VOLUME 10 ISSUE 2 2024

ISSN 2454 – 3055

INTERNATIONAL JOURNAL OF ZOOLOGICAL INVESTIGATIONS

Forum for Biological and Environmental Sciences

Published by Saran Publications, India

International Journal of Zoological Investigations Vol. 10, No. 2, 1300-1310 (2024)

International Journal of Zoological Investigations
Contents available at Journals Home Page: www.ijzi.net
Editor-in-Chief: Prof. Ajai Kumar Srivastav
Published by: Saran Publications, Gorakhpur, India

ISSN: 2454-3055

Exploring the Medicinal Potentials of *Mikania micrantha*: A Review

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Received: 27th May, 2024; **Accepted:** 29th August, 2024; **Published online:** 16th December, 2024

https://doi.org/10.33745/ijzi.2024.v10i02.131

Abstract: Wide-ranging healing properties of plant derivatives are driving their development in medical research. Today, phytochemicals are being investigated as novel and potent therapies due to the increase in drug resistance and the dangerous side effects of synthetic medications. *Mikania micrantha*, also known as mile-a-minute weed or bitter vine, is a versatile plant with a long history of traditional medicinal use across various cultures. This review aims to compile and analyze existing research on the various medicinal properties of *Mikania micrantha*, including its phytochemical composition, pharmacological activities, and potential therapeutic applications. Through a comprehensive examination of scientific literature, this article sheds light on the promising medicinal potentials of *Mikania micrantha* and highlights areas for future research and development.

Keywords: *Mikania micrantha,* Phytochemicals, Medicinal plants, Pharmacological activity, Traditional use

Citation: Lahan Madhuchandra, Bora Suraj, Akhtar Tanjimul and Barman Parag: Exploring the medicinal potentials of *Mikania micrantha*: A review. Intern. J. Zool. Invest. 10(2): 1300-1310, 2024.

https://doi.org/10.33745/ijzi.2024.v10i02.131

Introduction

The study of medicinal plants is still an important and fruitful area in drug development because it makes advantage of the plants' many bioactive compounds, traditional usage, and potential as long-term sources of therapeutic raw materials. Diverse bioactive chemicals found in medicinal plants can provide a wealth of resources for the creation of novel drugs. Natural plant products have been the source of many significant pharmaceuticals(Katiyar *et al.*, 2012; Atanasov *et al.*, 2021; Nasim *et al.*, 2022). Furthermore, the usage of medicinal plants has grown significantly in the past several decades in both the Western world and Asia, whether as dietary supplements or as cures in traditional medicine (Da Silva *et al.*, 2018). The selection of interesting medicinal plant species for additional research has frequently been influenced by the ethnobotanical knowledge of traditional medicine systems. The capacity to recognise, isolate, and characterise new bioactive chemicals from medicinal plants has improved with the development of analytical methods such

Table 1: Traditional uses of *Mikania micrantha* in various parts worldwide

Parts used	Traditional use	Location
Leaf juice	an antidote for insect bites and scorpion sting	Karbi tribes, Assam, India
Leaf juice	Anti-bacterial effect	Northern parts of India
Leaf	stomach-aches	Several parts of India
Leaf juice of Mikania	Curative agent for itches	Malaysia
Leaf	Wound healing	Uttar Pradesh, India
Leaf	it is used to heal cuts	Fiji
Whole tree	Treat gastric ulcer, local antiseptic	Bangladesh
Leaf	Local antiseptic	Mizoram
Decoction of the leaves Part	tumor	tribal of Cacher Hill of Assam, India
The vine	Snakebites	Miskito of Eastern Nicaragu
Leaf juice	Rashes and itching	Jamaica
Leaf	Wound dressing and healing of sores	Assam, India
Whole plant (tea)	Clean the uterus	Some East Asia parts

as proteomics, metabolomics, and genome analysis (Nasim *et al.*, 2022). As a result, there are now more possible medication leads from natural sources. Additionally, medicinal plants can be a reliable supply of raw materials for the manufacturing of drugs, particularly for complex natural compounds that are challenging to chemically synthesis. This is crucial to take into account in order to guarantee a sufficient supply of medications made from natural sources (Atanasov *et al.*, 2021). Additionally, researching the mechanisms of action of chemicals originating from plants might reveal new pharmacological targets and disease pathways, resulting in the creation of innovative treatment strategies (Katiyar *et al*., 2012; Nasim *et al.*, 2022).

Mikania micrantha belonging to family Asteraceae, commonly referred to as mile-a-minute weed, is a perennial creeping plant that grows very quickly (Day *et al*., 2016). Although it originated in Central and South America's tropical regions, it is now commonly found in Southeast Asia, the Pacific Islands, South China, and other places. Other names for this plant include Chinese creeper, American rope, Selaputtunggul in Malaysia, Chhagalbati or Japanilata in West Bengal, and Sembungrambat in Indonesia (Haisya *et al.*, 2013; Ishak *et al.*, 2018). It has a negative effect on the established area's agricultural output. It has emerged to be a significant issue in Southeast Asia, seriously harming local agriculture and plants for several decades (Ríos *et al.*, 2014). Thus, the Invasive Species Specialist Group of IUCN has identified the weed as one of the top 100 worst invasive alien species in the world (Li *et al.*, 2013). *Mikania* has around 430 species, of which roughly 50 have been the subject of chemical research. These investigations identified more than 300 distinct substances, primarily flavonoids, terpenoids, and sterols (Ríos *et al.*, 2014; Da Silva *et al.*, 2018).

In many parts of the world,different species of*Mikania* has historically been utilised as folk medicine (Jyothilakshmi *et al.*, 2015; Day *et al.*, 2016) as listed in Table 1. *Mikania micrantha* leaves are used to form a poultice for scorpion stings and snake bites in many parts of Mexico. Leaf decoction can also be used as a bath for rashes, skin irritation, athlete's foot, wound dressing etc. This plant is employed traditionally

to stop small external bleeding or ingested in the form of juice as a substitute for reducing blood pressure, cholesterol, and glucose (Facey *et al.*, 2010; Ishak *et al.*, 2018). Certain *Mikania* species have been utilized in traditional medicine to cure ailments including bronchitis, asthma, and coughing. *Mikania micrantha* is used as a remedy to cure a variety of illnesses in humans, such as bug bites, skin rashes and itches, chicken pox, wound and sore healing, fever and colds, nausea, rheumatism, jaundice, and respiratory conditions. *M. micrantha* possesses anti-inflammatory, analgesic, antioxidant, anti-microbial, antivirucidal, anthelmintic, anti-dermatophytic, anti-protozoal, antiparasitic, anti-diabetic, cytotoxic, anxiolytic, wound-healing, anti-aging, spasmolytic, memory-enhancing, and thrombolytic activities (Rufatto *et al.*, 2012; Ali *et al.*, 2023). It is used as a local antiseptic and to treat gastrointestinal ulcers in Bangladesh and India (Raka *et al.*, 2019). The tribal people of the Charchar Hill in Assam, India, have long utilised the decoction of the leaves to cure tumours (Debaprotim *et al.*, 2014). In Brazil, some other species of *Mikania,* like *Mikania laevigata* (known as 'guaco') leaves are widely used as infusions or plasters, and its crude extract is commercialized as phytomedicine. Preparations from the aerial parts of *Mikania laevigata* exhibit anti-ulcerogenic, antimicrobial, antispasmodic, bronchodilatory, and anti-inflammatory properties which is attributed to various chemical constituents (Alves *et al.*, 2009). Because of the medicinal properties of its leaves, people frequently utilize them to treat inflammatory conditions including cough, rheumatic fever, asthma, and bronchitis (Della Pasqua *et al.*, 2019).

Enough study has been done on *M. micrantha*'s biological characteristics but a few review studies have been carried out on either its medicinal or intrusive actions. Therefore, the objective of this review is to investigate and compile the traditional uses, phytochemical profile, and biological activity of the *M. micrantha* plant. The review of the biological activities and their mechanisms of action was conducted using the current literature from several sources.

Phytochemical Composition:

Over 150 distinct phytochemicals are present in the plant, categorised into the following groups: glycosides, phenolics, flavonoids, terpenes and terpene lactones. It also contains carbohydrates and micronutrients including vitamins and other trace minerals. Many chemical substances were isolated from *Mikania micrantha* including deoxymikanolide, dihydroscandenolide, scandenolide, mikanolide, dihydromikanolide, and m-methoxy benzoic acid (Li *et al.*, 2013). Furthermore, additional substances found in this plant include flavonoids, steroids, sesquiterpenes, sesquiterpene lactones, monoterpenes, alcohols, and ketones. These substances enhance *Mikania micrantha's* antioxidant and antibacterial qualities, making it a promising plant for possible medical uses (Zhang *et al.*, 2003; Rufatto *et al.*, 2012; Dong *et al.*, 2017).

The essential oil from *Mikania micrantha* flowers, mainly composed of sesquiterpene hydrocarbons (62.9%) and oxygenated sesquiterpenes (23.9%) (Saikia *et al.*, 2020). GC/MS analysis of the volatile oil of *Mikania micrantha*, showed twenty-two chemicals, including alcohols, ketones, sesquiterpenes, and monoterpenes together with their derivatives (Zhang *et al.*, 2003). The plant has structurally varied phenolic compounds which is responsible to show antioxidant activity even stronger than that of L-ascorbic acid (Dong *et al.*, 2017). *Mikania micrantha* contains terpenes, tannins, sterols, and flavonoids, which are known for their anti-inflammatory, antimicrobial, and antioxidant properties (Rufatto *et al.*, 2012).

Pharmacological Activities of Mikania micrantha:

Antioxidant Properties:

Free radical is a chemical species with unpaired electrons which are highly unstable and damage other molecules by extracting electrons to gain stability. These are generated during normal metabolism and play dual roles as both harmful and beneficial agents. Excess reactive oxygen species (ROS) and/or reduced antioxidants can

cause tissue damage and diseases. Antioxidants protect the body by reducing oxidative damage to cellular components caused by ROS (Krishnaiah *et al.*, 2011). Recent studies suggest that plant-derived antioxidants with free radical scavenging properties are therapeutically important in diseases like diabetes, cancer, neurodegenerative diseases, cardiovascular diseases, aging, and gastrointestinal diseases (Dev *et al.*, 2015). Significant antioxidant action can be attributed to its high polyphenol content.

In certain places, such as Malaysia, the traditional use of *M. micrantha* as medicine is widespread. In a study by Lallicchunga *et al.* (2016), the antioxidant activity of *Mikania micrantha* leaves was evaluated. The leaves showed significant antioxidant potential in the ferric reducing assay. DPPH scavenging prevents lipid oxidation and allows quick radical scavenging assessment. The ferric reducing test measures the reduction of Fe^{3+} to Fe^{2+}, linked to antioxidants' hydrogen donating capacity (Lallicchunga *et al*., 2016). In addition, fourteen phenolic compounds of *M. micrantha* were isolated which showed potent ABTS radical scavenging activity, strong DPPH scavenging and FRAP activities, compared to L-ascorbic acid (Dong *et al.*, 2017). In another study, Ishak *et al.* (2018) investigated the antioxidant capabilities and total phenolic (TPC) and flavonoid content (TFC) of *M. micrantha* leaf and stem extracts. Ethyl acetate extracts of stems and leaves showed the highest TPC and TFC (Ishak *et al.*, 2018). In a similar study, the maximum total phenolic content, DPPH and ABTS radical scavenging activity, and FRAP value were found in the 70% aq. ethanol extract of *M. micrantha* (Datta *et al.*, 2020).

Antimicrobial activity:

Since the 1940s, antibiotics have been used to treat bacterial illnesses. The bacteria are susceptible to developing antibiotic resistance which is currently regarded as a serious worldwide health risk. Most common bacterial pathogens have become resistant to many antibiotics, and new antibiotic discoveries are rare, with only daptomycin found in the last 50 years (Sheam *et al.*, 2020). Thus, alternative therapeutics are urgently needed. Plant-derived phytochemicals are promising due to their antimicrobial potency, nontoxic nature, and bioavailability. The genus *Mikania* contains plants have been shown to exhibit antibacterial action against a wide variety of microorganisms (Rufatto *et al.*, 2012).

Mikania micrantha leaves may be a promising source for new antimicrobial drugs, mitigating its adverse impact (Li *et al.*, 2013). Extracts from different species of *Mikania* have shown significant antibacterial activity against numerous bacteria (Sheam *et al.*, 2020). The antibacterial activity of aqueous and methanolic extracts from *Mikania micrantha* showed effectiveness against *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, *Enterobacter aeruginosa*, and *Proteus vulgaris* (Ghosh *et al.*, 2008). The antibacterial and cytotoxic properties of an ethanolic extract from *M. cordata* leaves extract showed moderate antibacterial activity, particularly against *S. flexneri*, with Gram-positive bacteria being more susceptible (Ali *et al.*, 2011). Additionally, a number of *M. micrantha* extracts containing tannins, flavonoids, and polyphenols showed promise as antibacterial agents against pathogenic *Pseudomonas aeruginosa* that is resistant to drugs, as well as *Salmonella* bacteria, including *Staphylococcus aureus, Staphylococcus epidermidis*, *Bacillus subtilis*, *E. coli*, and *Streptococcus pneumoniae* (Matawali *et al.*, 2016; Harahap *et al.*, 2018). The methanolic extract of *Mikania micrantha*, at a dosage of 200 mg/ml, showed antibacterial activity against *Bacillus cereus* that was comparable to that of the drug ciprofloxacin, potentially inhibiting the development of six bacterial strains (Borkataky *et al.*, 2013). In a similar study, the antimicrobial activity of *Mikania micrantha* leaves were evaluated against eight pathogenic fungi and eight bacteria. Antifungal and antibacterial activities were characterized

using MIC and MBC via broth microdilution. All compounds showed effectiveness, with deoxymikanolide exhibiting the strongest activity (Li *et al.*, 2013). A variety of plants' sesquiterpene lactones (SLs) have antibacterial action against a broad spectrum of microorganisms, such as viruses, bacteria, and fungus (Matejić *et al.*, 2010). The sesquiterpene mikanolide isolated from *Mikania micrantha* showed potential antimicrobial activity against *Staphylococcus aureus* (Facey *et al*., 2010). The essential oil extracted from *Mikania micrantha* flowers contains antimicrobial activity against *Mycobacterium smegmatis*, *Candida albicans*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* (MIC: 8 µg/ml), and showed cytotoxicity against HeLa and PA1 cancer cells (Saikia *et al.*, 2020).

Antifungal Activity:

Around a billion people globally suffer from skin, nail, and hair infections caused by pathogenic fungi, with fungal diseases having a mortality rate comparable to tuberculosis. Additionally, plant pathogenic fungi pose significant challenges in agriculture by affecting plant tissues. In response to fungal attacks, plants synthesize various metabolites as part of their defense mechanisms (Sheam *et al.*, 2020). The leaf extracts of *Mikania micrantha* inhibit the spore germination of several fungal species, including *Exserohilum turcicum*, *Pseudoperonospora cubensis*, *Colletotrichum lagenarium* and *Botrytis cinerea* (Li *et al.*, 2013). Glycosides and quinones in *M. micrantha* exhibit antifungal activity against *Fusarium moniliforme*, *Fusarium proliferatum, Fusarium eridiforme* and *Sclerotium rolfsii* (Baral *et al.*, 2011) by targeting cell-wall polypeptides and membrane-bound enzymes, thereby disrupting protein synthesis and cellular functions (Omojate *et al.*, 2014). The presence of terpene components in the essential oil of *M. glomerata* may be linked to its anti-candida effect, as confirmed by the MIC test (Da Silva *et al.*, 2018). The antifungal activity of mikanolide, deoxymikanolide, scandenolide, dihydroscandenolide, dihydromikanolide, and m-methoxybenzoic acid, isolated from *Mikania micrantha* chloroform extract, was evaluated and found that all compounds are effective against tested strains, with deoxymikanolide, showing the strongest activity (Li *et al.*, 2013).Ethyl acetate extracts from *M. micrantha* leaves, flowers, and stems completely inhibited the growth of phytopathogenic fungi like *Epidermophyton floccosum*, *Trichophyton rubrum*, *Microsporumcanis*, and *Microsporum gypseum* (Jyothilakshmi *et al.*, 2015).

Anthelmintic and Anti-protozoal property:

Helminthiases are parasitic worm infections that predominantly affect children in developing countries. Helminth infections are common around the world, especially in places with inadequate access to healthcare and poor sanitation. These worm infections cause malnutrition, pneumonia, and anemia (Ikbal *et al.*, 2020). Over 25% of the global population has been affected by soil-borne helminth infections, such as hookworm and *Ascaris species*; intestinal protozoal illnesses, such as giardiasis and amebiasis (Sheam *et al.*, 2020). These infections persist due to environmental contamination with eggs and larvae. These worms consist of flukes, roundworms, tapeworms, and other types. Drugs called antihelminthics, or anthelmintics, are used to treat illnesses brought on by these parasitic worms. They function by either eliminating the worms (vermicidal) or forcing them to leave the body (vermifuge). Although allopathic anthelmintic drugs exist, they often have side effects, including liver and kidney issues (Ikbal *et al.*, 2020). Therefore, the development of specific alternative medicines to combat the parasite infection is imperative. It has been discovered that natural products have little adverse effects when used to treat helminth infections.

Researches showed that the sesquiterpene lactones from *M. micrantha* exhibit significant antiprotozoal activity against *Trypanosoma cruzi* and *Leishmania braziliensis*. The α and β-unsaturated lactone groups in these compounds are key determinants of their antiprotozoal efficacy (Laurella *et al.*, 2017). Similarly, the

methanolic extract of *M. micrantha* contains alkaloids, flavonoids, saponins, and phenolic chemicals that have a modest antihelmintic action that paralyzes and kills adult *Pheretima posthuma* earthworms in a dose-dependent manner (Dev *et al.*, 2015). Ikbal *et al.* (2020) also observed the strong anthelmintic activity of *Mikania micrantha* by killing the earthworm *Pheritima posthuman*.

Anti-cancer activity:

Cancer, the second leading cause of death globally, accounts for about 13% of annual deaths. It is a complex disease which involves uncontrolled cell growth and genetic irregularities, impacting gene expression patterns. Beyond health issues, cancer poses significant economic challenges, even in industrialized countries. Cancer lacks a definitive cure, necessitating varied treatments like surgery, chemotherapy, or immunotherapy. Scientists persistently explore new plants and animals seeking a permanent solution. Herbal drug formulations have gained prominence in cancer prevention and treatment research over the past three decades. Interest in natural sources of potential chemotherapeutic agents persists, as they offer alternative or complementary methods for cancer management. Discovery of effective herbs and understanding their mechanisms holds promise for innovative cancer prevention and treatment strategies(Sheam *et al.*, 2020).

There are reports that *M. micrantha* contains a variety of extracts and phytochemicals with cytotoxic and anticancer properties. For example, against Ehrlich ascites carcinoma cells in Swiss albino mice, flavonoids extracted from *M. micrantha* have demonstrated a dose-dependent anticancer activity. In this study the anticancer activity of n-butanolic extract of *M. micrantha* was evaluated in Swiss albino mice bearing Ehrlich ascites carcinoma cells. Results showed significant reductions in tumor volume, increased lifespan (58.81% and 54.37%), and decreased tumor mass (1.92 ± 0.067g) (Debaprotim *et al.*, 2014). In another study, the aqueous extract of *Mikania micrantha* was investigated *in vivo* on K562 and HeLa cell lines which revealed dose-dependent inhibition, showing proliferation inhibition. *In vivo* tests on S180-bearing mice demonstrated tumor inhibitory rates ranging from 12.1 to 46.9% (Dou *et al.*, 2014). Sesquiterpene lactones (SLs), among other phytochemicals, are recognized to have potent antiproliferative properties. Because of their unique structural characteristics, nine SLs that were isolated from the aerial sections of *M. micrantha* showed cytotoxic effects on three cancer cell lines (Ríos *et al.*, 2014). Recently, silver nanoparticle containing aqueous leaf extract of *M. micrantha* showed cytotoxicity and inhibition of the development of A549 cell colonies in a dose-dependent manner. Treatment increased DNA damage, lipid peroxidation, and decreased antioxidant enzymes. m-RNA expression levels of pro-apoptotic gene expression and caspase activities were elevated, while anti-apoptotic genes were down-regulated, suggesting AgNPs' potential for cancer therapy via the apoptotic pathway (Lalsangpuii *et al.*, 2024).

Anti-inflammatory Properties:

Non-steroidal anti-inflammatory drugs (NSAIDs) are associated with various side effects, including gastrointestinal and cardiovascular complications. In contrast, medicinal plants with anti-inflammatory properties and minimal or no side effects have been used by Africans for centuries, offering a safer alternative (Sostres *et al.*, 2010). Research has indicated that *Mikania micrantha* extracts have strong anti-inflammatory properties.*Mikania micrantha* contains active compounds with anti-inflammatory effects, including micrantholides, terpenoids (sesqui-terpene lactones and diterpenes), polyphenols, and flavonoids. Terpene derivatives like mikanolide and miscandenin also contribute to the plant's antibacterial and analgesic activities. These compounds are crucial for the plant's anti-inflammatory properties, making *Mikania micrantha* a promising candidate for new anti-inflammatory medications (Sheam *et al.*, 2020).

Furthermore, it has been shown that the plant's bioactive substances, such as micrantholides, have a stronger anti-inflammatory

impact on mouse ear edoema produced by tetradecanoylphorbol acetate (TPA) (Ali *et al.*, 2023). Deori *et al.* (2017) assessed the anti-inflammatory effects of ethanolic extracts of *M. micrantha* on experimental animals using carrageenan-induced rat paw oedema, granuloma pouch, and adjuvant-induced chronic arthritis methods. The extract showed dose-dependent anti-inflammatory effects, suggesting significant activity comparable to aspirin (Deori *et al.*, 2017). In another study, ethanolic extracts of *M. micrantha* exhibited higher anti-inflammatory activity than *M. scandens* but lower than aspirin. This was estimated based on the inhibition of hypotonic solution and heat-induced hemolysis of human erythrocytes *in vitro* (Khatun *et al.*, 2017). Moreover, micrantholides, a sesquiterpene, extracted from *M. micrantha* have demonstrated superior anti-inflammatory effects in mouse ear edema generated by tetradecanoylphorbol acetate (TPA) (Ríos *et al.*, 2014). The ethanolic extracts of *M. scandens* leaf extract showed significant anti-inflammatory activity, with 50% inhibition of carrageenan-induced rat paw edema at 1000 mg/kg and superior *in vitro* effects at 16000 µg/ml, compared to the stem extract. (Banerjee *et al.*, 2014). Additionally, *M. micrantha* stem and leaf extracts in hexane and ethyl acetate significantly decreased inflammation *in vivo* (Sheam *et al.*, 2020). The aqueous extract of *M. micrantha* showed significant anti-inflammatory activity in the protein denaturation test, with a notably low IC_{50} value. This effectiveness in preventing denatured protein aggregates, which contribute to inflammation, is attributed to the high quantity of bioactive metabolites present (Datta *et al.*, 2020).

Some other species of *Mikania* also shows the anti-inflammatory potential. Leaf decoctions of *Mikania laevigata* and *Mikania involucrate* are more effective than stem decoctions in reducing paw edema by over 81%. In the pleurisy assay, leaf decoctions of *M. laevigata* and *M. involucrata* inhibited leukocyte migration to the pleural exudate (Suyenaga *et al.*, 2002). In a similar study, the anti-inflammatory activity of the hydroethanolic extract of *Mikania laevigata* showed reduction in vascular permeability, leukocyte rolling, and adhesion in inflamed tissues via a nitric oxide-dependent mechanism, likely by inhibiting pro-inflammatory cytokine production at the inflammation site (Alves *et al.*, 2009).

Antidiabetic Properties:

The International Diabetes Federation (IDF) estimates that 285 million people worldwide suffer from diabetes. The most popular oral and injectable antidiabetic drugs include a number of side effects, such as nausea, vomiting, diarrhoea, cardiovascular issues, and more (Sidhu and Sharma, 2013). Therefore, natural derivatives can be used as an antidiabetic medication with lower side effects and greater efficacy. It has been shown that certain plants in the Asteraceae family contain anti-diabetic properties (Sheam *et al.*, 2020). The hypoglycemic impact of *M. micrantha* extracts is one such instance. *Mikania micrantha* is a prospective source of anti-diabetic chemicals since it contains large levels of substances including naringin, rutin, and chlorogenic acid, which are thought to be responsible for the plant's anti-diabetic benefits (Nurdiana *et al.*, 2013). In alloxan-induced diabetic rats, the ethanolic extract of *M. micrantha* considerably lowered blood glucose levels, most likely as a result of the pancreatic βcells that produce insulin being activated. Additionally, it was found that the blood glucose level was lowered by 72%, which was more than the reduction seen with metformin, the first-line treatment for type-2 diabetes (Nurdiana *et al.*, 2013). Extracts from *Mikania micrantha* may help reduce blood sugar levels by having hypoglycemic effects. This might be explained by the plant's bioactive chemicals, which may improve insulin sensitivity or have actions similar to those of insulin (Datta *et al.*, 2020). *M. micrantha* showed evidence of the existence of secondary metabolites, which are engaged in a variety of biological processes. The 70% aqueous extract of *M. micrantha* was found to be effective in inhibiting α-amylase and α-glucosidase enzyme due to the abundance of bioactive metabolites. The IC_{50} values for the percentage inhibition of α-

amylase and α-glucosidase were significantly lower than those of acarbose (Datta *et al*., 2020). Furthermore, research has indicated that the extract from *Mikania micrantha* inhibits both ACAT2 and HMG-CoA reductase, therefore reducing lipid peroxidation and hypercholesterolemia in rats and offering a possible treatment for diabetes mellitus (Ibrahim *et al.*, 2020).

Wound healing Property:

Medicinal plants promote wound healing by enhancing blood clotting and combating infections with fewer side effects. Traditionally, herbal medicine has been used in India and China for wound dressing and healing sores due to its remarkable healing properties (Raina *et al.*, 2008). The ethanolic extract of *M. micrantha* significantly accelerated wound healing in fibroblast cells even at low doses. Histological studies indicated that this extract improved the healing process in diabetic wounds in rats by increasing granulation tissue and collagen deposition. Collagen acts as a scaffold in connective tissue, and its deposition increases the tensile strength of the wound site. Additionally, an ointment made from M. micrantha showed a moderate rate of wound healing in male Wistar albino rats by enhancing collagen concentration (Sarimah *et al.*, 2018).

Neuroprotective Activity:

Alzheimer's disease (AD) is a debilitating neurological condition marked by cognitive decline and memory problems. The brain neurotransmitter acetylcholine (ACh) is essential for the development of memories, verbal and logical thinking, and focus. However, the enzymes acetylcholinesterase (AChE) and butyryl-cholinesterase (BChE) greatly reduce the activity of ACh. ACh levels can be raised in many brain regions by inhibiting the cholinesterase enzymes (AChE and BChE), and symptoms related to the gradual loss of cholinergic function in AD ameliorate (Uddin *et al.*, 2021). Alzheimer's disease and other neurodegenerative illnesses have been treated with a variety of medicinal herbs, out of which *Mikania micrantha* is used commonly among them in many countries. In a study conducted by Uddin *et al*. (2021), the anticholinesterase effects of *Mikania micrantha* was investigated by Ellman's method in 96-well microplates and found that *M. micrantha* displayed noticeable BChE inhibitory effects.

Aging and dementia are linearly associated with neurodegenerative diseases. A decline in cognitive and behavioral abilities is a hallmark of dementia. Additionally, dementia is a sign of the brain's physiological function gradually failing. Diabetes patients who have dementia are linked to behavioral changes that are likely brought on by brain inflammation and a loss in cognitive function (learning and remembering) due to impaired brain insulin receptors (Blázquez *et al.*, 2014; Stanley *et al.*, 2016). According to recent study, depressive symptoms can be treated with *Mikania micrantha* cultivation. *Mikania micrantha* is a potential neuroprotective and neurocurative agent through improved insulin signaling and reduced brain inflammation. A study by Andriani *et al.* (2019) demonstrated that dementia models were created using diabetic test animals containing *M. micrantha* extracts, an antidiabetic drug (glibenclamide), and normal animals. Results showed that the extract and ethyl acetate fraction significantly improved memory in RAM tests.

Conclusion

Mikania micrantha, is a reservoir of numerous compounds and is extensively used traditionally worldwide for treating various diseases. It contains important phytoconstituents beneficial for human health. Studies have shown that these bioactive chemicals hold promising therapeutic potential for various pathological conditions including anticancer, antidiabetic, antimicrobial, antioxidant, anti-inflammatory, neuroprotective and wound healing effects. Thus, *Mikania micrantha* could be an important herb for treating various diseases. However, further research is needed to elucidate the molecular mechanisms behind their biological actions, which is crucial for functional drug development. Given its rapid and

widespread growth, *Mikania micrantha* could also be utilized to develop safe and cost-effective medical treatments for developing countries. Additionally, numerous toxicological tests on animals have been conducted, providing a scientific basis for the safe use of *Mikania* derivatives.

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