

Investigating the Bioactive Potential of *Wedelia chinensis* Leaves through in Vitro Cytotoxicity Screening: An Overview

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Abstract:

Wedelia chinensis, a medicinal herb traditionally used in Asian countries, has shown promising anticancer properties in various in vitro models. Several extracts from *W. chinensis* demonstrates significant cytotoxic effects against multiple cancer in vitro cell lines, including prostate, breast, and liver cancers. These effects are attributed to its rich phytochemical phytoconstituents, mainly wedelolactone, luteolin, and apigenin, which modulate key signalling pathways involved in cell proliferation, apoptosis, and inflammation. This plant extracts induce apoptosis, inhibit cell migration, and suppress the growth of cancerous cells without or less notable toxicity to normal physiological cells. The reported findings supports the potential of *Wedelia chinensis* as a natural source for developing anticancer therapeutics. This review article focuses on the leaves derived extracts of *Wedelia chinensis*, with particular attention to in vitro cytotoxicity screening as a gateway to anticancer and related bioactivities. These benefits and appearance of cytotoxic activity of *Wedelia chinensis* based on the ethnobotanical usage of the plant, a thorough review of previous research work. The major classes of secondary metabolites was identified in its leaves, such as diterpenoids and flavonoids would be responsible for cytotoxic activity. This review summarizes methods of in vitro cytotoxic activity and phytochemical investigation of *Wedelia chinensis* leaves.

Key Words: *Wedelia chinensis*, wedelolactone, in vitro anticancer activity, apigenin, luteolin

Introduction:

Wedelia chinensis, a perennial herb belonging to the Asteraceae family, is commonly referred to as *Wedelia* in Chinese, *bhringraj* in Hindi, and *manjal karisalanganni* in Tamil. Assam, Uttar Pradesh, Andhra Pradesh, and offshore regions of India are home to the climbing herb *Wedelia chinensis*. Additionally, it is grown in China, Japan, and India's Madras Presidency. With branches typically reaching a length of 50 cm, the herb is a delicate, hairy, and growing plant. The leaf architecture is straightforward, with short, white hairs and subsessile leaflets oriented opposite each other. It has yellow axillary-headed flowers. [1]



Figure1.1: Plant of Wedelia chinensis

In Ayurvedic, Siddha, and Unani systems of traditional medicine, the plant *Wedelia chinensis* (*W. chinensis*) is very important. A review of the literature on the plant reveals that it is a common remedy for a variety of illnesses among different ethnic groups. [2]

Many species, including *Wedelia chinensis* (Osbeck) Merry, *Wedelia paludosa* (Blume), *W. trilobata* (L.) Hitch, *W. Calendulacea* (L.) Less, *W. prostrata* Dalzell, and A. Gibson, have been utilized for medicinal purposes for a long time by the ancient people. The majority of research showed that this genus's plants could be used as medical herbs to treat conditions like diabetes, heart failure, cancer, and more. [3]

Wedelia chinensis may be a significant source of bioactive chemicals that warrant additional study in models to determine their potential as a therapy in the management of chronic illnesses. [4]

Alkaloids, flavonoids, and saponins are among the bioactive substances that give *Wedelia chinensis* its medicinal qualities and are well-known in traditional medicine. These compounds can also contribute to cytotoxicity. [5]

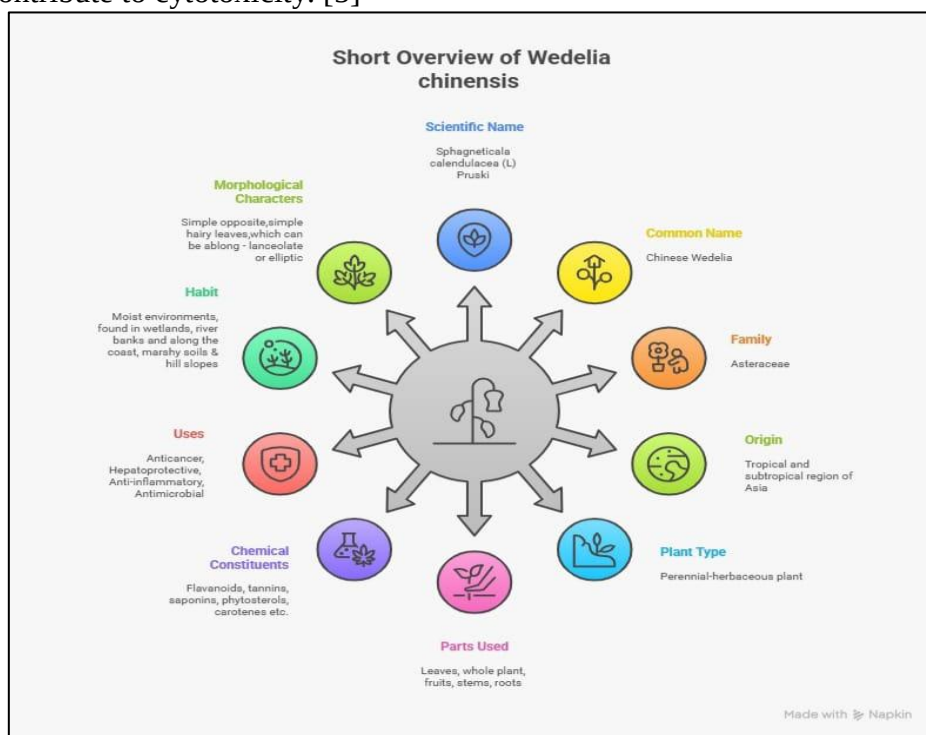


Figure 1.2: Short overview of Wedelia Chinensis

Table 1: Taxonomical Classification:

1	Kingdom	Plantae (plant)
2	Phylum/Division	Tracheophyte (Vascular plants)
3	Class	Magnoliopsida (Dicotyledons)
4	Order	Asterales
5	Family.	Asteraceae (sunflower family)
6	Genus.	wedelia or (sphagneticola)
7	Species.	Chinensis

Reported Phytochemical Constituents and Benefits:

Flavonoids:

The specific flavonoids like apigenin and luteolin found in plants—have anticancer effects in *Wedelia chinensis* via inducing apoptosis (planned cell death) or autophagy (self-degradation) of cellular components in cancer cells, indicating their potential in cancer therapy.

Tannins:

Through their pro-apoptotic, anti-angiogenic, and anti-metastatic properties, as well as their modulation of cellular signaling pathways implicated in the development of cancer, tannins help to enhance *Wedelia chinensis*' anticancer capacities.

Saponins:

Saponins found in *Wedelia chinensis* have anticancer properties through causing cancer cells to undergo apoptosis and autophagy, preventing cell division and metastasis, and encouraging tumour cell differentiation.

Phytosterols:

By preventing cancer cells from growing, invading, and spreading, as well as by encouraging apoptosis and cell cycle arrest, phytosterols found in *Wedelia chinensis* contribute to anticancer activities.

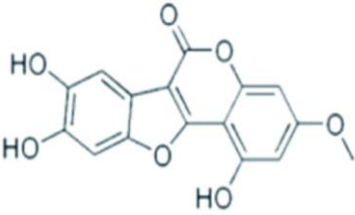
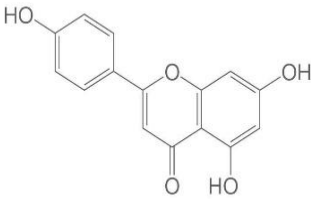
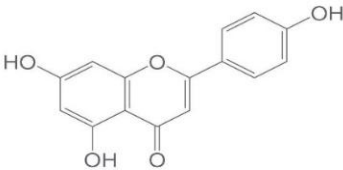
Lactones:

In *Wedelia chinensis*, lactones—like the coumestan wedelolactone—play a crucial role as anticancer agents by encouraging apoptosis, preventing tumour development and metastasis, and possibly intensifying the effects of chemotherapy.

Terpenes:

Wedelia chinensis contains terpenes, such as carvacrol and trans-(caryophyllene), which have anticancer properties by causing apoptosis (programmed cell death), stopping the progression of the cell cycle, preventing angiogenesis, and suppressing metastasis by altering signalling pathways like Wnt/beta-catenin and MAPK/ERK.

Table: Active constituents found in *Wedelia chinensis*

Sr. No	Active chemical constituents	Mechanism	Structure
1	Wedalolactone	It promotes apoptosis. (programmed cell death) in cancer cells and wedelolactone. acts as a proteasome inhibitor	
2	Luteolin	Inhibit the growth, proliferation of metastasis of various cancer cells structure and suppressing signaling pathways that support cancer cell survival	
3	Apigenin	Impacting cell death and cell cycle progression and inhibit cancer cell migration and invasion	

Useful In vitro Models for Cytotoxic activity:

A Model description:

Brine Shrimp:

The lethality bioassay for brine shrimp is a quick and thorough bioassay for bioactive substances of both synthetic and natural sources. Because of its capacity to eradicate brine shrimp naupli, it is a crucial instrument for the initial cytotoxicity test of plant extract. This technique makes it possible to assess the bioactivity of plant extracts. The technique is easy to use and can be used to track the separation and screening of novel plant-based bioactive natural compounds [6]



Figure 2.1: Brine Shrimp (*Artemisia*) as an in vitro Model organism for toxicity and pharmacological studies

Brine shrimp have a simple but fascinating life cycle that's perfectly adapted to their harsh environment. There are both males and females, and after they mate, the female carries either live young or eggs in a small sac on her body. The first time she gives birth, the babies are born alive. After that, she starts producing eggs instead. These eggs are released into the water, where they might hatch right away—or they might go dormant, staying inactive until conditions are just right for them to come to life.

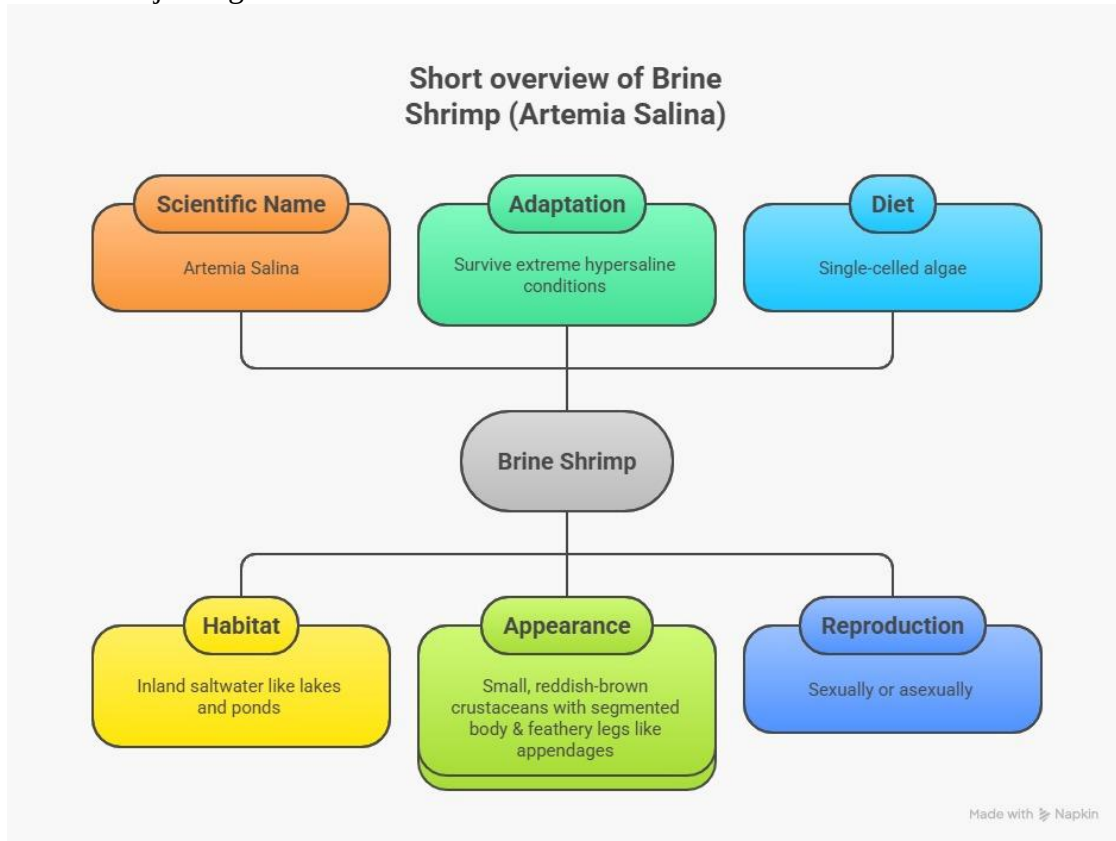


Figure 2.2: Short overview of Brine Shrimp

Onion Roots Model:

Wedelia chinensis works on the onion root (*Allium cepa*) model by slowing down and disturbing normal cell growth in the root tips. The plant contains natural chemicals like flavonoids, phenols, tannins, saponins, and wedelolactone that directly affect dividing cells.[7] First, the extract reduces cell division in the root meristem. Fewer cells are able to divide, so root growth becomes slower. This is seen as a decrease in the mitotic index.[8]

Second, it interferes with the spindle fibers that help chromosomes separate during mitosis. Because of this disturbance, many abnormal cell divisions appear, such as lagging chromosomes, sticky chromosomes, and bridge formations[9]

The extract can also damage chromosomes themselves. Some cells show broken or clumped chromosomes and micronuclei, which indicates genetic damage.

As a result of these effects, onion roots become shorter and weaker. The reduction in root length and number increases with higher extract concentration.[10],[11].

Overall, *Wedelia chinensis* affects onion roots by blocking cell division, disturbing normal chromosome movement, and causing cellular stress, leading to inhibited root growth in the *Allium cepa* model.



Figure 3.1: In Vitro Cultivation of Onion (*Allium Sepa*) Showing Root Development in Water

Garlic Roots Model:

In plant biology, the garlic root model, also called the *Allium cepa* assay, is a commonly used and sensitive method to study the toxic and growth-inhibiting effects of plant extracts and natural compounds. Because garlic and onion roots grow quickly, any changes in root length or structure can be easily observed and measured.[12],[13]

When *Wedelia chinensis* leaf extract is tested on garlic roots, researchers mainly look at whether the extract slows root growth, disrupts cell division, or causes stress in root cells. [14]The leaves of *W. chinensis* contain phenolic compounds such as gallic acid and vanillic acid, which act as natural growth inhibitors. These compounds can suppress root development in a concentration-dependent manner.[15]



Figure 4.1: In Vitro Cultivation of Garlic (*Allium sativum*) Showing Root Development in Water

In treated garlic roots, the extract often causes reduced root elongation, fewer dividing cells in the root tip, and visibly shorter and thinner roots compared to untreated plants. This indicates a clear phytotoxic or allelopathic effect.[16]

At the cellular level, the extract interferes with normal cell division in the root meristem, damages cell membranes, and limits water and nutrient uptake. It may also trigger oxidative stress by increasing reactive oxygen species, which leads to membrane damage, reduced

antioxidant activity, and poor energy metabolism. Together, these effects result in stunted root growth and reduced biomass.

Overall, the garlic root assay shows that *Wedelia chinensis* leaf extract inhibits root growth by disrupting cell division, damaging cellular functions, and inducing stress responses, a pattern commonly seen with phenolic-rich allelopathic plant extracts.

Ginger Tubers:



Figure 5: In Vitro Cultivation of Ginger (*Zingiber officinale*) Showing Root Development in Water

When ginger tubers are treated with *Wedelia chinensis* leaves extract, their normal sprouting and early growth are noticeably affected. The natural chemicals present in the extract slow down or delay the formation of new buds, so fewer sprouts appear. Even the sprouts that do develop tend to be shorter and weaker, with reduced root and shoot growth.[12],[14]

This happens because the plant compounds in *Wedelia chinensis* interfere with cell division and cell expansion in the growing regions of the ginger tuber. The extract can also disturb the plant hormones that normally help the tuber break dormancy and grow. In addition, some of these compounds can damage cell membranes and create stress inside the cells, which further reduces the energy needed for healthy growth.[17],[18]

Overall, the effect becomes stronger as the concentration of the extract increases. At low levels, growth is slightly suppressed, while higher concentrations can strongly inhibit sprouting or even stop growth completely. This shows that *Wedelia chinensis* extract acts as a natural growth-suppressing agent when tested on the ginger tuber model.

Table: Reported Active Components and Phytochemical Compounds in *Wedelia Chinensis*

Compound/Class	Type	Reported Activity
Wedelolactone	Lactone	Anti-androgen/prostate cancer, anti-inflammatory
Luteolin	Flavonoid	Antioxidant, anti-proliferative
Apigenin	Flavonoid	Antioxidant, Cholinesterase inhibition

Dimethyl wedelolactone	Lactone	Anti-hepatotoxic
Kaurane diterpenoids	Terpenoids	Cytotoxic, antioxidant, anti- microbial
Vanillic and gallic acid	Phenolic acid	Allelopathy/plant growth effects
Essential oil monoterpenes	Volatiles	Aroma and potential biological effects

Pharmacological Activities of *Wedelia chinensis* Plant:

Wedelia chinensis exhibits a broad range of pharmacological activities, primarily due to the presence of compounds like flavonoids, diterpenes, and the coumestan derivative wedelolactone.

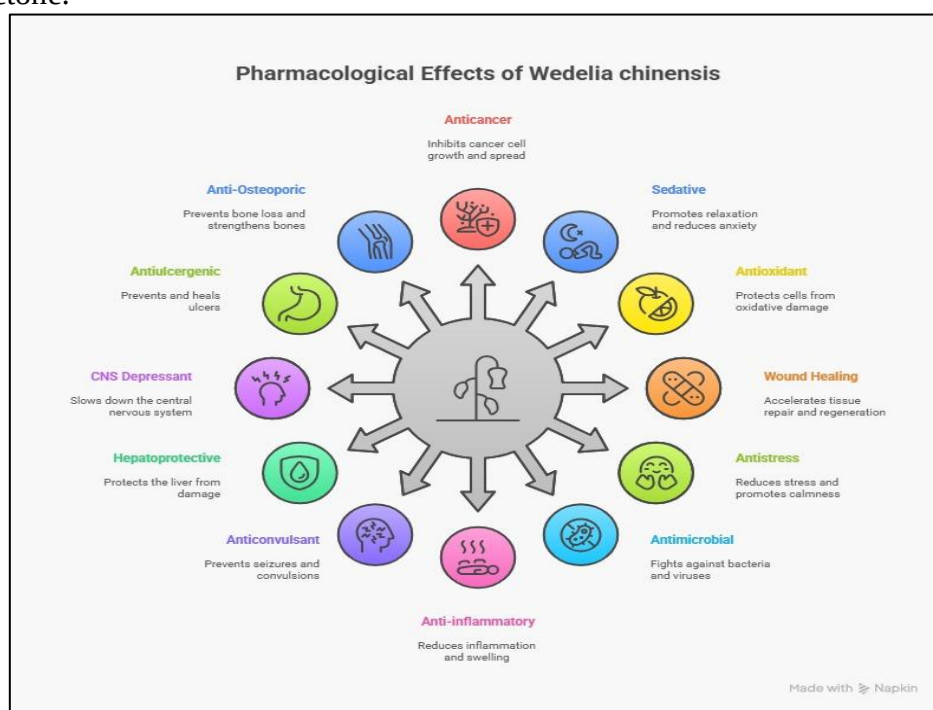


Figure 6: Pharmacological Effects of *Wedelia Chinensis*

Anticancer activity:

Wedelia chinensis (W. *Chinensis*) extract showed encouraging biological activity, including anticancer activity. Different biological activities can be found in isolated compounds of *Wedelia chinensis*. Compared to various extracts from W. *Chinensis*, *Wedelia chinensis* exhibits strong chemotherapeutic effectiveness against anticancer activity. The substance from *Wedelia chinensis*, wedelolactone, inhibits androgen receptors. [19]

Hepatoprotective activity:

The entire plant extract of W. *chinensis*, both alcoholic and aqueous, was found to have a strong protective effect against hepatotoxicity. This plant has long been used as atonic, to treat skin conditions, and to enlarge the liver and spleen. [20]

Wound healing:

Ethanollic extracts of *Wedelia chinensis* leaves in excision, incision, and dead space wound models are used to study wound healing. It was discovered that its ethanolic extract had strong wound-healing properties. [21]

Antioxidant activity:

To preserve the homeostasis of the intracellular redox state, plants have developed a number of intricate enzymatic and non-enzymatic antioxidant defence mechanisms. Protective enzymes include peroxidase (POD), catalase (CAT), and superoxide dismutase (SOD). Vitamins, phenols, and ketones are examples of non-enzymatic antioxidants; when plants are stressed by drought, their antioxidant content rises dramatically [22]

Anti-inflammatory + Analgesics Activity:

Carvacrol (46%) and trans-caryophyllene (14%), two important phytochemical elements that may be in charge of the plant's anti-inflammatory qualities, were responsible for the anti-inflammatory impact of the complete *Wedelia chinensis* alcoholic and aqueous extract. [5]

Antimicrobial + Antibacterial Activity:

The extract showed good antibacterial activity against bacterial cells, but it was more effective against Gram-positive bacteria, which had minimum inhibition concentrations of 3.12 to 6.25 mg/ml, than Gram-negative bacteria which had minimum inhibition concentration value of 25 mg/ml. *Wedelia chinensis* AgNPs have demonstrated strong antibacterial activity against a variety of harmful microorganisms. [6]

Difference between In-vitro and In-vivo Models used in Research Study

Parameters	In-Vitro	In-Vivo
Scope	In vitro studies concentrate isolated cells, which is ideal for molecular research.	In vivo research examines the complete organism, yielding comprehensive data
Accuracy	Only certain tissues can be used in-vitro	In vivo models are more closely related to clinical practice
Cost	Cost Effective	More expensive
Ethical	In-Vitro is more ethical	In-Vivo particularly
Consideration	Since no live animals are used	Involving Animals
Uses	Mechanistic Studies, Screening	Drug Testing, Disease Modelling
Results	Early Stage research is best served by In-Vitro investigation since they yield results more quickly	Analysing and doing research In-Vivo takes longer

Applications and significance of in-vitro anticancer activity:

- Easiest method for drug screening
- Minimizes the use of laboratory animals
- Suitable at laboratory level
- Parameters can be observed easily
- Alternative for laboratory animals
- Prevent excess harm and critical toxicology and safety assessment
- Simple and reliable method for primary screening of drugs.

Discussion:

Wedelia chinensis exhibits promising anticancer and other beneficial effects using in vivo and in vitro models, demonstrating significant cytotoxic effects against various cancer cell lines along with brine shrimp, onion root and garlic models. The bioactive phytocomponents present

in plant and specially leaves extract may be responsible for induction of apoptosis and inhibit proliferation. This review will help to support further comprehensive investigation with its molecular mechanisms, to find out specific active constituents for cytotoxic efficacy and potential development of formulation using preclinical experiments for identifying natural cytotoxic agent with less or no harms to animal and human physiology.

Conclusion:

Wedelia chinensis exhibits notable anticancer activity in vitro, showing cytotoxic effects against various cancer cell lines. Its bioactive compounds, such as wedelolactone and flavonoids, induce apoptosis and inhibit proliferation. These findings support its therapeutic potential, though further in vivo and clinical studies are needed to confirm its efficacy.

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References:

1. Hossen, K., Das, K. R., Okada, S., Iwasaki, A., Suenaga, K., & Kato-Noguchi, H. (2020). Allelopathic potential and active substances from *Wedelia chinensis* (Osbeck). *Foods*, 9(11), 1591.
2. Nomani, I., Mazumder, A., & Chakrabarthy, G. S. (2013). *Wedelia chinensis* (Asteraceae)—An overview of a potent medicinal herb. *Int. J. Pharm. Tech. Res*, 5, 957-964.
3. Ahmed, B. A., Idris, S. N., Taha, R. M., Mustafa, M. M., & Marikar, F. M. M. T. (2019). Phytochemical, pharmacological and tissue culture applications of *Wedelia* spp.—A review.
4. Khan, M. A. R., Islam, M. A., Biswas, K., Al-Amin, M. Y., Ahammed, M. S., Manik, M. I. N., ... & Sadik, G. (2023). Compounds from the petroleum ether extract of *Wedelia chinensis* with cytotoxic, anticholinesterase, antioxidant, and antimicrobial activities. *Molecules*, 28(2), 793.
5. Islam, M. A., Zaman, S., Biswas, K., Al-Amin, M. Y., Hasan, M. K., Alam, A. H. M. K., ... & Sadik, G. (2021). Evaluation of cholinesterase inhibitory and antioxidant activity of *Wedelia chinensis* and isolation of apigenin as an active compound. *BMC complementary medicine and therapies*, 21(1), 204.
6. Osamudiamen, P. M., Aiyelaagbe, O. O., Vaid, S., Sangwan, P. L., Ogbesejana, A. B., & Saxen, A. K. (2020). Comparative in-vitro anticancer and brine shrimp cytotoxic activities of *Mezoneuron benthamianum* Baill. *Journal of Medicinal Plants for Economic Development*, 4(1), 1-5.
7. Fiskesjö, G. (1985). The *Allium* test as a standard in environmental monitoring. *Hereditas*, 102(1), 99-112..
8. Leme, D. M., & Marin-Morales, M. A. (2009). *Allium cepa* test in environmental monitoring: a review on its application. *Mutation research/reviews in mutation research*, 682(1), 71-81..
9. Chanda, S., & Dave, R. (2009). In vitro models for antioxidant
10. t activity evaluation and some medicinal plants possessing antioxidant properties: An overview. *African Journal of Microbiology Research*, 3(13), 981-996.
11. Prakash, O. M., Kumar, A., & Kumar, P. (2013). Anticancer potential of plants and natural products. *Am J Pharmacol Sci*, 1(6), 104-115.
12. Rice, E. L. (2012). Allelopathy.
13. Inderjit, & Duke, S. O. (2003). Ecophysiological aspects of allelopathy. *Planta*, 217(4), 529-539.
14. Einhellig, F. A. (1995). Mechanism of action of allelochemicals in allelopathy.
15. Gill, S. S., & Tuteja, N. (2010). Reactive oxygen species and antioxidant machinery in abiotic stress tolerance in crop plants. *Plant physiology and biochemistry*, 48(12), 909-930.
16. Galati, G., & O'brien, P. J. (2004). Potential toxicity of flavonoids and other dietary phenolics: significance for their chemopreventive and anticancer properties. *Free radical biology and medicine*, 37(3), 287-303.
17. Singh, H. P., Batish, D. R., & Kohli, R. K. (2001). Allelopathy in agroecosystems: an overview. *Journal of Crop production*, 4(2), 1-41.
18. Duke, Dayan, Romagni, & Rimando. (2000). Natural products as sources of herbicides: current status and future trends. *Weed research*, 40(1), 99-111.
19. Roy, S. D., Das, S., Shil, D., & Dutta, K. N. (2012). Herbal hepatoprotective agents: a review. *World J. Pharma. Res*, 1(2), 87-99.
20. Ahmed, B. A., Idris, S. N., Taha, R. M., Mustafa, M. M., & Marikar, F. M. M. T. (2019). Phytochemical, pharmacological and tissue culture applications of *Wedelia* spp.—A review.
21. Zhang, Q., Chen, G., Huang, J., & Peng, C. (2020). Comparison of the ability to control water loss in the detached leaves of *Wedelia trilobata*, *Wedelia chinensis*, and their hybrid. *Plants*, 9(9), 1227.
22. Shamama, B., Avijit, M., & Saumya, D. (2017). *Wedelia chinensis* (Asteraceae)—An overview of a potent medicinal herb. *World Journal of Pharmaceutical Research*, 6(6), 488-496.