

# INVASIVE PLANT MIKANIA MICRANTHA A MAJOR THREAT TO BIOLOGICAL DIVERSITY - A REVIEW

**Bindu Vijay**

*Assistant Professor, Science and Technology, Gujarat National Law University (India)*

## ABSTRACT

*Invasive species are considered to be a major threat to biological diversity world –wide. In agronomic and non cropping land, weeds are the main threat. Mikania micrantha an invasive alien plant is a major threat to agricultural crops, especially affecting tea and other plantation crops. The plant is considered as one of the 100 worst invasive alien species in the world.*

*This review article aims to provide the general information about the distribution and ill effects of Mikania micrantha.. Role of allelochemicals in understanding the invasiveness of Mikania is also explored.*

**Keywords:** *Allelochemicals., Allelopathy, Biological Diversity, Invasive Alien Plants, Mikania Micrantha,*

## I. INTRODUCTION

Invasive alien species is recognized as a major threat of biodiversity worldwide [1] and is known for affecting the ecosystem services. Article 8[h] to the United Nation’s Convention on Biological Diversity [UNCBD, 1992] states that “Each Contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species”.

The ability of plant to become invaded are directly related to ability to grow rapidly from vegetative phase to flowering stage, ability to compete interspecifically by special means like release of allelochemicals and germination requirements that can be fulfilled in many environment [2]. Other traits that have contributed to its success as an invader include prolific reproduction [3], a short generation time [4], tolerance to mutilation [5], and a wide adaptive potential [6].

Mikania micrantha is causing serious threats to plantation crops especially to tea and rubber. It’s a climbing perennial weed of the family Asteraceae native to central and south America, and has been listed as one of the 100 worst invasive alien species in the world [7, 8] and one of the world’s 32 worst invasive plants.



**Fig.1 Mikania Micrantha [9]**

Ever since the weed became a menace around the globe including India, efforts have been made to manage the weed employing different methods such as mechanical, chemical, and biological control methods.

However control of *Mikania micrantha* is difficult, because of the high output of viable seeds, and because new plants can grow from even the tiniest stem fragments. Several methods have been used to control this aggressive weed.

In the recent years the impact of *M. micrantha* on agricultural and forest production and ecological environment has increased and government agencies both at National International level, researchers and scientist across the world are involved in finding a sustainable way of managing this weed.

## II. DISTRIBUTION

The genus *Mikania* contains about 250 species and belongs to the tribe eupatorieae, with in the family asteraceae. Most species of genus *Mikania* are native to America. *M. micrantha* is native to Central and South America. It has been reported as a weed in Bangladesh, Sri Lanka, Nepal, Mauritius, Thailand, Philippines, Malaysia, Indonesia and Papua New Guinea. It is known for its rapid growth in humid tropical environments and reported to be one of the worst weed intentionally introduced to India



**Fig:2 Mikania Overrunning a Banana Plantation [9]**

*Mikania micrantha* was introduced into India after the second World War to camouflage airfields [ 10]. It is been introduced as a ground cover in tea plantations and is known to occur in the states of Assam, West Bengal, Orissa, union territory of Andaman and Nicobar Islands and in Tamil Nadu [ 11].

Several articles report the occurrence of this weed in state of Gujarat, Arunachal Pradesh too. This shows the rapid spread to *Mikania micrantha* to other part of India.

## III. IMPACT

As a fast growing vine it climbs over other vegetation blocking sunlight, smothering forests, and preventing forest tree regeneration [5]. It forms dense tangled infestations in pastures, plantations and disturbed forests. It is known to suppress the underlying vegetation [12]. *M. micrantha* cover the tree crown, affecting the photosynthesis of the trees and habitats of birds [13]. Several studies have reported that *Mikania* can alter soil microbial communities thereby strengthening it to successfully invade the natural ecosystem [14]. *M. micrantha* could influence soil nitrogen availability and transformation through allelopathy, facilitating invasion [15].

In India, the most severely affected crops effected by *Mikania* include coconut, coffee, cocoa, banana. It cause enormous damage over a broad range of sectors. The most important are losses in potential agricultural output causing yield loss and boosting herbicide costs. Their invasion also causes serious threat to wildlife habitat.

*Mikania micrantha* in Chitwan national park in Nepal have heavily encroached most of the potential al rhino habitats [16].

#### IV. ALLELOPATHY OF MIKANIA

Allelopathy has been considered as a major mechanism for the successful invasion by alien plant species [15]. Several weed plants have shown allelopathic effect.

Allelopathic effect of *Mikania micrantha* may be an important mechanism involved in invasive success. Allelochemicals of *M. micrantha* are released by decomposition of plant debris or volatilization.[17]. The volatile oil from *M. micrantha* flowers contains high concentrations of  $\alpha$ -pinene and  $\beta$ -pinene, both of which are effective insect repellents. [18].  $\alpha$ -pinene and  $\beta$ -pinene are organic compounds of terpene class. Terpenoids are a diverse group of secondary compounds with a variety of functions, playing an important role in plant-plant, plant-insect and plant-pathogen interactions [19, 20,21].

$\beta$ -Caryophyllene is an important volatile sesquiterpene of plants that may serve as allelochemical to influence the neighboring plant growth or as an indirect defence to attract natural herbivore enemies.  $\beta$ -caryophyllene was also a major sesquiterpene [9.72%] in *M. micrantha* stem leaves and flowers [22]. This allelochemical inhibited the germination rate and seedling growth of *B. campestris* and *R. sativus*.

Along with terpenes, phenolic compounds are isolated from *Mikania micrantha*.

Leaf aqueous extract of *Mikania micrantha* had strong inhibitory effect on seedling germination and seedling growth of *Oryza sativa* and *Raphanus sativus* [23].

The aqueous extract of the branches and leaves inhibited the growth of *Raphanus sativus*, *Lolium multiflorum*, *Trifolium repens* L. [24]. The soil in the vicinity of *M. micrantha* inhibited seed germination and growth of tested species [15]. Extracts of *Mikania* plants significantly decreased the biomass and nitrogen content of tomato seedlings and legume cover crops [25]

It drastically suppresses the growth of associated plant species, mainly by reducing the availability of light, as it rapidly forms a dense cover over host plants, and also by secreting allelochemicals in their vicinity [26].

#### V. MANAGEMENT

*Mikania micrantha* is a serious weed of many crops especially that of tea, rubber and banana, coconut. It can reduce the productivity of these crops. In certain crops it can reduce the productivity by 10 – 50 per cent depending on the intensity of weed growth. Several mechanisms of management is adopted depending upon the intensity of *Mikania* growth. Mechanical control methods of *Mikania* like sickle weeding, uprooting and digging are labour intensive, expensive and not effective in the longer term [27].

Mechanical and manual weeding seems to be costly and time consuming and some time injurious to crops like tea. Herbicides like 2-4-D, Glyphosate and Atrazine is reported to be used in many countries. The efficacy of herbicides to control *mikania* weed is short lived and vigorous re-growth is observed after a few months of application [28]. Extensive use of herbicide harms the environment and in certain instances residues are seen deposited in crop plants. Effort has been made to use biological control mechanism to sustainably manage *Mikania*. The rust fungus *Puccinia spegazzinii* de Toni, from Trinidad, shown to be highly specific and damaging to *Mikania* is introduced to India to control the weed. The rust was first released in tea gardens in Assam. But it failed to establish. In 2006 the rust was introduced to Kerala initially in agricultural systems

followed by forest sites [27] literature review reveals that these releases were found to be successful in controlling *Mikania micrantha*. In 2008 the rust was introduced into Papua New Guinea [PNG] as a classical biological control agent of *Mikania micrantha*. The field trials showed that *P. spgazzinii* has the potential to reduce populations of *M. micrantha* [29].

## VI. CONCLUSION

Like many other invasive plants *Mikania micrantha* is invading the different ecosystems in India, causing a huge impact in biodiversity. Integrated methods for the management of *M. micrantha* are necessary to avoid potential threats to biodiversity and economic losses. Local communities should be made aware of *Mikania micrantha* in their localities, mode of dispersal, negative impacts to natural ecosystems, and management option to contain them. Community based approaches, for alien species management, can best be complemented with biological control.

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