IJPSR (2012), Vol. 3, Issue 1 (Review Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 03 September, 2011; received in revised form 22 October, 2011; accepted 14 December, 2011

THE INVASIVE WEED WITH HEALING PROPERTIES: A REVIEW ON *CHROMOLAENA ODORATA*

M. N. Vaisakh* and Anima Pandey

Department of Pharmaceutical Sciences, Birla Institute of Technology, Mesra, Ranchi- 835215, Jharkhand, India

Keywords:

Chromolaena odorata,
Invasive weed,
Management,
Traditional uses,
Pharmacological properties

Correspondence to Author:

M. N. Vaisakh

Department of Pharmaceutical Sciences,
Birla Institute of Technology, Mesra,
Ranchi- 835215, Jharkhand, India

ABSTRACT

Chromolaena odorata or siam weed is regarded as one of the most harmful weeds present on earth. Many efforts are being made for the control of this weed. But, none of them have provided any significant success. It has been utilized in the traditional medicinal systems for its curative properties for centuries. Some of the current studies have revealed its medicinal properties which have lead to an enhanced image of this plant as a medicinal herb. It showed anti-inflammatory, anti pyretic, analgesic, antimicrobial, cytotoxic and many other relevant medicinal properties in an appreciable scale.

INTRODUCTION: *Chromolaena odorata* (L.) R.M. King and H. Robinson is one of the world's worst tropical weeds. It is a member of the tribe Eupatorieae in the sunflower family Asteraceae. The weed goes by many common names including Siam weed, devil weed, French weed, communist weed, hagonoy, co hoy etc.

The native range of Chromolaena is in the Americas, extending from Florida (USA) to northern Argentina. Away from its native range, Chromolaena is an important weed in tropical and subtropical areas extending from west, central and southern Africa to India, Sri Lanka, Bangladesh, Laos, Cambodia, Thailand, southern China, Taiwan, Indonesia etc [2, 20, 6].

Chromolaena is being used traditionally for its many medicinal properties, especially for external uses as in wounds, skin infections, inflammation etc. Studies have demonstrated that the leaf extract has antioxidant, anti-inflammatory, analgesic, anti-microbial, cytoprotective and many other medicinally significant properties [1, 9, 27]. The phytochemical studies have revealed the presence of a wide range of chemical entities in the plant [14].

These studies underline the significance of treating the widely occurring flora on this planet as potential sources of new drug entities and not only as harmful weeds.

Chromolaena, the weed: The native range of chromolaena is in the Americas, extending from Florida (USA) to northern Argentina. Although, native to South and Central America, it is has spread throughout the tropics extending from west, central and southern Africa to India, Sri Lanka, Bangladesh, Laos, Cambodia, Thailand, southern China, Taiwan, Indonesia, Timor, Papua New Guinea (PNG), Guam, the Commonwealth of the Northern Mariana Islands (CNMI), Federated States of Micronesia (FSM), and Majuro in the Marshall Islands [1, 2].

It is a serious weed in many of the countries where it has been introduced: Africa, South and Southeast Asia. Chromolaena can grow rapidly and form infestations that can affect agriculture, pastures and biodiversity, as Chromolaena interferes with the functions of natural ecosystems.

It is considered a serious weed in plantation crops such as oil palm, coconut, cashew, teak, rubber and citrus, disturbed forests, pastures and natural reserves. It is highly allelopathic and suppresses neighboring vegetation. During the dry season the dried stems of this plant readily burn, but the stumps remain alive and rapidly grow and cover the area in the succeeding rainy season [2, 3, 7].

Long distance dispersal in the bodywork of long distance vehicles has been reported in Australia. Its establishment is favored by rural development (cultivation based on the fallow system, road construction, civil engineering works, electrical lines), and erosion also contributes significantly. In the towns, *C. odorata* grows in gardens, on buildings and along poorly maintained borders of canals. However, the weed is not fond of dry, sandy soils [2, 7].

Management: The ideal strategy for the Chromolaena control is prevention. Movement of seeds may occur due to increasing trade, travel and accidental introductions from countries or islands with the Chromolaena problem [1]. The major strategies being used for the control are described under.

Mechanical and cultural control comprises of Hand weeding, slashing, digging and uprooting of young plants. In case of Chemical control measures, Triclopyr is proposed to be suitable at early seedling or regrowth stage. A combination of 2, 4-D amine and picloram can be effective in killing the above-ground parts as well as the underground parts [1, 2]. A Commonwealth Institute of Biological Control project in 1966 identified over 200 arthropod natural enemies of this weed.

Pareuchaetes pseudoinsulata was one of the first natural enemies identified in this project. It was introduced to Ghana, Nigeria, India, Sri Lanka and Malaysia in the 1970s and early 1980s, but it established only in Sri Lanka. In the mid l980s it was confirmed that *P. pseudoinsulata* had established in Malaysia from the earlier introductions and had fortuitously spread to Brunei and the Philippines. Introductions after the mid 1980s resulted in its establishment in Guam, Rota, Tinian, Saipan, Yap, Pohnpei, Kosrae, India, Indonesia and Ghana. The success rate of *P. pseudoinsulata* establishment has increased from 17% in the 1970s and early 1980s to 75% from the mid -1980s onwards. The seed-feeding weevil, *Apion brunneonigrum* failed to establish after being released in Ghana, Nigeria, Malaysia, India, Sri Lanka and Guam. These natural agents are found to be the only effective method for Chromolaena control [3].

Chromolaena, the Medicinal Herb:

Traditional Uses: In traditional medicine, a decoction of the leaf is used as a cough remedy and as an ingredient with lemon grass and guava leaves for the treatment of malaria. Other traditional medicinal uses include anti-diarrheal, astringent, antispasmodic, antihypertensive, anti-inflammatory, diuretic, tonic, antipyretic and heart tonic [8, 9]. The fresh leaves and extract of *C. odorata* are a traditional herbal treatment in some developing countries for burns, soft tissue wounds and skin infections . A formulation prepared from the aqueous extract of the leaves has been licensed for clinical use in Vietnam [10, 11].

Newer Findings: *Chromolaena odorata* is found to be a highly efficacious medicinal herb according to the traditional and folk medicinal systems. The same is proved by its pharmacological evaluation performed by scientific community across the world.

The most established and discussed aspect of Chromolaena is its role in wound healing. Extracts from the leaves of *Chromolaena odorata* have been shown to be beneficial for treatment of wounds. In traditional usage, the leaf is ground into a paste and is applied topically on affected places to heal wounds [11].

The aqueous extract and the decoction from leaves of this plant have been used throughout Vietnam for the treatment of soft tissue wounds and burns for decades. A product made from Chromolaena named eupolin have already been licensed for use in Vietnam for soft tissue burns and wounds [12, 13].

Studies *in vitro* of these extracts demonstrated enhanced proliferation of fibroblasts, endothelial cells and keratinocytes, stimulation of keratinocyte migration in an *in vitro* wound assay, up-regulation of production by keratinocytes of extracellular matrix proteins and basement membrane components, and inhibition of collagen lattice contraction by fibroblasts [14].

A study on chromolaena has demonstrated that the extract increased expression of several components of the adhesion complex and fibronectin by human keratinocytes [15]. The process of wound healing is also enhanced by the antimicrobial activity of the Chromolaena [16]. The ability of wound healing is attributed to the antioxidant property of the drug which helps in conserving the fibroblast and keratinocyte proliferation on the site [17, 18].

The basis for the external applications of Chromolaena was found to be its profound antioxidant action [19, 20]. The antioxidant effects of purified fractions on cultured fibroblasts and keratinocytes were investigated using colorimetric and lactate hydrogenase release assay.

The results showed that the phenolic acids present (protocatechuic, *p*-hydroxybenzoic, *p*-coumaric, ferulic and vanillic acids) and complex mixtures of lipophilic flavonoid aglycones (flavanones, flavonols, flavones and chalcones) were major and powerful antioxidants [17].

The nitric oxide scavenging activity of the Chromolaena extract was demonstrated. Quantitative determination of the total phenolic content shows that the extract contains an appreciable amount of phenolic compounds and may be responsible for the observed antioxidant potential [21].

The anti-inflammatory, analgesic and antipyretic activities of the Chromolaena are evident from its traditional usage in rheumatic fever and similar conditions. In one of the recent studies, the pharmacological evaluation of the drug extract was performed by using standard experimental models which includes; hot plate and formalin paw licking tests for analgesic activities, carrageenan paw oedema and cotton pellet granuloma for anti-inflammatory activities and Brewer's yeast induced pyrexia for antipyretic tests.

The result shows that the extract produced consistent analgesic, anti-inflammatory and antipyretic activities [4]. Other studies have shown that the anti-inflammatory activity is accounted by the presence of flavonoids in the extract [10, 20, 22]. The antimicrobial activity of Chromolaena was evaluated and proved in a number of experiments.

This antimicrobial activity is a major factor in the wound healing power expressed by the herb. In one of the experiments, the crude extracts (dichloromethanic and ethanolic) from Chromolaena have been evaluated against 22 strains of microorganisms including bacteria (Gram-positive and Gram-negative) and yeasts.

All crude extracts have shown activity, mainly against Gram-positive bacteria [5]. The extract have also shown moderate activity against mycobacterium tuberculosis [9, 22]. The DCM/water extract of the plant showed anti-HSV-1 and anti- malarial activity [22]. It was found to be particularly active against staphylococci [8, 10, 19]. The extract also showed appreciable anti fungal activity [5, 8, 23]. The profound nematicidal activity of the herb has also been demonstrated [24].

The Chromolaena extract was found to be cytoprotective in combination with honey when used in stomach ulcer lesions. This experiment in rats proved their efficacy as an antiulcer agent when used orally [25]. Cytotoxicity of the Chromolaena extract was also studied. These studies have demonstrated the presence of some compounds in the extract such as acacetin (5, 7- dihydroxy- 4'- methoxy flavone) and luteolin (5, 7, 3', 4'- tetrahydroxyflavone) which expressed activity against human small cell lung cancer and human breast cancer [9].

The studies conducted on the cardiovascular effects of the Chromolaena showed its membrane stabilizing activity against haemolysis and PAF receptor binding inhibiting property [20].

CONCLUSION: Chromolaena or Siam weed was considered to be a harmful weed until the recent past due to its highly invasive, allelopathic nature. Although it was used traditionally for its healing properties, it never enjoyed the status of a medicinal herb. Instead, efforts were always made to eradicate the so called weed.

Some of the recent studies have proved its medicinal value beyond any doubt as mentioned in the article. Efforts should be made to exploit the medicinal properties of this abundant herb. The example of this herb indicates the importance to consider and evaluate the abundantly occurring weed species on this planet as potential sources of medicines than as invasive flora.

REFERENCE:

1. Warea O. Chromolaena (Siam) weed. Pest Advisory Leaflet no. 43, Secretariat of the Pacific Community. August, 2004.
2. Bani G. Status and management of *Chromolaena odorata* in congo. Proceedings of the fifth international workshop on biological control and management of *Chromolaena odorata*, ARC-PPRI 2002; 71-73.
3. Muniappan R and Bamba J. Biological Control of *Chromolaena odorata*: Successes and Failures. Proceedings of the X International Symposium on Biological Control of Weeds. Montana State University, 2000; 81-85.
4. Ogunbiyi, Aruboula E A and Soladoye A O. Analgesic, anti-inflammatory and antipyretic activities from flavonoid fractions of *Chromolaena odorata*. Journal of Medicinal Plants Research 2008; 2(9):219-225.
5. Taleb-Contini S H, Salvador M J, Watanabe E, Ito I Y, Oliveira D C R. Antimicrobial activity of flavonoids and steroids isolated from two *Chromolaena species*. Brazilian Journal of Pharmaceutical Sciences 2003; 39(4).
6. Chomnawang M T , Surassmo S , Nukoolkarn V S , Gritsanapan W. Effect of *Garcinia mangostana* on inflammation caused by Propionibacterium acnes. Fitoterapia 2007; 78: 401–408.
7. Breeÿen D, Groenewald A, Verkley J Z and Crous P W. Morphological and molecular characterisation of Mycosphaerellaceae associated with the invasive weed, *Chromolaena odorata*. Fungal Diversity 2006; 23: 89-110.
8. Vital P G and Windell L R. Antimicrobial activity and cytotoxicity of *Chromolaena odorata* (L. f.) King and Robinson and *Uncaria perrottetii* (A. Rich) Merr. Extracts. Journal of Medicinal Plants Research 2009; 3(7): 511-518.
9. Suksamrarn A, Chotipong A, Suavansri T, Boongird S,Timsuksai P, Vimuttipong S, and Chuaynugul A. Antimycobacterial activity and cytotoxicity of flavonoids from the flowers of *Chromolaena odorata*. Arch Pharm Res 2004; 5(27): 507-511.
10. Ling S K, Nor Azah M A, Mastura M, Khoo M G H, Saidatul Husni S, Salbiah M, Abdul Rashih A, Mazura M P, Vimala S, Ong B K, Siti Asha A B & Nuraini A M. Standardisation and formulation of *Chromolaena odorata* for herbal preparation. Forest Research Institute Malaysia (FRIM), 52109 Kepong, Selangor Darul Ehsan(Project No. 01-04-01-10006).
11. Ayyanar M, Ignacimuthu S. Herbal medicines for wound healing among tribal people in Southern India: Ethnobotanical and Scientific evidences. International Journal of Applied Research in Natural Products 2009; 2(3): 29-42.
12. Raina R, Parwez S, Verma P K and Pankaj N K. Medicinal Plants and their Role in Wound Healing. Online veterinary journal 2008; 3(1), article 21.
13. Phan T T, Hughes M A & Cherry G W. Enhanced proliferation of fibroblasts and endothelial cells treated with an extract of the leaves of *Chromolaena odorata* (Eupolin), a herbal remedy for treating wounds. Plastic & Reconstructive Surgery 1998; 101: 756–765.
14. Afolabi C. Akinmoladun E O. Ibukun and Dan-Ologe I A. Phytochemical constituents and antioxidant properties of extracts from the leaves of *Chromolaena odorata*. Scientific Research and Essay 2007; 2 (6): 191-194.
15. Phan T T, Allen J, Hughes M A, Cherry G, Wojnarowska F. Upregulation of adhesion complex proteins and fibronectin by human keratinocytes treated with an aqueous extract from the leaves of *Chromolaena odorata* (Eupolin). European Journal of Dermatology 2000; 10(7): 522-527.
16. Panda D, Dash S K, Dash G K. Qualitative phytochemical analysis & investigation of anthelminthic and wound healing potentials of various extracts of *Chromolaena odorata* Linn. collected from the locality of Mohuda Village, Berhampur (south Orissa). International Journal of Pharmaceutical Sciences Review and Research 2010; 1(2): Article 023.
17. Phan T T, Wang L, See P, Grayer R J, Chan S Y and Lee S T. Phenolic Compounds of *Chromolaena odorata* Protect Cultured Skin Cells from Oxidative Damage: Implication for Cutaneous Wound Healing. Biol. Pharm. Bull. 2001; 24(12): 1373—1379.
18. A.A. Mahmood, K. Sidik, K.A.R. Suzainur, M. Indran and I. Salmah. Evaluation of in-vitro wound healing activity of Chromolaena odorata leaf extract on excision wounds model in rats. Journal of Food Technology,3(2):126-129,2005.
19. Ling S K, Nor Azah M A, Mastura M, Khoo M G H, Saidatul Husni S, Salbiah M, Abdul Rashih A, Mazura M P, Vimala S, Ong B K and Siti Asha A B. Chemical constituents and therapeutic potential of the leaf extract from *Chromolaena odorata*(L.) King and Robinson. Forest research institute Malaysia (FRIM), 52109 kepong, Selangor Darul Ehsan.
20. Umukoro S and Ashorobi R B. Evaluation of the anti-inflammatory and membrane stabilizing effects of *Eupatorium odoratum*. International Journal of Pharmacology 2006; 2(5): 509-512.
21. Alisi C S and Onyeze G O. Nitric oxide scavenging ability of ethyl acetate fraction of methanolic leaf extracts of *Chromolaena odorata* (Linn.). African Journal of Biochemistry Research 2008; 2 (7): 145-150.
22. Pisutthanan N, Liawruangrath S, Bremner J B and Liawruangrath B. Chemical Constituents and Biological Activities of *Chromolaena odorata*. Chiang Mai J. Sci 2005; 32(2): 139-148..
23. Owolabi M S, Ogundajo A, Yusuf K O, Lajide L, Villanueva H E, Tuten J A, and Setzer W N. Chemical Composition and Bioactivity of the Essential Oil of *Chromolaena odorata* from Nigeria. Records of Natural Products 2010; 4(1): 72-78.
24. Thoden T C, Boppre M and Hallmann J. Pyrrolizidine alkaloids of *Chromolaena odorata* acts as nematicidal agents and reduce infection of lettuce roots by Meloidogyne incognita. Nematology 2007; 9(3): 343-349.
25. Nur Jannah M H, Mahmood A A, Sidik K and Salmah I. Cytoprotective effects of honey in combination with aqueous and ethanol extracts from *Chromolaena odorata* L (*Eupatorium odoratum*) in rats. Jummec 2006; 9(1).
26. Hung T M, Cuong T D, Dang N H, Zhu S, Long P Q, Komatsu K and Min B S. Flavonoid Glycosides from *Chromolaena odorata* Leaves and Their in Vitro Cytotoxic Activity. Chem. Pharm. Bull. 2011; 59(1): 129-131.
27. Ling S K, Mazura M D and Salbiah M. Platelet-Activating Factor (PAF) Receptor Binding Antagonist Activity of the Methanol Extracts and Isolated Flavonoids from *Chromolaena odorata*(L.) King and Robinson. Biol. Pharm. Bull. 2007; 30(6): 1150—1152.

****