Chromolaena odorata is a species of flowering shrub in the sunflower family, Asteraceae. It is native to North America, from Florida and Texasto Mexico and the Caribbean, and has been introduced to tropical Asia, west Africa, and parts of Australia. Common names include Siam Weed, Christmas Bush, and Common Floss Flower. It is sometimes grown as a medicinal and ornamental plant. It is used as a traditional medicine in Indonesia. The young leaves are crushed, and the resulting liquid can be used to treat skin wounds. It was earlier taxonomically classified under the genus Eupatorium, but is now considered more closely related to other genera in the tribe Eupatorieae.[31]

Chromolaena odorata is considered invasive weed of field crops in its introduced range, and has been reported to be the most problematic invasive species within protected rainforests in Africa.[32] Chromolaena odorata is a fast-growing perennial shrub, native to South America and Central America. It has been introduced into the tropical regions of Asia, Africa and the Pacific, where it is an invasive weed. It is also known as Siam weed,[4] it forms dense stands that prevent the establishment of other plant species. It is an aggressive competitor and may have allelopathic effects. It is also a nuisance weed in agricultural land and commercial plantations. Chromolaena odorata contains carminogenic pyrrolizidine alkaloids.[5]

**Synonyms:**

**Kingdom:** Plantae – Plants
**Subkingdom:** Tracheobionta – Vascular plants
**Superdivision:** Spermatophyta – Seed plants
**Division:** Magnoliphyta – Flowering plants
**Class:** Magnoliopsida – Dicotyledons
**Subclass:** Asteraidae
**Order:** Asterales
**Family:** Asteraceae – Aster family
**Genus:** Chromolaena DC. – thornbush
**Species:** Chromolaena odorata (L.) King & H. Rob. – Jack in the bush

**General Description**
Chromolaena odorata is an herbaceous perennial that forms dense tangled bushes 1.5-2.0 m in height. It occasionally reaches its maximum height of 6 m as a climber on other plants. Its stems branch freely, with lateral branches developing in pairs from the axillary buds. The older stems are brown and woody near the base; tips and young shoots are green and succulent. The root system is fibrous and does not penetrate beyond 20-30 cm in most soils. The flowerheads are borne in terminal corymbs of 20 to 60 heads on all stems and branches. The flowers are white or pale bluish-lilac, and form masses covering the whole surface of the bush.[9] C. odorata is a big bushy herb with long rambling (but not twining) branches, stems terete, pubescent; leaves opposite, flaccid-membranous, velutin-pubescent, deltoid-ovate, acute, 3-nerved, very coarsely toothed, each margin with 1-5 teeth, or entire in youngest leaves; base obtuse or subtruncate but shortly decurrent; petiole slender, 1-1.5 cm long; blade mostly 5-12 cm long, 3-6 cm wide, capitula in sub-corymbose axillary and terminal clusters; peduncles 1-3 cm long, bracteate; bracts slender, 10-12 mm long; involucre of about 5-8 series of bracts, pale with green nerves, acut; the lowest ones about 2 mm long, upper ones 8-9 mm long, all acute, distally ciliate, flat, appressed except the extreme divergent tip; florets all alike (disc-florets), pale purple to dull off-white, the styles extending about 4 mm beyond the apex of the involucral, spreading radially; receptacle very narrow; florets about 20-30 or a few more, 10-12 mm long; ovarian portion 4-mm long; corolla slender trumpet form; pappus of dull white hairs 5 mm long; achenes glabrous. The seeds of Siam weed are small (3-5 mm long, ~1 mm wide, and weigh about 2.5 mg seed-1).[7]

**Range**
Christmas bush is native from Florida through the West Indies and from Texas through Central and South America to Argentina. It has been introduced and spread throughout much of the tropics, including Guam and Hawaii.[8]

**Ecology**
Chromolaena odorata grows on a wide range of soils and grows in a range of vegetation types, e.g. forests (annual rainfall 1500mm), grassland and arid bushveld (annual rainfall less than 500mm).[10] In arid areas, it is restricted to riverbanks and it will only become invasive in the frost-free areas of medium to arid woodland which are not water-stressed in the growing season.[12] For good growth of Siam weed seedlings, the relative humidity should be in the range of 60–70%; at values higher than 80% the growth performance was poor.[13] Experiments show that Siam weed seedlings grew well at 30°C and even better on mulched soils at 25°C. In heavy shade, Siam weed will not seed. It has a negative relationship with tree canopy cover and appears to be most abundant on the edge of forested areas.[14] Witkowski (2002) reports that in north-eastern India, Siam weed is regarded as a nutrient-demanding early successional species.[15] It takes advantage of the flush of soil that becomes available after a disturbance, such as fire or land clearing for agriculture, and exhibits relatively high foliar N, P and K contents.[16,17]

**Reproduction**
Christmas bush blooms annually and is an abundant producer of seeds. Flowering and fruiting begins after plants are 1 year old.[17] The flowers are pollinated by insects. The small fruits mature in about a month. One collection of seeds in Puerto Rico averaged 2,670,000 seeds/kg but did not germinate. A second collection averaged 1,560,000 seeds/kg and gave 11 percent germination between 3 and 120 days after sowing. Germination is reduced and has naturalized throughout much of the tropics, including Guam and Hawaii.[18]

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through the use of aggressive cover crops. Relatively good biological control has been obtained with *Parvuchaetes pseudovinSalata* Rego Barros (Lepidoptera) in Guam and several other Pacific islands.\(^{59}\)

**Ethnobotanical uses**

*Chromolaena odorata* is an ornamental plant that is sometimes encouraged for use in shifting slash-and-burn agriculture to compete with *Imperata cylindrica* (alang alang or cogon grass), which is harder to control. It is mainly used by the tribal people for the treatment of cuts and wounds.

It is also used for the treatment of Amenorrhea, Amygdalitis, Bite(Leech) Hunan; Cataplasm; Catarh; Cold;Congestant Diabetes Diharzha; Fever, Gargle; Hemostat; Hoarseness Infiammation Laryngitis Brusn, r; Leptospirosis; Pertussis; Rheumatism Vermifuge.

**General impacts**

*Chromolaena odorata* forms dense stands preventing establishment of other species, both due to competition and allelopathic effects. When dry, *C. odorata* becomes a fuel which may promote wild bushfires (PIER 2003). *C. odorata* may also cause skin complaints and asthma in allergy-prone people. It is a major weed in plantations and croplands, including plantations of rubber, oil palm, forestry and coffee plants.

**Biogas production by anaerobic digestion of *Eupatorium odoratum L.*\(^{28}\)**

*Eupatorium odoratum* L. is a prolific producer of biomass among the weeds introduced into India and it can be used for energy production. Since freshly harvested biomass contains inhibitors of microorganisms involved in methanogenesis, the effects of leaching and partial aerobic decomposition of the weed before anaerobic digestion were studied (1.0 m² pilot-scale batch fermenters) in relation to biogas production. About 70% more biogas was produced with the pretreated waste, and it also gave a higher count of cellulolytic and methanogenic bacteria than the untreated material.

**Pharmacological Activities of *Chromolaena odorata***

**Anthelmintic Activity**

Debidani Mishra et al.\(^{22}\) found that all the doses of petroleum ether, ethanol and chloroform extracts of the leaves of *Eupatorium odoratum* showed better anthelmintic activity than the standard drug albendazole except petroleum ether extract at 2.5 mg/ml of concentration. The extracts of three solvents at concentration of 2.5 and 5.0 mg/ml showed lesser anthelmintic activity than the standard drug piperazine citrate. When the dose of the extract is increased, a gradual increase in anthelmintic activity was observed. The Ethanolic extract showed better anthelmintic activity in comparison with petroleum ether and chloroform extracts.

**Wound healing effect**

Rungnara Ongkanont\(^{23}\) found that chloroform extract of the leaves of *Eupatorium odoratum* was effective against K1 strain of plasmodium falciparum in *invitro* cultures with an EC50 value of 9.3 µg/ml.

**Fungicidal Activity**

Chakraborty et al.\(^{24}\) found that only ethanolic extract shows maximum anaglycic activity at a dose of 300 mg/kg whereas petroleum ether extract and chloroform extract shows moderate activity at the same dose when compared with the standard drug aspirin.

**Anti-inflammatory, Antipyretic and Antispasmodic Properties**

Oluade B. Taiwo et al.\(^{25}\) evaluated the anti-inflammatory as well as antipyretic activity of methanolic extract of the leaves of *Chromolaena odorata*. The effects of the extract on intestinal transit of charcoal meal and castor oil-induced diarrhoea were also investigated. The extract (50-200 mg/kg) inhibited paw edema in rats and produced significant reduction in rectal temperature of mice rendered hyperthermic by yeast suspension. Antimotility intestinal transit of charcoal meal and castor oil-induced diarrhoea were also investigated.

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conductivity and Na⁺, K⁺ and Ca²⁺ content were investigated in saline-loaded rats. The extract showed a dose-dependent decrease in diuretic effect, but augmented significantly with respect to the control group for the urinary excretion of water and sodium. Furthermore, a potassium-sparing effect at 10 and 20% was showed. The diuretic effect does not seem to be related to the potassium content of the starting material. The results justify the use of *E. odoratum* as diuretic agent by the Malaysian traditional medicine.

**Blood Coagulating Activity**

Tiratana T et al. [45] found that the compound 4', 5, 6, 7-tetramethoxyflavone from Eupatorium odoratum enhanced blood coagulation, the observed APTT being shorter than that observed in the control. The result suggested that the compound accelerated clotting time through the intrinsic pathway of the coagulation which may involve the reaction of factor XII, factor XI, factor IX or factor VIII.

**Antimicrobial Activity**

Mullika Traidej Chomnawang et al. [47] investigated the antimicrobial activity of *Eupatorium odoratum* against *Propionibacterium acnes* and *Staphylococcus epidermidis*, respectively. The disc diffusion method showed that *Eupatorium odoratum* had strong inhibitory effects against *Propionibacterium acnes*. The MIC values were the (0.039 mg/ml) for both bacterial species and the MBC values were 0.039 and 0.156 mg/ml against *Propionibacterium acnes*.

Chemical constituents of *Chromolaena odorata*  
1. Thirty-three components were identified from the volatile oil of *C. odorata*. Terpenoids are major components of the volatile oil. The main terpenic components are trans-carvone (16.22%), δ-cadinene (15.53%), α-copaene (11.32%), carvophyllene oxide (9.42%), germacrene-D (8.46%) and α-humulene (4.23%). [36]
2. The constituents of the Cholorof soluble and petroleum ether-soluble portions in the 95% ethanol extract were isolated and purified by means of chromatography. Ten compounds were isolated and identified as odoratin, dillenitin, pectolinarigenin, quecrerin-7, 4'-dimethyl ether, kaempferol 4'-methyl ether, isosakuranetin, acacetin, dotriacontic acid, α-sitosterol, daucosterol. [37]
3. Four flavanones isosakuranetin (5,7-dihydroxy-4'-methoxyflavanone), 4', 5', 6', 7-tetramethoxyflavone, 4'-hydroxy-5,6,7-trimethoxyflavone, two chalcones, 2'-hydroxy-4, 2'-dihydroxy-4', 5',6'-trimethoxychalcone and 4,2'-dihydroxy-4', 5',6'-trimethoxychalcone (6), and two flavones, acacetin (5,7-dihydroxy-4'-methoxyflavone) and luteolin (5,7,3',4'-tetramethoxyflavone) were isolated and identified from the flowers of *Chromolaena odorata*. [38]
4. Two chalcones and a new chalcone, odoratin, derived from the leaves of *Eupatorium odoratum*. The structure of odoratin has been shown to be 2-hydroxy-4, 4', 5, 6-tetramethoxychalcone. [39]
5. Four flavanones isosakuranetin (5,7-dihydroxy-4'-methoxyflavone), persicigenin (5,3'-dihydroxy-7',4'-dimethoxyflavone), 5,6,7,4'-tetramethoxyflavone and 4'-hydroxy-5,6,7,3'-tetramethoxyflavone, two chalcones, 2'-hydroxy-4, 4', 5', 6'-tetramethoxychalcone and 4,2'-dihydroxy-4', 5',6'-trimethoxychalcone (6), and two flavones, acacetin (5,7-dihydroxy-4'-methoxyflavone) and luteolin (5,7,3',4'-tetramethoxyflavone) were isolated and identified from the flowers of *Chromolaena odorata*. [40]
6. Phytochemical studies on the petroleum ether extract of the roots of *Eupatorium odoratum* have resulted in the isolation of a novel triterpene, 3β-hydroxy-28-carboxyolean-12-ene along with seven known compounds − perrieraster, octadecane, butyrospermic acid, bis(2-ethylhexyl) phthalate, chrysophycin, physcion and palmitic acid. Novel compound 3β-hydroxy-28-carboxyolean-12-ene is designated as euryacid A. The cytotoxicity of all the isolated compounds except palmitic acid was studied using a lethality test against *Artemia salina* (brine shrimp). [41]
7. An anionic peroxidase isozyme having a pI of 3.5 was purified from *Eupatorium odoratum*. The molecular weight of the enzyme was identified as 55 kDa. The specific activity of the crude extract was increased to 647 U/mg from 62 U/mg by ammonium sulfate precipitation. The enzyme was 114-fold purified by ion exchange chromatography and had a specific activity of 7094 IU/mg. The specificity constant (k / Km) of the isozyme was 8.75 x 10² s⁻¹ M⁻¹ with ABTS and 6.9 x 10⁴ s⁻¹ M⁻¹ with H₂O₂ as substrates. The enzyme was found to be very stable at room temperature (30 ± 2 °C) and retained more than 90% activity even after a period of 2 months and was stable for more than 6 months at 4 °C without any additive, stabilizer or preservative. The activation energy for inactivation (Ea) of the isozyme was 120.14 kJ mol⁻¹ and the half-life was found to be around 34 h at 50 °C. The purified Eupatorium peroxidase has an optimum pH of 4.5 and optimum temperature of 55 °C. This isozyme was stable in metal ionic solutions and showed increased activity in presence of Hg²⁺ and Cd²⁺. The enzyme can also be used as a low cost temperature indicator strip for which the preliminary works have already been carried out satisfactorily. [42]

24. Ling Bing, Zhang Mao-xin , Pang Xiong-fei, Biological Activities Of The Volatile Oil From Chromolaena Odorata On Fungi And Insects And Its Chemical Constituent. Laboratory of Insect Ecology.South China Agricultural University ,Guangzhou,China
33. Ling Bing, Zhang Mao-xin , Pang Xiong-fei, Biological Activities Of The Volatile Oil From Chromolaena Odorata On Fungi And Insects And Its Chemical Constituent. Laboratory of Insect Ecology.South China Agricultural University ,Guangzhou,China

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