

## Phytochemical Analysis of Toxic Plant *Chromolaena odorata* (*Eupatorium odoratum*)

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### ABSTRACT

*Chromolaena odorata* King and Rob. (Syn. *Eupatorium odoratum* Linn.) is a toxic weed that is widespread over many parts of the world including India. This plant is responsible for illness and death of cattle and goats in Karnataka. In this study, four extracts (petroleum ether, chloroform, methanol and aqueous) of *Chromolaena odorata* leaves were qualitatively analysed for the presence of various phytochemicals.

The petroleum ether extract of *Chromolaena odorata* leaves showed the presence of steroids, triterpenes, alkaloids, flavonoids, tannins, diterpenes, and saponins. The chloroform extract showed the presence of steroids, alkaloids, flavonoids, tannins, and glycosides. The methanol extract showed the presence of steroids, alkaloids, flavonoids, tannins, lactones, diterpenes, and saponins, and the aqueous extract showed the presence of alkaloids, flavonoids, lactones, tannins, and saponins. The green leaves of the plant tested positive for the presence of nitrate.

Manifestations of toxicity due to *Chromolaena odorata* depend upon relative abundance of these different toxins.

**Key words:** *Chromolaena odorata*, *Eupatorium odoratum*, Phytochemicals, Nitrate, Pyrrolizidine alkaloid

### Introduction

*Chromolaena odorata* King and Rob. (Syn. *Eupatorium odoratum* Linn.) belongs to family Asteraceae (alt. Compositae) and the tribe Eupatorieae. This plant is native to South America and West Indies. It is one of the most toxic weeds, which is established and naturalized in Indian native flora. Animals tend to avoid feeding on *C. odorata* due to unpalatability, but during drought conditions they may be compelled to do so, particularly when other green vegetation becomes scarce. Cattle, sheep, bush buck, etc., are known to sometimes graze on this plant.<sup>1</sup> Many field cases of toxicity have been reported across the world, with hundreds of cattle deaths annually in the Philippines and some other countries. In India, with particular reference to Karnataka, the plant is responsible for periodic reports of illness and death among cattle and goats. Considering its importance, the present study was done to elucidate the phytochemical features of the toxic plant.

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## Materials and Methods

### Collection and preparation of plant material:

Fresh leaves of *Chromolaena odorata* were collected from the Western Ghat region, and were dried under shade, finely powdered, and stored in airtight containers.

### Preparation of extracts:

One hundred grams of leaf powder was packed in a filter paper and transferred into Soxhlets extractor, and extraction was made with petroleum ether, chloroform, and methanol separately in different extractors. The aqueous extract was prepared by adding 100g of powdered *C. odorata* with chloroform and water (70:30) for seven days with periodical stirring, care being taken to see no fungal growth occurred. Then it was filtered and concentrated. The residues were weighed after concentration and their respective percentage yield was determined. Extracts were used to find out the presence of secondary cell constituents in their active form by standard set procedure.<sup>2</sup>

## Results and Discussion

The petroleum ether extract of *C. odorata* leaves showed the presence of steroids, triterpenes, alkaloids, flavonoids, tannins, diterpenes, and saponins. The chloroform extract showed the presence of steroids, alkaloids, flavonoids, tannins and glycosides. The methanol extract showed the presence of steroids, alkaloids, flavonoids, tannins, lactones, diterpenes, and saponins, while the aqueous extract showed the presence of alkaloids, flavonoids, lactones, tannins and saponins. Details of the various extracts are outlined in **Table 1**. The physical characteristics and their percentage yield on extraction are presented in **Table 2**.

Phytochemical analysis revealed the presence of steroids, triterpenes, alkaloids, flavonoids, lactones, tannins, diterpenes, saponins, and glycosides. The tannin and saponin content in *C. odorata* seems to be the reason for low palatability of the plant. Many phytochemical constituents such as cadinene, cadinol, pinene, pyrrolizidine alkaloids (PAs) and sesquiterpenes with known potential for causing toxicity have been reported with this plant.<sup>3</sup>

Fresh plant material (tender stem and leaves) gave an intense blue coloration with diphenylamine test indicating the presence of >15000 ppm nitrate in the plant. The young shoots of *C. odorata* contain six times the toxic levels of the nitrate, as compared to older plants. This is enough to poison animals feeding on its foliage.<sup>4</sup>

Many species of *Eupatorium* are rich in pyrrolizidine alkaloids (Pas), which are known to cause a number of adverse effects, especially hepatotoxicity.<sup>5,6</sup> The hepatotoxicity of PAs is due to the formation of pyrrole metabolites in the liver.<sup>7,8</sup>

Many species of *Eupatorium* are also rich in sesquiterpene lactones containing  $\alpha$ -methylene and  $\gamma$ -lactone. Such compounds cause degranulation of mast cells and liberate histamine.<sup>9</sup> Toxicosis in ruminants grazing on species of *Eupatorium* containing sesquiterpene lactones in addition to PAs, cadinene, tremetol and other noxious constituents can be of additive type. Clinical manifestations will depend upon the relative abundance of the different toxins in the species prevalent in a particular geographical region.

**Table 1: Phytochemical analysis of *Chromolaena odorata* leaves**

(Note: “+” indicates presence; “-” indicates absence)

Chemical Tests	Extracts			
	Petroleum ether	Chloroform	Methanol	Aqueous
<b>Tests for Steroids</b>				
Salkaowski test	+	+	+	-
Lieberman Burchardt test	+	+	+	-
<b>Tests for Triterpenes</b>				
Salkaowski test	+	-	-	-
Lieberman Burchardt test	+	+	-	-
<b>Tests for Alkaloids</b>				
Mayer’s test	+	+	+	+
Wagner’s test	+	+	+	-
Dragendroff’s test	+	+	+	+
<b>Tests for Flavonoids</b>				
Ferric chloride test	+	+	+	+
Lead acetate test	-	-	+	+
<b>Tests for Lactones</b>				
Legal’s test	-	-	+	+
Feigel’s test	-	-	+	+
Baliet test	-	-	+	+
<b>Tests for Tannins</b>				
Ferric Chloride test	+	+	+	+
Gelatin test	+	+	+	+
<b>Tests for Diterpenes</b>				
Copper acetate test	+	-	+	-
<b>Tests for Saponins</b>				
Foam test	+	-	+	+
Haemolysis test	-	-	-	-
<b>Tests for Glycosides</b>				
Sodium Hydroxide test	-	+	-	+
Picrate paper test	-	+	-	+

Comment [p1]:

**Table 2: Physical characteristics of extracts of *Chromolaena odorata* leaves**

S.No	Extracts	Color	Nature	% Yield
1.	Petroleum ether	Black	Sticky	12.92
2.	Chloroform	Greenish black	Sticky	8.84
3.	Methanol	Greenish black	Sticky	10.55
4.	Aqueous	Brown	Dry/powder	4.38

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