Verbesina encelioides: Perspective and potentials of a noxious weed

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Verbesina encelioides (Cav.) Benth. & Hook. Fil ex Gray (Asteraceae) regarded as a notorious weed and an ornamental garden plant has found various uses in folk medicine in different parts of the world. This plant possesses analgesic, emetic, febrifuge and insecticidal actions but is mildly toxic to small ruminants, which is attributed to the relative amount of galegine. V. encelioides also produces a number of metabolites like flavonoids, terpenoids, sesquiterpenes and essential oils, etc. in appreciable yields. Some of these compounds have exhibited significant antimicrobial, antiviral, antitumour, hypoglycaemic, antiimplantation and antiinflammatory activities. The paper is an overview of the potential utilization of V. encelioides, which is otherwise a well known weed.

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Verbesina encelioides (Cav.) Benth. & Hook. Fil ex Gray (Asteraceae), commonly known as golden crown beard, is one of the most widespread species. The plant is an upright to sprawling annual commonly of 30-50 cm height. Its leaves are toothed or lobed with white hairs on both leaves and stem, flower heads are found on elongated stalks and resemble small sunflower, 2.5-5.1 cm in length and consists of numerous disk flowers and approximately 12 ray flowers, which blooms from April to October. The seeds (achenes) are grayish-brown, flat and winged along the margins and also covered with fine hairs. The native range of V. encelioides is generally considered to be North and South America, specifically Mexico and the Southwestern United States of Texas, Arizona. It is an introduced weed in South Africa and has extended its range within the United States including Hawaii, and to several Latin American countries as well as to Australia and India. It is an excellent example of an exotic invasive plant that literally suffocated and killed native plants, as well as engulfed open space used as nesting sites and disturbed habitats appear to be ideal for other plants. The plant is an aggressive, obligate out breeder weed that has invaded vast expanses of pastures, orchards and forest areas in many tropical and subtropical regions. Much has been written on its encroaching habitat, methods of eradication and control. The species has low economic importance, as it is used limitedly as an ornamental, being poisonous to livestock. The plant is attractive to bees, butterflies and/or birds and resistant to deer. A number of characteristic aids in the aggressive quality of this plant include fast growing abilities, its bright colours, drought tolerant property, suitable for landscaping and xeriscaping, ability to handle a wide range of growing conditions, rapid growth, allelopathic effect on other plants, high seed production and dispersal ability, high periods of seed dormancy and high germination rates. In the paper, ethnopharmacology, allelopathy, phytochemistry, toxicity and bioefficacy of V. encelioides has been discussed and would provide a basis for the evaluation of the plant as a useful source of renewable material.

Traditional uses
The weeds have been used in different parts of the world and are an important source of medicines for indigenous peoples. V. encelioides found use in folk remedies for cancer, gastro-intestinal disturbance, skin ailments, snakebite, warts and haemorrhoids. North Dakota Hopi Indian tribes and early settlers utilize V. encelioides for the treatment of spider bite symptoms and skin diseases.
Allelopathy

In allelopathy, secondary compounds inhibit germination and growth of other plants and as chemical defense against herbivory. Allelopathic effects of *V. encelioides* have also been noted and attributed to its dominant coverage and success in inhibiting native plant growth. The aggressive and dominant growth ability of *V. encelioides* prevents the growth of less aggressive native plants such as *Seaveola sericea* and *Ipomea pesaprae*. Peanut farmers in State Texas considered *V. encelioides* a “troublesome” weed due to its ability to quickly infest fallow peanut fields. Allelopathic potential of its roots and the probable involvement of allelopathy in its interference success has been demonstrated.

Toxicology

Early researches efforts on the toxicity of *V. encelioides* pointed to the plant’s high levels of nitrates as the toxic agents and classified as a high poisoning threat for grazing sheep and cattle. Subsequent studies pointed out that the toxic component in the plant is galegine, not the nitrate levels as previously thought. Toxicity is not cumulative and only occurs when sufficient amounts of toxic plant are consumed at one feed. The toxic isoprenoid guanidine compound, galegine, cause vascular leakage and a consequent heavy odema resulting in the respiratory distress and death. Galegine was also isolated as an active antihyperglycaemic agent from the plant *Galega officinalis*. Galegine provided the template for the synthesis of other biguanidine-type antidiabetic drugs.

Phytochemistry

The initial work on the terpenoids was conserved with the structural elucidation of β-sitosterol and β-sitosterol-D-(+)-glucoside, hentriacontol, pseudotaraxasterol, pseudotaraxastenone and pseudotaraxasteryl acetate from the whole plant. This was the first report of isolation of triterpenoids from a *Verbesina* species. Three-flavonoid glycosides quercetin-3-galactoside, quercetin-3-galactoside-7-glucoside and quercetin-3-xylloside-7-glucoside from the flowers have also been reported. This was the first report of quercetin-3-galactoside-7-glucoside in nature and *V. encelioides* particularly. Subsequently, triterpenoids as α- and β-amyrins, benzyl-2, 6-dimethoxy benzoate, bornyl ferulate, linoleic acid, linolenic acid, phytol, stigmasterol and taraxasterol acetate were isolated from the roots and aerial parts.

Pharmacological activities

Some researchers have used different extracts / fractions of the plant for the different bioefficacies like antibacterial, antifungal, antiviral, antitumour, hypoglycaemic and anti-implantation activities. According to these results, greatest antimicrobial activity was demonstrated by root extract against *Streptococcus faecalis*. Out of various enriched fractions, the essential oils and flavonoids exhibited maximal inhibitory activity against *S. faecalis* and *Curvularia lunata*, respectively. Substantial antiviral activity was also demonstrated by the plant extract against the test viruses. Aqueous infusion of roots shows a significant antimutagenic inhibitory activity (11-40%). Galegine isolated from flowers exhibited an initial increase in the blood glucose level by 32.79 ± 2.69 (%) after 0.5 hrs and then demonstrated a continuous effect reaching a maximum of 60.63 ± 2.78 (%) within 2 hrs of its administration. A small effect on rat pregnancy at the tested dose levels of the roots extract was observed, which was also effective in lowering the ratio of implantation sites and corpus luteum. Methanolic extract of the heads of *V. encelioides* has a more notorious antimicrobial activity against Gram +ive microorganisms and *C. albicans* than against Gram –ive bacteria, having no activity against *Citrobacter freundii*.

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References