolic extracts of *C. odorata* showed significant anti-inflammatory activity in various rat models and justifies the traditional uses of the plant in the treatment of wounds and inflammation [18,19]. Apart of this methanolic extract of *C. odorata* demonstrated significant antipyretic and antispasmodic activity [19]. The aqueous leaf extract of *C. odorata* showed wound healing effects in rabbits [20]. The crude extract of *C. odorata* showed strong antimicrobial effects against Propionibacterium acnes and *Staphylococcus epidermidis* recognized as pus-forming bacteria triggering an inflammation in acne [21]. Moreover, the essential oil of *C. odorata* demonstrated antibacterial activity against *Staphylococcus aureus* and *Escherichia coli* [9]. The *in vitro* cytotoxicity bioassays on human cell line HaCaT did not revealed any toxicity of *C. odorata* essential oil up to 3000 µL/mL [22].

CONCLUSION

A plant can be considered as a system where many biochemical reactions occur. The secondary metabolites are the product or byproduct of biosynthesis, where several factors alter the synthetic route, including soil, climate, rainfall, altitude, grazing frequency, and amount of sunlight, causing the plant to produce different metabolites. Based on the geoclimatic distribution of the flora, botanicals may be consumed by local residents to cure disease, and some plants are frequently used in food preparation [23]. The quantitative and qualitative divergence may be due to the geographical, climatic, and soil conditions, which in turn may affect the composition and other secondary metabolites of the plants [24-26]. The variation on the secondary metabolites among plants chemotype may occur among sites. The quantitative change in individual or groups of substances, some remain constant, some increase, some decrease, some disappear, or may originate a new constituent [27]. The secondary volatile metabolites of different parts of same plant virtually showed quantitative differences of compounds reported in the essential oil composition from aerial parts flowers and roots of the plant *C. odorata* **(Figure 1).** The compositional variation of essential oils of different parts (aerial, flower and root) of similar plant taking consideration of other plants also viz. *Anaphalis contorta, Craniotome furcata, Crassocephalum crepidioides, Coleus aromaticus, Tagetes minuta, Ocimum sanctum, Curcuma longa, Artemisia persica, Senecio Belagaviensis, Senecio bombayensis, Prangos ferulacea, Vernonia cinerea and Lantana camara* also showed the marked variation in the essential oil content of various individual plant parts [28-47]. Moreover, oil constituent was extremely variable, and individual constituents were not affected by intra plant location of the leaves, plant age, or geographic site [48]. This limits their taxonomic value, but possibly enhances their ecological significance as a defense adaptation to herbivores [49]. Nevertheless, there are an almost uncountable number of single substances and a tremendous variation in the composition of essential oils. Apart from the phytochemical group of substances typical for a taxon, the chemical outfit depends on the specific genotype, the stage of plant development, influence of environmental factors and the part of the plant [50]. This report described that the roots essential oil of *C. odorata* produced different chemotypes, other than the aerial parts oil.

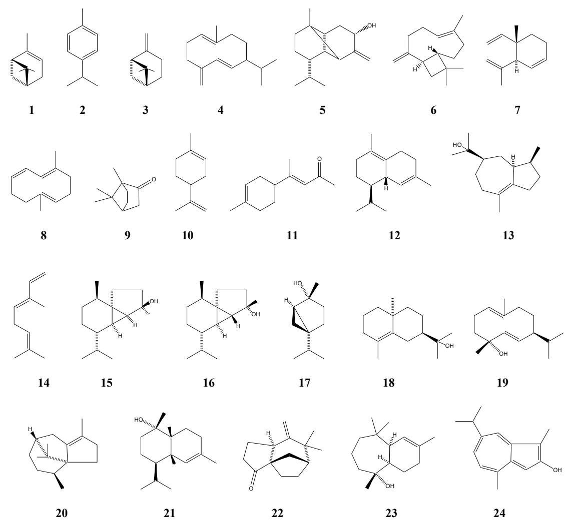

Figure 1. Major compounds of the essential oil of *C. odorata.*

A single plant is used in the treatment of various diseases or as a food supplement can varies phytochemicals as per the geoclimatic distribution. As the development of technologies more efforts are utilized to search of new chemical entities for treatment of the diseases which are safe from adverse effects. Now a day's various bioactive compounds are investigated from those where the plants are traditionally used for treatment of particular disease. In the future, further phytochemical and biological activities should be carried out on this plant to disclose its active principles not only from essential oils but also from various solvents extracts and mechanism of active constituents.

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