

QUALITATIVE PHYTOCHEMICAL ANALYSIS AND ALLELOPATHIC EFFECT OF *MIKANIA MICRANTHA*-AN INVASIVE SPECIES OF KERALA

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Abstract

Aqueous, methanolic, ethyl acetate and acetone extracts of *Mikania micrantha* HBK (Asteraceae) were screened for phytochemical compounds. Tests for tannins and phenols were positive in all the four extracts. Alkaloids, terpenoids and steroids were absent in the aqueous extract and present in other three extracts. Flavonoids were present only in the aqueous extract. Currently *Mikania micrantha* has become a serious threat to the plantation crops, due to its rapid spreading. Allelopathy may be the phenomenon that boosts up the aggressive invasion of weeds in our region. In the present study, we examined the effect of aqueous extracts from the leaves of *Mikania* at different concentrations (control, 1%, 5% and 10%) on the seed germination and seedling growth of *Vigna radiata* using petri plate bioassay. Here the leaf extracts inhibited the seed growth (radicle length and hypocotyl length) at different concentrations. But the inhibitory effect was maximum in the 10% concentration (radicle length is 0.2 cm). Maximum germination percentage was observed in the control (86%) and least (6%) in 10% sample. Bioassays indicated that the inhibitory effect was proportional to the concentrations of the extracts and higher concentrations had the stronger inhibitory effect. So, it is revealed that allelopathy may be the reason for the plant to become a dominant weed in our country.

Key words: *Mikania micrantha*, Allelopathy, *Vigna radiata*

Introduction

Plants have been utilized as a reliable source of medicines and nutritional products from time immemorial. Different kinds of bioactive chemical compounds are present in various plants which have often been utilized either in traditional methods or as pure principles. If we can make use of medicinal plants that are locally available, synthetic drugs will have a strong substitute. The appearance of multiple drug-resistant strains of microorganisms subsequent to indiscriminate use of antibiotics has created an additional interest in herbal drugs.

Plants are rich with large number of compounds which are claimed to have anti-cancer, anti- microbial, anti-diabetic properties etc. Most of the plants are used extensively by indigenous people all over the world. Many plants have been found to be effective in curing a wide range of diseases among the tribals. As a result, the researchers are now focusing on the evaluation and characterization of different phytochemicals against a number of ailments. Currently plant compounds have achieved great demand due to their successful application. So, extracting those phytochemicals through different procedures could be -

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pathbreaking in its scientific advances.

Weeds, basically defined as plants that are undesirable, having vigorous growth in particular places, are considered persistent and noxious as well. Most of the weeds are invasive in nature and they replace other plant species by means of a special phenomenon called allelopathy. This makes it relevant and inevitable to study the phytochemical and allelopathic effects of a weed.

Mikania micrantha is a weed, known to have originated from central and South America (Holm et al., 1977) is commonly called as mile - a - minute weed (Water house, 1994). It is an extremely fast spreading perennial creeping weed in the Asteraceae family. *Mikania micrantha* is one of the 100 worst exotic species (Lowe et al, 2001) and is among the ten worst alien species in south -east and South Asia; and one of the 16 exotic species in China (Zhang L Y et al., 2004). The weed has been introduced into the tropical regions of Asia. So, in India the plant is an invasive alien weed. *Mikania micrantha* is an aggressive competitor that grows various forms of soils where it forms dense mass that prevent the growth of other native flora. The major threat of global diversity is the invasive species. In India *Mikania micrantha* is a notorious weed in plantation crops. It has spread to most tropical and sub-tropical regions and the north - east of India.

Despite of its harmful effects, the plant has been considerably used in traditional medicine. The plant is used to treat fever, rheumatism, influenza and respiratory disease (Muceneek et al., 2009).

Exotic plant invasions badly affect the structure of native plant communities and their ecosystem. They reproduce quickly with the help of numerous small seeds. The process of allelopathy promotes exotic plant invasion. Commonly cited effects of allelopathy include reduced seed germination and seedling growth. Allelopathy refers to the beneficial or harmful effects of biochemical that are released by one plant species (Putnam and Tang, 1986). This is due to the chemicals named allelochemicals, which are secondary metabolites. The word allelopathy is from two Greek words; 'Allelon' meaning each other and 'pathos' meaning to suffer (Reigosa et al., 2006). Allelopathy is the effects of one plant on another due to chemicals released by them, or the breakdown products of their metabolites. Allelopathy is considered to be an important process behind plant invasion.

The aim of the present study was to analyse the phytochemical compositions of *Mikania micrantha* and to investigate its allelopathic effect from its leaf extract.

Materials and Methods

Collection of Plant Material

The leaves of *Mikania micrantha* were collected from vicinity of Kollam district, Kerala, India. The leaves were first washed with tap water to remove adhering dust particles and then rinsed with distilled water. The leaves were then shade dried, ground into a fine powder and stored in air tight dark bottles at room temperature.

Sample Preparation for Phytochemical Analysis

The extract was prepared by soaking 50-gram powdered sample in respective solvents (Ethyl

acetate, Acetone, Methanol and water) for a period of three days at room temperature. The crude extract was prepared by filtering the extracts using Whatman filter paper No.1. The extract was stored in air tight container for further use.

Preliminary Quantitative Phytochemical Screening

Phytochemical examination was carried out for all the extracts using standard procedures to identify the constituents as described by Harborne (1998).

Allelopathic Studies

From the field studies it was observed that plants have strong allelopathic effects towards the growth of crop plants. In the present investigation the leaf of *Mikania micrantha* has been selected for the detailed experimentation. Seeds of *Vigna radiata* were used for the germination studies.

Preparation of Aqueous Extracts

The leaves of *Mikania micrantha* was washed, dried and ground to a fine powder. The aqueous extract was prepared by mixing 10 grams of the powder with 100ml distilled water and left for 24 hours in the dark at 27°C. After 24 hours the aqueous extract was filtered and the final volume was made up to 100 ml. 10% aqueous extract thus obtained was used as the stock solution. Different dilutions such as 1% and 5% extract was prepared from the stock solution. The three concentrations (10%,5%,1%) of the extracts were tested for the allelopathic potential by seed germination tests.

Germination Studies

The seeds of *Vigna radiata* were surface steril-

ized with 0.1% mercuric chloride for two minutes and immediately washed twice with distilled water.

Petri plates were sterilized and in which sterile filter paper was placed. Twenty seeds were placed per petri plate. The filter papers were wetted with aqueous leaf extracts. Five ml extract was added to the petri plate. Seeds treated with distilled water served as a control. For each treatment two replicates (each containing twenty seeds) were maintained. The petri plates were maintained under the laboratory condition (room temperature 27°C) for 10 days. The seeds were kept moist by applying about 2ml of appropriate extract daily. Seed germination was recorded daily for 10 days. On tenth day length of the radicle, hypocotyl of seedlings and Germination rate were measured.

Results and Discussion

Phytochemical Screening

The phytochemicals detected in the leaf extract of *Mikania micrantha* is presented in table 1. Test for tannin, phenols were positive in the ethyle acetate, methanol, aqueous and acetone extracts. Alkaloids, steroids and terpenoids are absent in aqueous medium. Saponins and flavonoids are present in aqueous extracts. Cardiac glycosides are present on methanol and acetone extracts. Quinones and phlobatanins are absent in all extracts.

Phenolics, alkaloids and cardiac glycosides were identified in the extract, these phytochemicals have been documented to possess medicinal properties and health promoting effect (Del-Rio et al., 1977; Okwu, 2004; Liu, 2004.) Substantial amount of tannin and phenols were detected in qualitative test. Phenolics are the largest group of phytochemicals and the -

Table 1. Phytochemicals detected in different extracts of *Mikania micrantha*

Sl. Number	Phytochemicals	Ethyl acetate	Methanol	Acetone	Aqueous
1	Alkaloids	+	+	+	-
2	Saponins	-	-	-	+
3	Tannins and Phenols	+	+	+	+
4	Flavanoids	-	-	-	+
5	Quinones	-	-	-	-
6	Cardiac glycosides	-	+	+	-
7	Terpenoids	+	+	+	-
8	Steroids	+	+	+	-
9	Phlobatanins(+)	-	-	-	-

(+)= present (-) = absent

Table 2. Effect of aqueous leaf extract of *Mikania micrantha* against the seeds of *Vigna radiata*.

Treatments	Germination after 10 days	Radicle length (in cm)	Hypocotyl length (in cm)
Control	86%	1.13	1.73
1%	66%	0.83	1.29
5%	33%	0.41	0.56
10%	6%	0.20	-

antioxidant activity of plant extract have been due to this compound. (Thabrew *et al.*,1998). Tannins reduce the risk of coronary heart diseases (Janaky Renjithkumar *et al.*,2010). Our results showed that saponin present only in water in moderate amount.

Allelopathic Studies

The germination percentage of *Vigna radiata*

seeds were shown in Table 2. Highest germination percentage was observed at control; and the lowest germination percentage was observed at treatment with 10% concentrations (6%). Table. 2also revealed the radicle length and hypocotyl length of the seedlings. It was revealed that control has the highest values and 10%treatment showed the least value. The seeds treated with the higher concentration (10%) germinate after 10 days. But there were

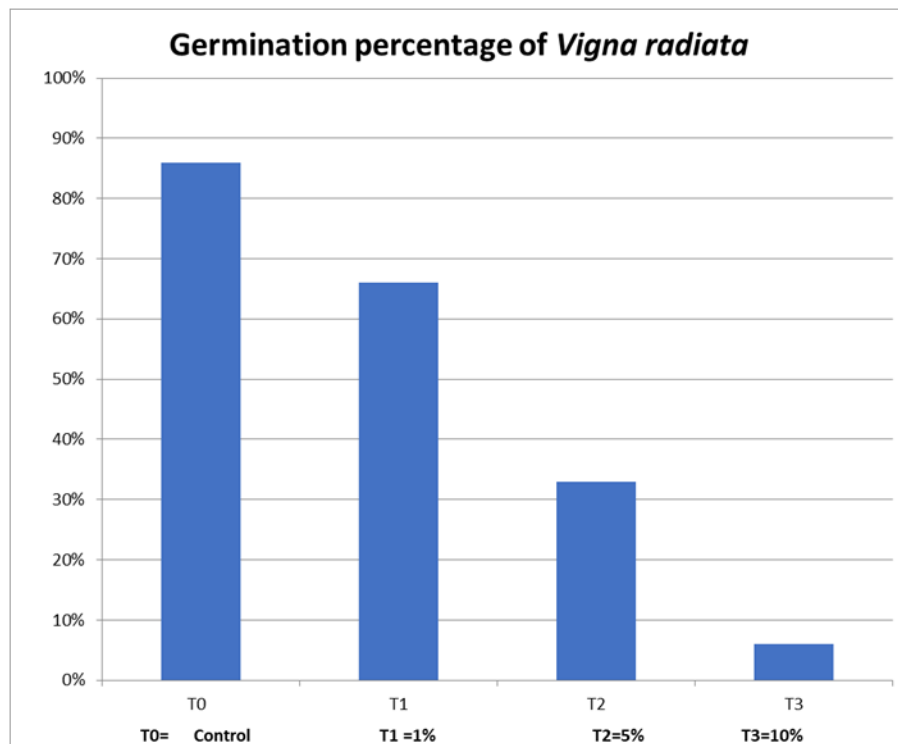


Figure 1. Germination Percentage of *Vigna radiata*

no plumule formation after 10 days. But the seeds of control, 1 % and 5% treatments were germinated within two days.

The present investigation distinctly explained the suppressive phenomenon of *Mikania micrantha* leaf extract on the germination and seedling growth of *Vigna radiata*. There are many studies which show evidences on the inhibitory effects of weed plants on the growth and multiplication of other native plants, such as their depletion in seed germination and seedling growth (Orr et al.,2005; Abhilasha et al.,2008). In the study the maximum inhibitory effect on seedling growth were seen in the higher concentration (10%). Inhibitory effect was increased with an increase of extract con-

centration indicating that the effect of plant extracts dependent very much on their concentrations. The observation was supported by the works of Ballester et al.,1982, Rizvi and Rizvi,1987; Bansal,1998; Daniel,1999). The inhibitory effect of Mikania on the growth of other plants may be due to the presence of the allelochemicals. These results are correlated with the findings of Kanchan and Jayachandra,1979 who worked out the allelopathic effects of many Indian weeds on major crop plants. After their detailed study they were reported that phenolics found in leaves have inhibitory effects on growth of nitrogen fixing bacteria (Kanchan and Jayachandra.1979). Allelochemicals are found in different parts of a plant, and they reach the soil by exudation from roots into soil water or after falling down of -

leaves and other parts, subsequently they decomposed and get incorporated into the soil (Inderjit and Duke,2003).

Conclusions

Allelopathic properties and phytochemical constituents in leaf extract of *Mikania micrantha* were evaluated in this study. Phytochemical investigations identified the presence of alkaloid, saponins, tannins, phenols, flavonoids, cardiac glycosides and steroids. The extract had strong inhibitory effect on germination and root elongation. The leaf extract can suppress seed germination and seedling growth of *Vigna radiata*. Thus, it is proved that the plant exhibits strong allelopathic character. The allelopathic impact of *Mikania micrantha* may be an important factor adding to the violently invasive nature of this plant.

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