ANTIDEPRESSANT AND ANXIOLYTIC EFFECTS OF WHOLE PLANT EXTRACT OF *MIMOSA PUDICA* LINN

A Dissertation submitted to

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MASTER OF PHARMACY

IN

BRANCH IX - PHARMACOLOGY

Submitted By

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CERTIFICATE

This is to certify that the dissertation entitled **"ANTIDEPRESSANT AND ANXIOLYTIC EFFECTS OF WHOLE PLANT EXTRACT OF *MIMOSA PUDICA* LINN." Submitted by Mr. M. TAMIL SELVAN [REG.NO: 261725152]** for the award of the degree of **"MASTER OF PHARMACY"** is a bonafide research work done by him in the Department of Pharmacology, Periyar College of Pharmaceutical Sciences, Tiruchirapalli under my direct guidance and supervision.

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This is to certify that the dissertation entitled **"THE ANTIDEPRESSANT AND ANXIOLYTIC EFFECTS OF WHOLE PLANT EXTRACT OF *MIMOSA PUDICA* LINN" done by Mr. M. Tamilselvan [REG. No: 261725152]** for the award of the degree of **"MASTER OF PHARMACY"** under the Tamilnadu Dr. M.G.R. Medical University, Chennai is a bonafide research work performed by him in the Department of Pharmacology, Periyar College of Pharmaceutical Sciences, Tiruchirapalli. The work was performed under the guidance and supervision of **Dr. S. Karpagam Kumara Sundari, M.Pharm., Ph.D.,** Head, Department of Pharmacology, Periyar College of Pharmaceutical Sciences.

This dissertation is submitted for acceptance as project in partial fulfillment for the award of the Degree of **"MASTER OF PHARMACY"** in Pharmacology, of The Tamilnadu Dr. M.G.R. Medical University, during May 2019.

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ABBRIVIATION

- AD Anno Domini
- AEMP Aqueous Extract of Mimosa Pudica
- ALFF Amplitude of Low Frequency Fluctuations
- ASL Arterial Spin Labeling
- ACC Anterior Cingulated Cortex
- BC Before Christ
- BDNF Brain Derivate Neurotropic Factor
- CBT Cognitive Behavioral Theraphy
- DMPEC Dorsovedial Prefrontal Cortex
- FDA Food Drug Administration
- GHB Gamma Hydro butyric acid
- HPTLC High Perfomence Thin Layer Chromotography
- IL Interleukin
- LD50 Lethal Dose
- MSG Mono Sodium Glutamate
- TLC Thin Layer Chromotography
- SEM Scanning Electro Microscophy
- TST Tail Suspension Test
- LAT Loco Motor Activity Test
- LDB Light Dark Box
- FST Forced Swim Test
- SNRI Serotonin Nor- epinephrine Reuptake Inhibitors

- MDD Major Depressive Disorder
- PMS Premenstrual Syndrome
- PMDD Premenstrua l Dysphoric Disorder
- SAD Seasonal Affective Disorder
- MAO Mono Amine Oxidase Inhibitor
- OFC Orbito Frontal Cortex
- REM Rapid Eye Movement
- 5HIAA 5 Hydroxy Indole Acetic Acid
- ECT Electro Convulsive Therapy
- OFT Open Fixed Test
- U/V Volume/Volume
- W/V Weight/Volume
- UND United Nations Development
- UK United Kingdom
- P.O per Oral
- MM Milli Meter
- MIN Minutes
- MG MIlli Gram.

1.INTRODUCTION

Archaeological evidence indicates that the use of medicinal plants dates back to the Paleolithic age, approximately 60,000 years ago. Written evidence of herbal remedies dates back over 5,000 years, to the Sumerians, who compiled lists of plants. A number of ancient cultures wrote about plants and their medical uses in books called H*erbals*. In ancient Egypt, herbs are mentioned in Egyptian medical papyri, depicted in tomb illustrations, or on rare occasions found in medical jars containing trace amounts of herbs.[1]

Among the oldest, lengthiest, and most important medical papyri of ancient Egypt, the Ebers Papyrus dates from about 1550 BC, and covers more than 700 drugs, mainly of plant origin. The earliest known Greek herbals come from Theophrastus of Eresos who in the 4th c. B.C. wrote in Greek HistoriaPlantarum, from Diocles of Carystus who wrote during the 3rd century B.C, and from Krateuas who wrote in the 1st century B.C.

Herbs also commonly featured in the medicine of ancient India, where the principal treatment for diseases was diet. De MateriaMedica, originally written in Greek by PedaniusDioscorides (c. 40 – 90 AD) of Anazarbus, Cilicia, a Greek physician, pharmacologist and botanist, is a particularly important example of herbal writing; it dominated for some 1500 years until the 1600s.

Herbal Medicine is an interdisciplinary branch between Herbal Medicine and Ayurveda and it covers all the fields of Herbal Medicine related to Botany, Medicinal Plant Research, Pharmacognosy, Phytochemistry, Phytotherapy, botanical medicines, Ayurveda and Natural chemistry, Agriculture Science, Unani Medicine, Biotechnology and Biochemistry.

1.1 MODERN HERBAL MEDICINE[2]

The World Health Organization (WHO) estimates that 80 percent of the population of some Asian and African countries presently use herbal medicine for some aspect of primary health care. Pharmaceuticals are prohibitively expensive for most of the world's population, half of whom lived on less than $2 U.S. per day in 2002. In comparison, herbal medicines can be grown from seed or gathered from nature for little or no cost.

According to the World Health Organization, approximately 25% of modern drugs used in the United States have been derived from plants. At least 7,000 medical compounds in the modern pharmacopoeia are derived from plants. Among the 120 active compounds

currently isolated from the higher plants and widely used in modern medicine today, 80% show a positive correlation between their modern therapeutic use and the traditional use of the plants from which they are derived.

1.2 INDIAN SYSTEM OF MEDICINE

- Siddha
- Ayurvedha
- Unani
- Homeopathy

Siddha Medicine

Siddha medicine of traditional medicine originating in ancient Tamilakam (Tamil Nadu) in South India and Sri Lanka.

Traditionally, it is taught that the siddhars laid the foundation for this system of medication. Siddhars were spiritual adepts who possessed the ashta siddhis, or the eight supernatural powers. Agastyar is considered the first siddha and the guru of all siddhars; the siddha system is believed to have been handed over to him by Murugan, son of Shiva and Parvati. Siddha is focused on "Ashtamahasiddhi," the eight supernatural power.

Concept of Disease and Cause

It is assumed that when the normal equilibrium of the three humors — Vaadham, Pittham and Kapam — is disturbed, disease is caused. The factors assumed to affect this equilibrium are environment, climatic conditions, diet, physical activities, and stress.

Diagnosis

- Varnam(colour)
- Kural (voice)
- Kan (eyes)
- Thodal (touch)
- Malam (stool)
- Neer (urine)
- Naadi (pulse).[3]

Ayurvedha Medicine

The main classical Ayurveda texts begin with accounts of the transmission of medical knowledge from the Gods to sages, and then to human physicians.In SushrutaSamhita (Sushruta's Compendium), Sushrutawrote that Dhanvantari, Hindu god of Ayurveda, incarnated himself as a king of Varanasi and taught medicine to a group of physicians, including Sushruta. Ayurveda therapies have varied and evolved over more than two millennia.[4].

Eight components in Ayurvedha

- Kayacikitsa
- Kaumara
- Salyatantra
- Salakyatantra
- Bhutavidya
- Agadatantra
- Rasayanatantra
- Vajikaranatantra

Diagnosis

Ayurveda has eight ways to diagnose illness,

- Nadi (pulse)
- Mootra (urine)
- Mala (stool)
- Jihva (tongue)
- Shabda (speech)
- Sparsha (touch)
- Druk (vision)
- Aakruti (appearance)

Treatment and Prevention

Two of the eight branches of classical Ayurveda deal with surgery but contemporary Ayurveda tends to stress attaining vitality by building a healthy metabolic system and maintaining good digestion and excretion. Ayurveda also focuses on exercise, yoga, and meditation. Ayurveda follows the concept of Dinacharya, which says that natural cycles (waking, sleeping, working, meditation etc.) are important for health. Hygiene, including regular bathing, cleaning of teeth, skin care, and eye washing, is also a central practice.

Unani Medicine

"Unani" or "Yunani medicine" is the term for Perso-Arabic traditional medicine as practiced in Mughal India and in Muslim culture in South Asia and modern day Central Asia. The unani medicine is considered to be a product of pseudoscience by several skeptics.The term means "Greek", as the Perso-Arabic system of medicine was based on the teachings of the Greek physicians Hippocrates and Galen.

The Hellenistic origin of Unani medicine is still visible in its being based on the classical four humours.

- Phlegm (Balgham)
- Blood (Dam)
- Yellow bile (Ṣafra)
- Black bile (Sauda)

Diagnosis and Treatment

According to Unani medicine, management of any disease depends upon the diagnosis of disease. In the diagnosis, clinical features such as signs, symptoms, laboratory features and mizaj (temperament) are important. Qualitatively derangement of the normal equilibrium of akhlat (humors) of body which constitute the tissues and organs.[5]

Homeopathy

Homeopathy is a system of alternative medicinecreated in 1796 by Samuel Hahnemann, based on his doctrine of like cures like, a claim that a substance that causes the symptoms of a disease in healthy people would cure similar symptoms in sick people. Homeopathy is a pseudoscience – a belief that is incorrectly presented as scientific.

Homeopathic preparations are not effective for treating any condition. The preparations are manufactured using a process of homeopathic dilution, in which a chosen substance is repeatedly diluted in alcohol or distilled water.

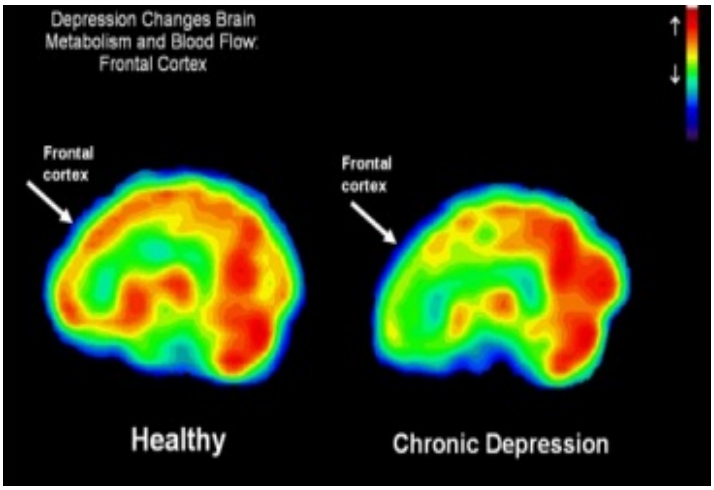
There have been four large scale assessments of homeopathy by national or international bodies, the Australian National Health and Medical Research Council; the United Kingdom's House of Commons Science and Technology Committee.

Homeopathy uses animal, plant, mineral, and synthetic substances in its preparations, generally referring to them using Latin or faux-Latin names. Examples include arsenicum album (arsenic oxide), natrummuriaticum (sodium chloride or table salt), Lachesismuta (the venom of the bushmaster snake), opium, and thyroidinum(thyroid hormone).[6]

1.4. DEPRESSION

Depression (major depressive disorder) is a common and serious medical illness that negatively affects how you feel, the way you think and how you act. Fortunately, it is also treatable. Depression causes feelings of sadness and/or a loss of interest in activities once enjoyed. It can lead to a variety of emotional and physical problems and can decrease a person's ability to function at work and at home.[8]

FIG NO : 1 NORMAL BRAIN VS DEPRESSED BRAIN



History Of Depression[9]

Depression is a common illness worldwide, with more than 300 million people affected. Depression is different from usual mood fluctuations and short-lived emotional responses to challenges in everyday life. Especially when long-lasting and with moderate or severe intensity, depression may become a serious health condition. Close to 800 000 people die due to suicide every year. Suicide is the second leading cause of death in 15-29-year-olds.

The burden of depression and other mental health conditions is on the rise globally. A World Health Assembly resolution passed in May 2013 has called for a comprehensive, coordinated response to mental disorders at country level.

During the 1960s and 70s, manic-depression came to refer to just one type of mood disorder (now most commonly known as bipolar disorder) which was distinguished from (unipolar) depression.

COMMON CAUSES OF DEPRESSION

Depression can affect anyone at almost any age. And the reasons why some people grow depressed isn't always known. But, researchers suspect there are many causes of depression and it isn't always preventable.

- Genetics and Biology
- Brain Chemistry Imbalance
- Female Sex Hormones
- Circadian Rhythm Disturbance
- Poor Nutrition
- Physical Health Problems
- Drugs
- Stressful life Events
- Grief and Loss

COMMON TYPES OF DEPRESSION

Major Depressive Disorder

When people use the term clinical depression, they are generally referring to major depressive disorder (MDD). Major depressive disorder is a mood disorder characterized by number of key features:

- Depressed mood
- Lack of interest in activities normally enjoyed
- Changes in weight
- Changes in sleep
- Fatigue

- Feelings of worthlessness and guilt
- Difficulty concentrating
- Thoughts of death and suicide

If a person experiences the majority of these symptoms for longer than a two-week period, they will often be diagnosed with MDD.

Persistent Depressive Disorder

Dysthymia, now known as persistent depressive disorder, refers to a type of chronic depression present for more days than not for at least two years. It can be mild, moderate, or severe.

Bipolar Disorder

Bipolar disorder is a mood disorder characterized by periods of abnormally elevated mood known as mania. These periods of A major can be mild (hypomania) The vast majority of those with bipolar illness also have episodes of major depression.

In addition to depressed mood and markedly diminished interest in activities, people with bipolar depression often have a range of physical and emotional symptoms which may include:

- Fatigue, insomnia, and lethargy
- Unexplained aches, pains, and psychomotor agitation
- Hopelessness and loss of self-esteem
- Irritability and anxiety
- Indecision and disorganization

Postpartum Depression

Pregnancy can bring about significant hormonal shifts that can often affect a woman's moods. Depression can have its onset during pregnancy or following the birth of a child. Postpartum depression is more than that just the "baby blues." It can range from a

persistent lethargy and sadness that requires medical treatment all the way up to postpartum psychosis, a condition in which the mood episode is accompanied by confusion, hallucinations or delusi.

Premenstrual Dysphoric Disorder

Among the most common symptoms of premenstrual syndrome (PMS) are irritability, fatigue, anxiety, moodiness, bloating, increased appetite, food cravings, aches, and breast tenderness. Premenstrual dysphoric disorder (PMDD) produces similar symptoms, but those related to mood are more pronounced. They may include:

- Feeling sad, hopeless, or self-critical
- Severe feelings of stress or anxiety
- Mood swings, often with bouts of crying
- Irritability
- Inability to concentrate

Seasonal Affective Disorder (sad)

If you experience depression, sleepiness, and weight gain during the winter months but feel perfectly fine in spring, you may have a condition known as seasonal affective disorder (SAD), currently called major depressive disorder, with seasonal pattern. SAD is believed to be triggered by a disturbance in the normal circadian rhythm of the body. Light entering through the eyes influences this rhythm, and any seasonal variation in night/day pattern can cause a disruption leading to depression.

Atypical Depression[10]

Do you experience signs of depression (such as overeating, sleeping too much, or extreme sensitivity to rejection) but find yourself suddenly perking up in face of a positive event. Based on these symptoms, you may be diagnosed with atypical depression, a type of depression which does not follow what was thought to be the "typical" presentation of the disorder.

Atypical depression is characterized by a specific set of symptoms related to:

- Excessive eating or weight gain
- Excessive sleep
- Fatigue, weakness, and feeling "weighed down"
- Intense sensitivity to rejection
- Strongly reactive moods

It is actually more common than the name might imply. Unlike other forms of depression, people with atypical depression respond better to a type of antidepressant known as a monoamine oxidase inhibitor (MAO).

COMMON SYMPTOMS OF CLINICAL DEPRESSION

- Low Mood
- Decreased Interest or Pleasure
- Changes In Appetite
- Sleep Disturbances
- Fatigue
- Feelings Of Worthlessness or Guilt
- Difficulty Concentrating
- Recurrent Thoughts of Death

MECHANISM INVOLVED IN DEPRESSION

Scientific studies have found that numerous brain areas show altered activity in patients suffering from depression, Several theories concerning the biologically based cause of depression .

- Monoamine Neurotransmitters
- Neuroplasticity
- Inflammation
- Circadian rhythm.

Abnormalities are commonly found in the lateral prefrontal cortex whose putative function is generally considered to involve regulation of emotion. Regions involved in the generation of emotion and reward such as the amygdala, anterior cingulate cortex (ACC), orbitofrontal cortex (OFC), and striatum are frequently implicated as well.

Genetic Factors

Genetic factors involved in depression have been difficult to identify. Historically, candidate gene studies have been a major focus of study. However, as the number of genes reduces the likelihood of choosing a correct candidate gene, Type I errors (false positives) are highly likely.

Candidate genes studies frequently possess a number of flaws, These effects are compounded by the usual assessment of genes without regard for gene-gene interactions.

The genes encoding for the 5-HTT and 5-HT_{2A} receptorwere inconsistently associated with depression and treatment response. Mixed results were found for brain-derived neurotrophic factor (BDNF) Val66Met. polymorphisms. Polymorphisms in the tryptophan hydroxylase gene was found to be tentatively associated with suicidal behavior.

Circardian Rhythm

Depression may be related to abnormalities in the circadian rhythm or biological clock. For example, rapid eye movement (REM) sleep—the stage in which dreaming occurs—may be quick to arrive and intense in depressed people. REM sleep depends on decreased serotonin levels in the brain stem and is impaired by compounds, such as antidepressants, that increase serotonergic tone in brain stem structures.

Prolonged wakefulness due to sleep deprivation activates serotonergic neurons, leading to processes similar to the therapeutic effect of antidepressants, such as the selective serotonin reuptake inhibitors (SSRIs).

Exposure to light also targets the serotonergic system, providing more support for the important role this system may play in depression, Sleep deprivation and light therapy both target the same brain neurotransmitter system and brain areas as antidepressant drugs, and are now used clinically to treat depression Light therapy, sleep deprivation and

sleep time displacement (sleep phase advance therapy) are being used in combination quickly to interrupt a deep depression in hospitalized patients.[11]

Mono Amines

Monoamines are neurotransmitters include serotonin, dopamine, norepinephrine,and epinephrine. Many antidepressant drugs acutely increase synaptic levels of the monoamine neurotransmitter, serotonin, but they may also enhance the levels of two other neurotransmitters, norepinephrine and dopamine.

Others have also proposed the relationship between monoamines and phenotypes such as serotonin in sleep and suicide, norepinephrine in dysphoria, fatigue, apathy, cognitive dysfunction, and dopamine in loss of motivation and psychomotor symptoms.

Initial studies of serotonin in depression examined peripheral measures such as the serotonin metabolite 5-Hydroxyindoleacetic acid (5-HIAA) and platelet binding. The results were generally inconsistent, and may not generalize to the central nervous system

One method used to study the role of monoamines is monoamine depletion. Depletion of tryptophan (the precursor of serotonin), tyrosine and phenylalanine (precursors to dopamine) does result in decreased mood in those with a predisposition to depression, but not healthy persons.[12]

Emotional Processing and Neural Circuit

People with MDD show a number of biases in emotional processing, such as a tendency to rate happy faces more negatively. Depressed people also have impaired recognition of happy, angry, disgusted, fearful and surprised, but not sad faces. Functional neuroimaging has demonstrated hyperactivity of various brain regions in response to negative emotional stimuli, and hypoactivity in response to positive stimuli. This is supported by the observation that both acute and subchronic SSRIadministration increases response to positive faces. Antidepressant treatment appears to reverse mood congruent biases in limbic, prefrontal, and fusiform areas.

Depressed patients showed hyperactivity of circuits in the salience network (SN), composed of the pulvinar nuclei, the insula, and the dorsal anterior cingulate cortex (dACC), as well as decreased activity in regulatory circuits composed of the striatum and dlPFC.[13]

Structural neuroimaging

Meta analyses performed using seed-based d mapping have reported grey matter reductions in a number of frontal regions. One meta analysis of early onset general depression reported grey matter reductions in the bilateral anterior cingulate cortex(ACC) and dorsomedial prefrontal cortex (dmPFC).

One study in medication free depression found reductions in the left middle frontal gyrus, right superior frontal gyrus, and left insula, while reporting increases in the thalamus and cuneus. Increases in thalamic and ACC grey matter was reported in the medication free and medicated populations respectively. A meta analysis performed using "activation likelihood estimate" reported reductions in the paracingulate cortex, dACC and amygdala.

Using statistical parametric mapping, one meta analysis replicated previous findings of reduced grey matter in the ACC, medial prefrontal cortex, inferior frontal gyrus, hippocampus and thalamus; however reductions in the OFC and ventromedial prefrontal cortex grey matter were also reported.[14]

Functional Neuroimaging

Studies of resting state activity have utilized a number of indicators of resting state activity, including regional homogeneity (ReHO), amplitude of low frequency fluctuations (ALFF), fractional amplitude of low frequency fluctuations (fALFF), arterial spin labeling (ASL), and positron emission tomography measures of regional cerebral blood flow or metabolism. Studies using ALFF and fALFF have reported elevations in ACC activity, with the former primarily reporting more ventral findings, and the latter more dorsal findings .[15]

Inflammation and Oxidative Stress

Various reviews have found that general inflammation may play a role in depression. One meta-analysis of cytokines in depressed patients found increased IL-6 and TNF-a levels relative to controls. Meta-analysis on cytokine levels in depressed patients have demonstrated increased levels of IL-1, IL-6, C-reactive protein, but not IL-10 in depressed patients. Increased numbers of T-Cells presenting activation markers, levels of neopterin, IFN gamma, sTNFR, and IL-2 receptors have been observed in

depression. Various sources of inflammation in depressive illness have been hypothesized and include trauma, sleep problems, diet, smoking and obesity. Cytokines, by manipulating neurotransmitters, are involved in the generation of sickness behavior, which shares some overlap with the symptoms of depression.

Neurotransmitters hypothesized to be affected include dopamine and serotonin, which are common targets for antidepressant drugs. Induction of indolamine-2,3dioxygenease by cytokines has been proposed as a mechanism by which immune dysfunction causes depression. One review found normalization of cytokine levels after successful treatment of depression.[16]

PHARMACOLOGICAL ACTION OF DEPRESSION

Central nervous system depression is a physiological state that can result in a decreased rate of breathing, decreased heart rate, and loss of consciousness possibly leading to coma or death. It is the result of inhibited or suppressed brain activity.

Depression of the central nervous system is generally caused by the use of depressant drugs, ethanol, opioids, barbiturates, benzodiazepines, general anesthetics. In a study comparing the central nervous depression due to supra-therapeutic doses of triazolam (a benzodiazepine), pentobarbital (a barbiturate) and gamma-hydroxybutyric acid, it appeared as if GHB had the strongest dose-effect function. Since gamma-hydroxybutyric acid has a high correlation between its dose and its central nervous system depression, it has a high risk of accidental overdose. In the case of accidental overdose of gamma-hydroxybutyric acid, patients can become drowsy, fall asleep and may enter a coma.[17]

Although gamma-hydroxybutyric acid had higher sedative effects at high doses as compared to triazolam and pentobarbital, it had less of an amnestic effect. Arousal of subjects who received gamma-hydroxybutyric acid sometimes even required a painful stimulus; this was not seen in patients who received triazolam or pentobarbital group. During the heavy sedation with gamma-hydroxybutyric acid, the subjects maintained normal respiration and blood pressure. This is often not the case with opioids as they cause respiratory depression.

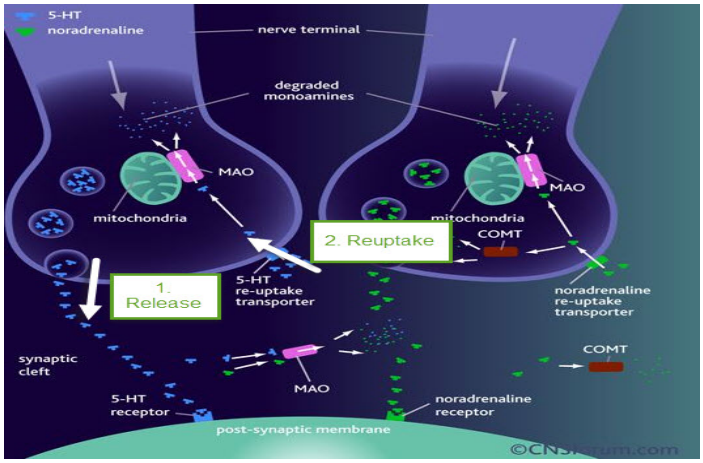
Significant central nervous system depression is treated within a hospital setting by maintaining breathing and circulation. Individuals with reduced breathing may be given supplemental oxygen, while individuals who are not breathing can be ventilated with bag valve mask ventilation or by mechanical ventilation with a respirator. Sympathomimetic drugs may be used to attempt to stimulate cardiac output in order to maintain circulation.[18]

Classification of Anti depression Drugs:

Selective Serotonin Reuptake Inhibitors (SSRIs)

- Citalopram
- Fluvoxamine
- Paroxetine
- Fluoxetine
- Sertraline
- Escitalopram

FIG NO : 2 MECHANISM PATHWAY OF (SSRI)



Possible side effects include

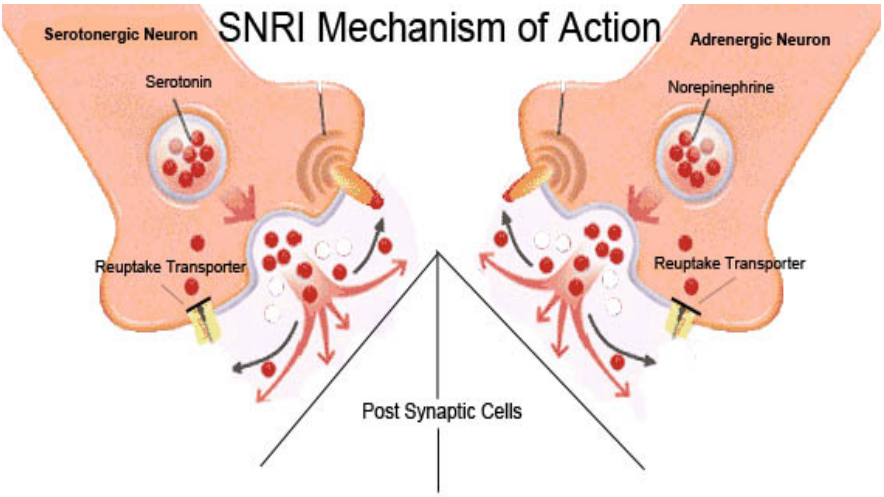
- Nausea
- Stomach irritation
- Diarrhea
- Insomnia

- Loss of appetite or weight loss
- Increase in appetite or weight gain
- Nervousness

Serotonin/Norepinephrine Reuptake Inhibitors (SNRIs)

- Venlafaxine
- Duloxetine
- Desvenlafaxine

FIG NO : 3 MECHANISM PATHWAY OF SNR INHIBITORS



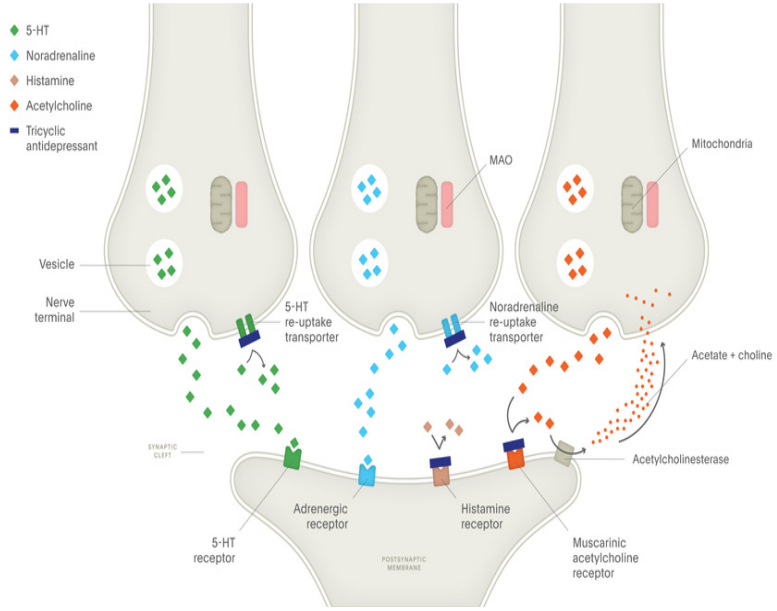
Possible side effects[19]

- Dry mouth
- Constipation
- Nausea
- Fatigue
- Drowsiness
- Excessive sweating
- Higher heart rate
- High blood pressure (when taking venlafaxine)
- Lightheadedness
- Low blood pressure

Tricyclic Antidepressants

- Doxepin
- Clomipramine
- Nortriptyline
- Amitriptyline
- Imipramine
- Maprotiline
- Desipramine
- Trimipramine
- Protriptyline

FIG NO : 4 MECHANISM PATHWAY OF TRICYCLIC ANTI DEPRESSANT



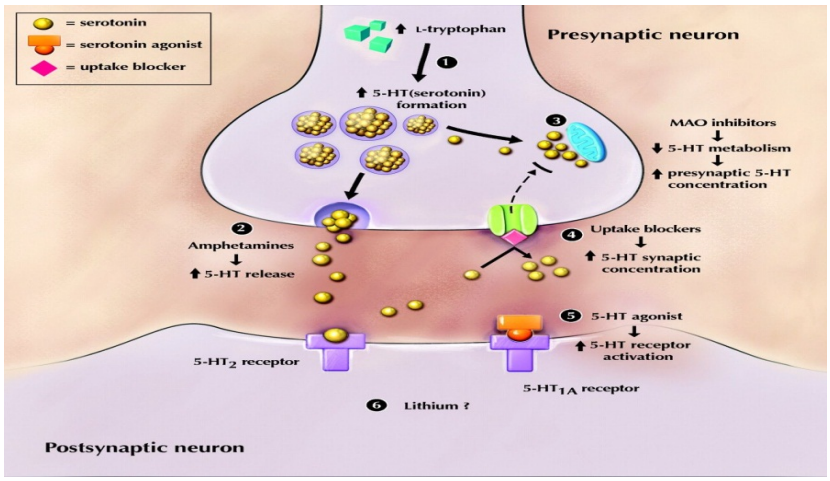
Possible side effects

- Lightheadedness
- Dry mouth
- Constipation
- Difficulty urinating
- Low blood pressure
- Irregular or rapid heartbeat

Monoamine Oxidase Inhibitors (MAOIs)

- Isocarboxid
- Phenelzine
- Tranylcypromine
- Selegiline patch

FIG NO : 5 MECHANISM PATHWAY OF MONO AMINE OXIDASE INHIBITORS



Examples of foods that need to be avoided include

- Alcoholic drinks
- Many types of cheese, such as aged cheddar, Gouda, or Parmesan
- Overripe or spoiled fruits
- Chicken and beef liver
- Dried meats
- Certain kinds of beans, such as broad bean or fava bean
- Food containing monosodium glutamate (MSG)

Possible Side effects

- Lightheadedness, sleepiness, blurred vision, changes in the ability to think clearly
- Headache
- Constipation
- High blood pressure
- Insomnia
- Skin irritation
- Sexual dysfunction
- Serotonin syndrome (a serious condition caused by an overload of serotonin).[20]

Other Antidepressants

- Trazodone
- Nefazodone
- Bupropion
- Mirtazapine

Depending on the drug, possible side effects include:

- Lightheadedness
- Dry mouth
- Constipation
- Difficulty urinating
- Low blood pressure
- Sedation
- Nausea
- Diarrhea
- Increase in appetite or weight gain
- Decrease in appetite or weight loss
- Nervousness
- Blurry vision
- Sexual dysfunction (ranging from decreased arousal to erectile dysfunction and/or delayed time to orgasm)

Alternative remedies for depression

- Omega-3 fatty acids
- Saffron
- SAM-e
- Folate
- Zinc

Antidepressant Activity of Herbs

- ***Crataegus Oxyacantha***
- ***Eschscholzia Californic****a*
- ***Lavandula Angustifolia***
- ***Matricaria Recutita***.[21]

1.3. HERBS USED IN DEPRESSION[7]

- ***Glycyrrhiza Uralensis***
- ***Lafoensia-Pacari***
- ***Siphocampylus Verticillatus***
- ***Schinus Molle***
- ***Tabebuia Avellanedae***
- ***Curcuma Longa***
- ***Bupleurum Falcatum***
- ***Piper Laetispicum***
- ***Mitragyna Speciosa***
- ***Piper Tuberculatum:***
- ***Salviaelegan Vahl***
- ***Asparagus Racemosus***
- ***Polygalasa Bulosa***
- ***Berberis Aristata***
- ***Valeriana Officinalis***
- ***Marsilea Minuta***
- ***Emblica Officinalis***
- ***Bacopa Monnieri***
- ***Cimicifuga Racemosa***
- ***Crocus Sativus***
- ***Ocimum Sanctum***
- ***Withania Somnifera***
- ***Tinospora Cordifolia***
- ***Glycyrrhiza Glabra***
- ***Morinda Officinalis***
- ***Allium Sativum.***
- ***Glycyrrhiza Uralensis***
- ***Lafoensia-Pacari.***

2. LITERATURE REVIEW

1. **D.L . Dawack et al ., (2004)[22]** The decoction of ***Mimosa pudica*** leaves given intraperitoneally at dose of 1000–4000 mg/kg protected mice against pentylentetrazol and strychnine-induced seizures. ***M. pudica*** had no effect against picrotoxin-induced seizures It also antagonized ***N***-methyl-D-aspartate- induced turning behavior. These properties could explain its use in African traditional medicine.

2. **H. S. Patil et al, (2007)[23]** Many structural and functional properties possessed by plants have great potentials to stimulate new concepts and innovative ideas in the field of biomimetic engineering. The key inputs from biology can be used for creation of efficient and optimized structures. The study of the geometry and folding pattern of leaves of ***Mimosa pudica***, referred as ***Sensitive Plant***, reveals some of the peculiar characteristics during folding and unfolding. When the leaf is touched, it quickly folds its leaflets and pinnae and droops downward at the petiole attachment. With the help of experiments on simulation model, the variations in angle of leaflets and degree of compaction after folding are investigated.

3. Seyed Adel Moallem et al., (2007)[24] In traditional medicine, Echium spp., including E. vulgare L., are utilized as exhilarant and mood stimulant. On the other hand, depression is a state of intense sadness, melancholia or despair that has advanced to the point of being disruptive to an individual's social functioning and/or activities of daily living. Therefore, finding effective and safe treatments is a hotly contested area in the present time. In this study, the antidepressant effects of aqueous and alcoholic extracts of Echiumvulgare L. aerial parts were investigated on mice. Materials and Methods Boiling and percolation were used for aqueous and alcoholic extractions, respectively. Toxicity and anti- depressant studies were performed in male BALB/C mice. Three doses of 0.05, 0.2 and 0.35 g/kg for aqueous extracts and five doses of 0.01, 0.04, 0.07, 0.3 and 0.5 g/kg for alcoholic extracts were selected in the forced swimming test employing 8 mice in each group.

4. **Mathew et al., (2008)[25]** The aqueous extract of Mimosa pudica was found to inhibit the generation of superoxide, hydroxyl radical, lipid peroxidation by F^{e2+}/ascorbate system as well as F^{e3+}/ascorbate/ADP system and nitric oxide radical in vitro.

Concentrations needed for 50% inhibition of these free radicals were 26.3, 156.2, 106.5, 122.1 and 101.2 µg/ml respectively. Administration of *M. pudica* 100, 500 mg/kg, b.wt. to normal rats increased glucose tolerance significantly (P<0.001) from 60 min. *M. pudica* was also found to reduce serum glucose level in streptozotocin induced diabetic rats significantly (p<0.005) at a dose level of 150 mg/kg, b.wt. from 2nd hour. Continued administration (15 days) of the extract 75,150 mg/kg, body weight, produced 41.1% and 48.3% reduction in the elevated serum glucose level produced by streptozotocin administration. The animals treated with *M. pudica* extract, the decrease in body weight was completely suppressed as compared with diabetic group. Elevated hepatic and renal enzymes produced by streptozotocin were found to be reduced (P<0.001) by *M. pudica* extract**.**

5. **Dnyaneshwar et al., (2009)[26]*Mimosa pudica,*** commonly known as touch-me-not, is used in folklore medicine in arresting bleeding and in skin diseases. In the present study the roots ***Mimosa pudica*** were studied for wound healing activity by incorporating the methanolic and the total aqueous extract in simple ointment base B.P. in concentration of 0.5% (w/w), 1% (w/w) and 2% (w/w). Wound healing activity was studied in three types of model in rats viz. excision, incision and estimation of biochemical parameter. In case of the excision wound model wound contraction and period of epithelization was studied while in incision wound model was evaluated by determining tensile strength and hydroxyproline content in the scab.

6. **M. karthikeyan and M. K. Deepa, (2009)[27]** *Mimosa pudica* Linn (Mimisoideae) is a plant used in traditional medicine for various disorders. The aim of this work was to evaluate the acute toxicity and antinociceptive activity of the aqueous extract of Mimosa pudica in animal models. In the acute toxicity study, a single dose of aqueous extract of 2000 mg kg-1 body weight p.o. was administered. For 48 h, animals showed no clinical signs and mortality.

7. **Rekha Rajendran et al ., (2010)[28]** ***Mimosa pudica*** Lin., known as chueMue, is a stout straggling prostrate shrubby plant, with spinous stipules and globose pinkish flower heads, and grows as weed in almost all parts of the country. It is traditionally used for its various properties and hence in the present study, chloroform extract of ***Mimosa pudica*** leaves has been screened for its hypolipidemic activity.

Hypolipidemic activity is screened by inducing hyperlipidemia with the help of atherogenic diet in wistar albino rats and serum levels of various biochemical parameters such as total cholesterol, triglycerides, LDL, VLDL and HDL cholesterol were determined. The overall experimental results suggests that the biologically active phytoconstituents such as flavonoids, glycosides alkaloids present in the chloroform extract of ***Mimosa pudica,*** may be responsible for the significant hypolipidemic activity and the results justify the use of ***Mimosa pudica*** as a significant hypolipidemic agent.

8. **Vinotha pooshan et al., (2010)[29]** The effect of Methanolic, chloroform and diethel ether extracts of Mimosa pudica was investigated in rats to evaluate the anti-ulcer activity by using three models, i.e. Aspirin, Alcohol and pyloric ligation models experimentally induced gastric ulcer. The parameters taken to assess anti-ulcer activity were volume of gastric secretion, PH, free acidity, total acidity and ulcer index. The results indicate that the alcoholic extract significantly (P<0.001) decreases the volume of gastric acid secretion, PH, free acidity, total acidity and ulcer index with respect to control.

9. ***Sadia Afreen Chowdhury et al., (*2010)[30]** The petroleum ether, chloroform and methanol crude extracts of the two different plant parts (aerial part and root) of ***Mimosa pudica*** (Mimosaceae) were screened ***in vitro*** for cytotoxicity studies by brine shrimp lethality bioassay and antimicrobial screening by disc diffusion method. The methanol crude extract of the aerial part was screened in vitro for antioxidant activity using the 1, 1-diphenyl-2-picrylhydrazyl-hydrate (DPPH) free radical scavenging assay. The petroleum ether and methanol crude extracts of the root showed potential cytotoxic activities (LC_{50} 0.05 µg/ml and 0.035 µg/ml respectively) whereas the other extractives showed poor cytotoxicity. All the crude extracts showed poor activity or inactivity against the test microorganisms.

10. **Akter et al., (2010)[31]** Organic extracts (ethanol, petroleum ether and chloroform) of two medicinal plants Lawsoniainermis L. and *Mimosa pudica* L. were proven for antibacterial properties against 15 Gram-positive and Gram-negative human pathogenic bacteria. Among the three types of extracts tested, ethanol extract was found to possess maximum antibacterial activity.

11. **Manish Pal Singh et al, (2010)**[32] The present work was attempts to study wound healing activity of the Ethanolic extract of leaves of *Mimosa pudica* Linn. belong to family Mimisace. The ethanolic leaves extract of Mimosa pudica was evaluated for its wound healing activity in rats using excision and burn wound models. Extract treated animals exhibited 73% & 92% respective (5% & 10%w/w) formulations, reduction in the wound area when compared to control which was 28%. In the excision model the extract-treated wounds were found to epithelialise faster and the rate of wound contraction was higher, as compared to control wounds. This was further supported by histopathological studies. The wound contraction Studies revealed that the wound contractions increase with an increase in the herbal extracts concentration. Mupirocin used as standard in both models.

12. **V.A. Niraimathee et al.,** (2010)[33] An aqueous root extract of Mimosa pudica was used to synthesise iron oxide nanoparticles. The formation of iron oxide nanoparticles was observed on exposure of the aqueous root extract with the ferrous sulphate solution. The iron oxide nanoparticles were characterised using UV-Visible spectroscopy, Fourier transform infrared (FTIR) spectroscopy, X-ray diffraction (XRD), scanning electron microscopy (SEM), particle size analyser (PDA) and vibrating sample magnetometer (VSM). UV-Vis is a spectrum of iron oxide nanoparticles showed a sharp peak at 294 nm due to the surface plasmon resonance. FTIR spectroscopy confirmed the attachment of bioactive molecules of plant on the iron oxide nanoparticle surfaces. The phase and crystal structure were determined through XRD.

13. **Tasnuva Sarvar et al., (2010)**[34] Diabetes mellitus is one of the major reasons for mortality worldwide and numerous scientific studies are going on to find plausible solutions to overcome and manage diabetes and its related infirmities. Traditional medicines use medicinal plants as anti-diabetic agents and despite being a disturbing weed to farming land *Mimosa pudica* Linn. has a high traditional usage for various purposes including anti-diabetic complications. The objective of this article is to accumulate and organise literatures based on traditional claims and correlate those with current findings on the use of *M. pudica* in the management of diabetes mellitus. *M. pudica* is a creeping perennial shrub which is a common weed widely distributed in Southeast Asia specially in India, Bangladesh, Malaysia, China, Philippine etc. This

plant has various species of which *M. pudica* is a well recognised plant of medicinal origin which has been traditionally used as folk medicine in India.

14. **Onasanwo S. A et al., (2010)[35]** The dichloromethane fraction of Hedranthera barteri (DMHBR), a common medicinal plant, was investigated in animal models of depression and anxiety in mice. Graded doses (25-200mg/kg p.o.bw) of DMHBR reduced the immobility time with significant effects produced by 50mg/kg (43.7%), 100mg/kg (45.6%) and 200mg/kg (31.5%) in the tail suspension test (TST) and by 100mg/kg (66.3%) in forced swimming test (FST), indicating a possible antidepressant-like activity when compared with standard antidepressant drug, imipramine. Furthermore, a diminution in the anxiety response was also observed against elevated plus maze and light dark tests, which signify its anti-anxiety activity when compared with standard anxiolytic drug, diazepam. Moreover, DMHBR has no significant effects on both the motor coordination of the mice in the rota rod test and the sleeping time in the pentobarbitone-induced sleeping time test. These results show that DMHBR has significant neuropharmacological activity as an antidepressant and anxiolytic activity.

15. **Sudhakar Pemminati et al., (2010)[36]** Depression is a widespread psychiatric disorder affecting around 5% of the population. Furthermore, it is difficult to predict which patient will respond to any given treatment. In the traditional systems of medicine, many plants and formulations have been used to treat depression for thousands of years. Emblicaofficinalis (EO) contains tannic acid as its main ingredient and this compound has been shown to have non-selective mono-amine oxidase activity.

16. **Jing Zhang et al., (2011)[37]** The total flavonoid (TF) and total phenolic (TP) contents of the ethanol extracts of the whole plant, stem, leaf, and seed of ***Mimosa pudica*** Linn belonging to the genus ***Mimosapudica*** which originates from the subtropical regions of southern China, were determined in this experiment.The antioxidant activity of the extracts and 5 flavonoid monomers of ***M. pudica*** Linn. were also evaluated by 2 assays, the 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical-scavenging activity and ferric reducing/antioxidant power (FRAP) assays. In addition, correlation analysis was also made in the present study. The results showed that leaf extracts contained the highest amount of TF and TP, and the content was significantly higher than that found in other

parts of the plant. Moreover, the sequence of antioxidant activity of the ethanol extracts was as follows: leaf > the whole plant > seed > stem.

17. **Kadarkarai Murugan et al., (2011)[38]** The ethanolic extract of Phyllanthus niruri and *Mimosa pudica l*eaves was investigated for antimalarial activity against Plasmodium berghei infections in mice. The median lethal dose was determined to ascertain the safety of the extract in mice. The antimalarial activities during early and established infections were evaluated. Phytochemical screening was also investigated to elucidate the possible mechanism of the antimalarial properties. The extract of P.niruri and M.pudica leaf demonstrated significant antiplasmodial activity in all the three models of the antimalarial evaluations. Phytochemical screening revealed the presence of some vital antiplasmodial constituents such as terpenoids ,flavonoids and alkaloids. The leaf extract of P.niruri and M.pudica thus possesses antimalarial activity, which explains the rational usage of this plant in traditional medicine.

18. **Sia FY et al., (2011)[39]** In the present study, the effectiveness of *Mimosa pudica* tannins (MPT) in neutralizing the lethality of *Najakaouthia* venom was compared with commercially derived tannins. Preincubation of MPT with *N. kaouthia* venom maintained 100% survival of mice after 24 hours. The mouse group in which there was no preincubation, no protection against the effects of the venom was observed. *M. pudica* tannin was found to be more effective in neutralizing the lethality of *N. kaouthia* venom when compared to commercial tannic acid. Two protein spots were missing in the two-dimensional gel electrophoresis (2-DE) of the MPT.

19. **G.Mohan et al., (2011)[40]** Aqueous and methanol extract of two medicinal plants of Caesalpiniasappan L. and *Mimosa pudica* L. were evaluated for their antimicrobial activities against Staphylococcus aureus NCIM 5021, Bacillus subtilis NCIM 2010, Escherichia coli NCIM 2118, Pseudomonous aeruginosa NCIM 5029, Klebsiella pneumoniae NCIM 2707, Proteus vulgaris NCIM 2027, Candida albicans NCIM 3102 and Aspergillus niger NCIM 545. The antibacterial activity of aqueous and methanol extracts was determined by agar disk diffusion and broth dilution method. The plant extracts were more active against Gram positive bacteria than against gram negative bacteria. The most susceptible bacteria were S.aureus, followed by B.subtilis, while more resistant bacteria were S.aureus, followed by E.coli.

20. **Srikanta Chowdhury et al., (2012)[41]** The present research was conducted to investigate the cytotoxic activities of methanolic extract of plant of Mimosa pudica. Cytotoxic activity was evaluated using brine shrimp lethality bioassay. For the determination of cytotoxicity, seven different concentrations (80, 100, 200, 400, 600, 800 and 1000 µg/ml) of methanol extract of Mimosa pudica were used. LC50 value of methanolic extract of *Mimosa pudica* was found to be 2.6621 µg/ml. Methanolic extract of *Mimosa pudica* showed lethality in a dose reliant conduct. More exclusively 0%, 10%, 30%, 50%, 80% and 100% mortality were observed at the concentration of 80, 100, 200, 400, 600, 800 and 1000 µg/ml, respectively. The brine shrimp lethality bioassay results suggest that the plant can be a promising source of anticancer compounds.

21. **Pradeep Kumar vikram et al., (2012)[42]** The aim of this work to evaluate the acute toxicity, Analgesic and Anti-Inflammatory activity of Ethanolic extract of *Mimosa Pudica* Linn. In the acute toxicity study, the extracts were administered in doses of 5, 50, 300 and 2000 mg/kg p.o. and behavioral changes were observed after 24 hrs. In hot plate test the pethidine treated group, Tail flick Diclofenace treated group, and group given ethanolic extracts as 250 mg/kg and 500 mg/kg showed increase in latency time dose dependent manner.

22. **Tamilarasi T. and Ananthi T., (2012)[43]** Ethanolic extracts of *Mimosa pudica* leaves were screened for phytochemical constituents and antimicrobial activity towards pathogens i.e. bacteria and fungi. The activity was tested against Bacillus subtilis, Pseudomonas aeruginosa, Klebsiella pneumonia, Aspergillus flavus and Tryco phytonru brum at different concentrations of 25, 50, 75 and 100 µl/ disc and the results have been illustrated. Phytochemical analysis of the extract revealed that the antimicrobial activity of the plant materials is due to the presence of active constituents like alkaloids or tannins.

23. **P.H. Rajasree et al., (2012)[44]** Herbal therapy and herbal drugs predominates in traditional medicine as well as in alternative medicine practiced in the developed world. Among the various indications where traditional herbal medicines are used, skin and skin related disorders is ranked top. Thus, the main objective of the present study is to formulate and evaluate a poly herbal ointment with antiseptic activity. evaluated for its

physicochemical property, antibacterial and antioxidant activity. Ointments were prepared using different concentrations of the extracts such as 2%, 4%, 6% w/w by fusion method using emulsifying ointment as base. Formulations were then tested for its physicochemical properties like loss of drying, pH, spreadability, extrudability and diffusion study and gave satisfactory results. The prepared formulations were also stable at 4ºC, 25ºC and 37ºC.

24. **Sunil Mistry et al., (2012)**[45] Anti-inflammatory activity of ethanolic extract of *Mimosa pudica* leaves was investigated at the doses of 200 and 400 mg/kg using carrageenan induced paw edema and cotton pellete granuloma technique in albino rats. The extracts showed significant activity in dose dependent manner as compared to control group. The observations suggested that the extract of M. pudica leaves were effective in exudative and proliferative phases inflammation i.e. in acute and chronic inflammation. The results obtained indicate that *M. pudica* has an anti-inflammatory activity that supports the folk medicinal use of the plant.

25. **Okoronkwo Joseph Chukwu et al., (2012)**[46] In this study, the whole plant of ***Mimosa pudica*** was extracted using absolute ethanol. The crude ethanolic extract and its isolated triterpenoid glycoside were tested for antifungal activity towards ***Aspergillus flavus*** and ***Tricho phytonrubrum*** using Well Diffusion Method. At concentrations of 25 – 100 mg/mL, the extract possesses antifungal activity (from being partially active to very active) against ***Aspergillus flavus*** and ***Tricho phytonrubrum***. The TLC profile of the crude extract indicated many compounds with R_F values of 0.41, 0.43, 0.56, 0.68, 0.89, and 0.90. The isolation and purification were established using extensive thin layer and column chromatographic processes by employing various solvents with varied polarity.

26. **Hirenkumar P Purohit et al., (2012)**[47] Bioinspired technologies have inspired the researchers, inventors and developers towards the world of Bio inspired innovations. The modern era of Science created a wide platform for the innovations, immerging from the active participation of living culture. Such Bio inspired involvements have key benefits of being the fruitful outcome of undiscovered or sometimes underestimated potentials of the traditional treatments of any subjects.This paper highlights the Bio electrochemical response of plant Mimosa Pudica, also known as Touch-me-not, humble plant, Lajjawanti (Sanskrit) or Chhuimui (Hindi), and its vicinity to be

introduced as a smart bio inspired sensor. Paper emphasizes on the response or movement of plant under applied damaging or non damaging stimulus. Finally, paper concludes with the prospective study of the ability of *Mimosa Pudica* as Smart Sensor.

27. **Lieh-Ching Hsu et al., (2012)[48]** This study investigated the antidepressant activity of ethanolic extract of U. *lanosa Wallich* var. appendiculata Ridsd (UL_{EtOH}) for two-weeks administrations by using FST and TST on mice. In order to understand the probable mechanism of antidepressant-like activity of UL_{EtOH} in FST and TST, the researchers measured the levels of monoamines and monoamine oxidase activities in mice brain, and combined the antidepressant drugs (fluoxetine, imipramine, maprotiline, clorgyline, bupropion and ketanserin). Lastly, the researchers analyzed the content of RHY in the UL_{EtOH}. The results showed that UL_{EtOH} exhibited antidepressant-like activity in FST and TST in mice.

28. **R.P. Singh et al., (2012)[49]** The present study was design to evaluate the effect of *Zingiber officinale* hydro-alcoholic extract as well as its interaction with conventional anxiolytic and anti depressant drugs using tail suspension test and forced swim test (FST) and to evaluate the possible mechanisms involved in its actions. The rhizomes of ginger were collected and authenticated. Extraction of dried rhizomes was carried out using soxhlet apparatus to obtain its Hydro alcoholic extract. The extract of *Zingiber officinale* showed the significant antidepressant activity comparable to the standard drug. The oral administration of Zingiber officinale extract at 150 mg/ kg and 300 mg/kg respectively as compared to the control treated group showed an antidepressant activity comparable to that of standard drug. The antidepressant effects of *Zingiber officinale* extract seem to be mainly associated with the activation of antidepressant activities.

29. **Thiago Henrique Costa Marques et al., (2012)[50]** Acute toxicity, antioxidant activity *in vitro* and general pharmacological effects of the flower crude ethanolic extract of *Bellisperennis* L., Asteraceae, a popular medicine used in South America, were investigated in mice. The oral route LD50 value was found 2.31 g/kg. Oral administration at doses 50, 100 and 150 mg/kg of the extract neither caused significant changes in general behavior nor led to toxic symptoms. Anxiolytic-like properties were studied in the open field test and the possible antidepressant-like actions were evaluated

in the forced swimming test (FST). There is a significant decrease in the number of crossings at all dosages mentioned above, but no sedative effects at any dosages when compared to controls. In the FST, the extract dosage of 150 mg/kg was effective in reducing immobility, along with a significant increase in swimming time. The ethanolic extract showed strong antioxidant potential in vitro, through the removal capacity against hydroxyl radicals and nitric oxide as well as prevented the formation of reactive substances to thiobarbituric acid (TBARS). Together, these results indicate that the ethanolic extract has effect on central nervous system, which might due to its antioxidant property, as demonstrated *in vitro* methods used.

30. **Jeevan Malayan et al., (2013)**[51] Mumps is an acute and self-limiting disease characterized by parotitis, however in some cases it leads to aseptic meningitis, deafness, encephalitis and orchitis, which is a serious health concern. MMR vaccination was successful in eradicating the disease however, recent reports question the efficacy of MMR vaccine and countless outbreaks are observed in vaccinated populations throughout the world. Lack of specific treatment methods for mumps infection and inefficiency of MMR vaccine in vaccinated populations accentuates the need for the development of novel drugs to control mumps virus mediated serious infections. It was with this backdrop of information that the anti-mumps virus activity of ***Mimosa pudica*** was evaluated.

31. **Baby Joseph et al., (2013)**[52] Mimosa belongs to the taxonomic group Magnoliopsida and family Mimosaseae. In Latin it is called as Mimosa pudica Linn. Ayurveda has declared that its root is bitter, acrid, cooling, vulnerary, alexipharmic. It is used in the treatment of leprosy, dysentery, vaginal and uterine complaints, and inflammations, burning sensation, asthma, leucoderma, fatigue and blood diseases. Decoction of root is used as gargle to reduce toothache. It is very useful in diarrhea (athisaara), amoebic dysentery (raktaatisaara), bleeding piles and urinary infections. This review gives a brief compilation of its phytochemical and pharmacological activities.

32. **Mishra Swati., (2013)**[53] *Eclipta alba* (Asteraceae) is a traditional medicinal plant known as Bhringaraj.This plant has been used for the treatment of a variety of diseases. The leaves of Ecliptaalba showed anti hyperglycemic activity. The roots of Eclipta alba were found effective in wound healing .Methods : This study was undertaken to

evaluate the possible antidepressant effect of Eclipta alba leaf extract (EALE) using Tail suspension test(TST) & Forced swim test (FST). 36 albino rats of either sex weighing between 200-250gm were randomly selected and divided into 6 equal groups. Group-I (control) received polyethyleneglycol (1ml/100gm),Group-II, III & IV received EALE in doses of 100,200,400 mg/kg orally (P.O.) respectively. Group V & VI (positive control) received Fluoxetine & Imipramine at doses of 20mg/kg & 15mg/kg p.o respectively. Drug treatment was given for seven & fourteen successive days. 60 minutes after last dose of drug or standard the immobility period was recorded.

33. **Bharati B Zaware et al., (2014)**[54] *Mimosa pudica* Linn. is a commonly used herb in Ayurvedic medicine. This review supports all updated information on its phytochemical and pharmacological activities, traditional uses and scientific approach. The plant extract have been widely used for the treatment of a large number of human ailments. The chemical entities of this plant have been used as an antidiabetic, antibacterial, anti-inflammatory, antifungal, anti nociceptive, anti androgenic, anticonvulsant, antioxidant, and anti-tumor, anti ulcer agents.

34. **Rajesh Singh Tomar et al., (2014)**[55] India have diversified fauna & flora, most of them are rich in natural products and naturally derived components. These components showed the antioxidant, anti microbialetc potential. The main aim of this study is to strengthen the multiple potential values of *Mimosa pudica L*. In this study, antimicrobial activities of 50% methanolic crude extracts of *Mimosa pudica L* were evaluated against different bacterial strains (E.coliMTCC-443, Pseudomonas aeruginosa MTCC-4673, Staphylococcus aureus MTCC- 3160, Bacillus subtilis MTCC-441, Streptococcus pyogenes MTCC-1926.) by agar well diffusion method & MIC determination.

35. **Bhutani k and Patel et al., (2014)**[56] The present study deals with the isolation of fourteen compounds from the active ethyl acetate (MPE) extract of M. pudica (L.) whole plant and their subsequent evaluation for the nitric oxide (NO), tumor necrosis factor alpha (TNF-α) and interleukin 1 beta (IL-1ß) inhibitory activities in lipopolysaccharide (LPS) stimulated RAW 264.7 and J774A.1 cells. Among the tested compounds, L-mimosine (12; IC50 = 19.23 to 21.15 μM), crocetin (4; IC50 = 23.45 to 25.57 μM), crocin (14; IC50 = 27.16 to 31.53 μM) and jasmonic acid (11; IC50 = 21.32 to 29.42 μM) were identified as potent NO inhibitor when tested on the macrophages.

Similarly, towards TNF-α and IL-1ß inhibition, including these four compounds, and ethyl gallate (3), gallic acid (10) and caffeic acid (7) were found to be more active with half maximal concentration, 17.32 to 62.32 μM whereas the other compounds depicted moderate and mild effects (IC50 = 59.32 to 95.01 μM).

36. **Samuel Akash Raj et al., (2014)**[57] The present study is to synthesize nanoparticles using the leaf extracts of Mimosa pudica and screen for its α-amylase inhibiting potential as well as antibacterial properties. Silver nanoparticles were synthesized using extract of *Mimosa pudica* leaves under various conditions such as sunlight, UV and room temperature. The synthesized nanoparticles were further characterized using UV, FTIR, XRD and SEM analyses. The inhibitory effect of the synthesized nanoparticles on bacterial pathogens and α-amylase activity was also studied. Results: Exposure of reaction mixture to sunlight produced maximum amount of nanoparticles, comparatively. The particles showed a dose dependent increase in percentage inhibitory activity on α-amylase enzyme.

37. **B.S. Ashok Kumar et al., (2014)**[58] Depressive disorder is a prevalent psychiatric disorder, which affects 21% of the world population. The presently using drugs can impose a variety of side-effects including cardiac toxicity, hypopiesia, sexual dysfunction, body weight gain, and sleep disorder. During the last decade, there is a growing interest in the therapeutic effects of natural products on mental disorders. Amaranthusspinosus was investigation for antidepressant activity.Antidepressant activity of methanolic extract of Amaranthus spinosus (MEAS) was investigated by using Forced swimming test (FST) and Tail suspension test (TST) models. Escitalopram and Imipramine were used as reference standards.It has been observed from our study that both the MEAS at higher concentration showed significant ($p<0.01$) reduction in immobility in tail suspension and forced swim model of depression comparable to Escitalopram and Imipramine.

38. **Ravindra C. Sutar et al., (2014)**[59] In traditional system of medicine Holoptelea Integrifolia is useful in treating various ailments. The main objective of the work was to evaluate the antidepressant activity of petroleum ether and methanolic extract of Holoptelea Integrifolia leaves using forced swim test (FST) and tail suspension test (TST) in mice. The petroleum ether extract (100 and 300 mg/kg) and methanolic extract

(100 and 300 mg/kg) were administered to mice for 14 days for evaluating antidepressant activity using forced swim test (FST) and tail suspension test (TST) in mice.

39. **R. Kumaresan et al., (2015)**[60] Liver disease is one of the outrageous diseases all over the world. Nature is the source of wide range of plants with medicinal value. Hence our study is focused on the study of efficacy and hepatoprotective activity of Mimosa pudica on experimentally induced hepatotoxic rats. Twelve healthy albino rats were taken for the study. These animals were segregated into 3 groups viz. normal, untreated and treated containing 4 animals in each group. Before the injection of hepato toxic substance to the rats, they were fasted overnight. Then 0.3 ml of CCl4 with paraffin in the ratio of 3:1 was injected for 10 days per animal. The crude powder of *Mimosa pudica* was administered to the animals belonging to the treated group starting from the day of injection of CCl4 and was continued for 10 days. The liver function of the 3 distinct groups of the animals was assessed by collecting the blood sample and liver homogenate.

40. **Lakshmibai et al., (2015)**[61] Plants and their bioactive principles have a long history of use in modern medicine and in certain systems of traditional medicine. Plant derived compounds are the basis for pharmaceutical drugs and phytotherapy. Prosopisjuliflora, commonly called as mesquite and Mimosa pudica, also known as touch me not plant or sensitive plant are used in this study. Flavonoids, steroids, phenolic compounds, glycosides, alkaloids, carbohydrates and proteins were revealed in the preliminary phytochemical analysis. The antioxidant studies were done by DPPH scavenging method with the ethanolic and aqueous extracts of Prosopisjulifolra and Mimosa pudica leaves. Different concentrations, ethanolic extracts of Prosopisjuliflora leaves exhibited significant antioxidant activity but in Mimosa pudica.

41. **Felisa Parmar et al., (2015)**[62] The present study is an attempt to investigate the antioxidant and anticancer potential of hydro alcoholic extract of ***Mimosa pudica*** Linn (Mimosaceae) and L-Mimosine on Daudi cell line. The analysis of the standard compound L-Mimosine was ascertained by High Performance Thin Layer Chromatography **(**HPTLC). Free radical scavenging activity of ***M. pudica*** extract and L-Mimosine was also compared using 2,, 2-diphenyl–1-picrylhydrazylradical scavenging

assay (DPPH). Cell viability and cytotoxicity on Daudi cells were evaluated by trypan blue and 3-(4, 5-dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide (MTT) assays in a dose and time-dependent manner respectively. HPTLC analysis showed the presence of amino acids, amines, lipids in the hydroalcoholic extract of ***M. pudica.*** Crude hydroalcoholic extract of ***M. pudica*** showed antioxidant activity (IC_{50}=103.88 µg/ml) whereas L-Mimosine showed antioxidant activity (IC_{50}=233.06 µM).

42. **Prosanta Pal et al., (2015)[63]** *Mimosa pudica* (Linn.) is a creeping annual or perennial herb. It has been identified as lajjalu in Ayurveda and has been found to have antiasthmatic, aphrodisiac, analgesic, and antidepressant properties. M. pudica is known to possess sedative, emetic, and tonic properties, and has been used traditionally in the treatment of various ailments including alopecia, diarrhea, dysentery, insomnia, tumor, and various urogenital infections. As the whole plant being used to cure various diseases so we have extracted all the plant constituents from whole plant powder of Mimosa pudica (Linn.) using 50% ethanol following cold maceration technique. Preliminary phytochemical evaluation showed the presence ofcarbohydrates, alkaloids, proteins, amino acids, tannins, phenolics, flavonoids, steroids, fixed oil, mucilage and saponins. Among these compounds alkaloid was found to exhibit different pharmacological properties.

43. **Ganesh Patro. et al., (2015)[64]** *Mimosa pudica* (*M. pudica*) Linn. (family: Mimosaceae) is a traditionally used folk medicine to treat various ailments including convulsion, alopecia, diarrhea, dysentery, insomnia, tumor, wound, snake bite, etc., Here, the study was aimed to evaluate the potential on antiepileptic, analgesic, and motor activities of *M. pudica* leaves on rodents. In an acute toxicity study, the extracts were administered in doses of 50-2,000 mg/kg/p.o. and behavioral changes were observed for up to 24 h. For a pharmacological study, the ethyl acetate extract of *M. pudica* (EAMP) leaves in doses of 100 mg/kg/day, 200 mg/kg/day, and 400 mg/kg/day were orally administered for consecutive 7 days to animals. The antiepileptic study was evaluated by inducing electric shock, pentylenetetrazole (PTZ), and isoniazid (INH) in mice, whereas the motor activity test was performed by using an actophotometer.

44. **R. Kumaresan et al., (2015)[65]** Liver disease is one of the outrageous diseases all over the world. Nature is the source of wide range of plants with medicinal value. Hence our

study is focused on the study of efficacy and hepato protective activity of *Mimosa pudica* on experimentally induced hepatotoxic rats. Twelve healthy albino rats were taken for the study. These animals were segregated into 3 groups viz. normal, untreated and treated containing 4 animals in each group. Before the injection of hepato toxic substance to the rats, they were fasted overnight. Then 0.3 ml of CCl4 with paraffin in the ratio of 3:1 was injected for 10 days per animal. The crude powder of Mimosa pudica was administered to the animals belonging to the treated group starting from the day of injection of CCl4 and was continued for 10 days. The liver function of the 3 distinct groups of the animals was assessed by collecting the blood sample and liver homogenate.

45. **Y. Jamuna Devi et al., (2015)[66]** Alcolholic, water and petroleum ether extracts of *Mimosa pudica* Linn leaves was screened for their antifertility activity at the doses of 50,100,150mg/KG body weight in female rats.Oral administration of 150mg/kg body weight of all extracts for 1-7 days of post coitum was found to be optimum and most effective dose for antifertility activity. At 50mg/kg body weight implantation sites were observed with water, alcoholic and petroleum ether treated group showing 40,80 and 40% antifertility activity. Maximum antifertility was observed after administration of the extract group at a dose of 150mg/kg body wt. From day 1-7 of pregnancy showing 80,100% antifertility activity.It is well established that the inhibition of implantation in albino rats is due to imbalance of progesterone ,estrogen ratio.

46. **Praveen Kumar Uppala et al., (2015)[67]** To investigate antidepressant activity of aqueous and chloroform extract of Eicchornia crassipes plant leaves and shoots in mice. The antidepressant activity of aqueous and chloroform extract of Eicchornia crassipes plant leaves and shoots were tested by forced swim test (FST) and tail suspension test (TST) in albino mice and the results were compared for the both extracts. Imipramine was used as the standard drug for comparison. Phytochemical screening showed presence of carbohydrates, alkaloids, flavanoids, steroids, saponins, amino acids, gums and mucilage. aqueous extract of Eicchornea crassipes (AEEC) and chloroform extract of E. crassipes (CEEC) did not produce any lethal effect even upto 2000 mg/kg, p.o during acute oral toxicity study.

47. **Mohammad Shah et al.,(2015)[68]** To estimate the antidepressant, anxiolytic and antinociceptive activities of ethanol extract of *Steudneracolo casiifolia* K. Koch

(S. colocasiifolia) leaves. Swiss albino mice treated with 1% Tween solution, standard drugs and ethanol extract of S. colocasiifolia, respectively, were subjected to the neurological and antinociceptive investigations. The tail suspension test and forced swimming test were used for testing antidepressant activity, where the parameter is the measurement of immobility time. Anxiolytic activity was evaluated by hole board model. Anti-nociceptive potential of the extract was also screened for centrally acting analgesic activity by using formalin induced licking response model and acetic acid induced writhing test was used for testing peripheral analgesic action. In formalin induced licking model, a significant inhibition of pain compared to standard diclofenac sodium was observed ($P < 0.05$ and $P < 0.001$).

48. **Abdul Mannan et al., (2015)[69]** ***Bacopa monniera*** has been used as a cure for various ailments that include anxiety, epileptic disorders, dementia, blood purifier, cough and rheumatism, and some important local uses of the plant are in dermatitis, anemia, diabetes, promote fertility and prevent miscarriage for many years in Bangladesh. According to this background, the aim of the study was to evaluate the antidepressant-like effect of the methanolic extract of ***B. monniera*** (MEBM) in different behavioral models such as forced swimming test (FST), measurement of locomotor activity test (MLAT) and tail suspension test (TST) on mice after two weeks treatment.

49. **M. Mahmoud et al., (2015)[70]** Many pharmacological activities have been reported for *Feijoa sellowiana.* The aim of present study was to investigate antidepressant activities of its leaf and fruit extracts. Antidepressant activities of methanolic extracts were evaluated by modified forced swimming test (FST) and tail suspension tests (TST) in male Swiss albino mice. Extracts showed significant antidepressant activity in both models. They shortened remarkably the immobility period in both FST and TST and exhibited a dose dependent activity ($p < 0.001$). Leaf extract showed better activity than fruit extract. At 800 mg kg-1, it showed far better activity than imipramine in FST

($p < 0.001$). Both extracts showed significantly better activity than imipramine in increasing climbing time ($p < 0.001$). They showed significant activity in increasing in swimming time as compared to the control group ($p < 0.001$). .

50. **Pragati Khare et al., (2015)[71]** *Bauhinia variegata* (Caesalpiniaceae) also known as Mountain Ebony (English), Raktakanchan (Marathi), Kachnar (Hindi). It is a medium-

sized, deciduous tree, found throughout India, 1800m in Himalayas. Bauhinia variegata Linn. is traditionally used in bronchitis, leprosy and tumors. The stem bark is used as astringent, tonic and anthelmintic. This study was done to investigate the possible antidepressant effect of Bauhinia variegata plant extract (BVMEL) using Tail suspension test (TST), Forced swim test (FST) 24 Wistar Albino rats of either sex weighing between 150-200gm were randomly selected and divided into 4 equal groups. Group-I (control) received 1% gum acacia, Groups- II, III received BVMEL in doses of 100, 200 mg/kg orally (p.o.) respectively. Group IV (positive control) received Imipramine at doses of 15mg/kg p.o. Drug treatment was given for seven & fourteen successive days. After 60 minutes of the last dose of drug or standard the immobility period was recorded.

51. **Zoya Shaikh et al., (2016)**[72] *Mimosa pudica* from latin "pudica" means shy, shrinking is also called a sensitive plant and touch me not is a creeping annual and perennial herb. The species is native to South America and Central America. Mimosa belongs to the taxonomic group Magnoliopsida and belonging to family Mimosaseae. It folds itself when touched and spreads its leaves once again after a while. Thigmonastic movements in the sensitive plant Mimosa pudica L., associated with fast responses to environmental stimuli, appear to be regulated through electrical and chemical signal transductions. These are plants used in traditional medicine in Cameroon to treat insomnia, epilepsy, anxiety, agitation, leprosy, dysentery, depression, vaginal, uterine complaints, inflammations, burning sensation, asthma, leucoderma, fatigue and blood diseases.

52. **Ganesh Patro et al., (2016)**[73] The present study was carried out to investigate the neuro pharmacological activities of ethyl acetate extract of Mimosa pudica (EAMP) leaves on anxiety, depression and memory in a mouse model. Anti-anxiety potential of EAMP was evaluated by elevated plus maze (EPM), light-dark box (LDB) and social interaction (SI) tests in mice.Anti-depressant potential of EAMP was evaluated by forced swimming (FST), tail suspension (TST), and open field tests (OFT). The behaviora l findings were further corroborated with estimation of neurotransmitters and their metabolites from mouse brain homogenate. Effect on learning and memory was evaluated by EPM, passive avoidance (PA) tests. Further, it was confirmed with assessment of acetylcholinesterase and caspase-3 activity in brain homogenate.

53. **Tanvir Ahmed et al., (2016)**[74] The present study was to investigate antidepressant action of the methanol extract of *Commelina benghalensis*. Leaves of C. benghalensis was extracted with pure methanol (MECB). The forced swimming (FST) and tail suspension (TST) tests were used as predictive animal models of antidepressant activity, where the time of immobility was considered. For in vivo tests, doses of 200 and 400 mg/kg body weight were used. Results: The extract also significantly decrease the duration of immobility in both animal models of antidepressant activity, forced swimming and tail suspension tests. In FST, mice treated with two doses of MECB (200 and 400 mg/kg) showed decreases in their immobility times, which was significant (131.17±2.75 and 108.70±1.14 respectively; $p<0.001$) when compared with control (194.27±4.81).

54. ***Parvathy Velayudhan Nair et al., (2017)***[75] *Mimosa pudica* is a traditionally used folk medicine to treat various disorders like infections, anxiety, depression, bleeding disorders, convulsions, rheumatoid arthritis, muscular pain, asthma, snake bite etc. We evaluated the anti-inflammatory activity of hydroalcoholic extract of Mimosa pudica whole plant (HAEMPWP) in rats. HAEMPWP was prepared using Soxhlets apparatus. Acute toxicity tests were done with HAEMPWP given orally to albino rats in increasing doses up to 3200 mg/ kg body weight. The anti-inflammatory action was evaluated by Carrageenan induced paw edema method.

55. **Mahadevan V et al., (2017)**[76] *Mimosa pudica* is a traditional Siddha medicinal plant useful in the treatment of various neurological (vaatham) disorders. The main objective of the study is to demonstrate the neuroprotective effects of Mimosa pudica on against MPTP induced Parkinsonism in mice model. Male C57BL/6J mice (20-25 g bwt) were used for the study. Following acclimatisation the animals .were divided into five groups with 6 in each. Group served as I negative control, Group II served as MPTP group, Group III as carbidopa 250 mg/kg IV & V as Mimosa pudica at 100 and 300 mg/kg, respectively. Animals were pretreated with vehicle or drugs (once a day) for five consecutive days. On day 5, one hour after vehicle or drug administration, MPTP was injected intraperitoneally at 80 mg/kg b.wt in two divided doses (2 X 40 mg/kg bwt. at 16 h interval).

56. **Rajeshwari Shastry et al., (2017)**[77] India is a rich source of medicinal plants used therapeutically to treat various disorders including depression. This study was undertaken to evaluate the antidepressant effect of acute and chronic administration of Punicagranatum (pomegranate) whole fruit in mice. We used the aqueous extract of Punicagranatum (250 and 500 mg/kg per day), standard drug used was Imipramine (10 mg/kg) and vehicle was gum acacia (10 ml/kg), orally. Four groups of animals were used and each group had six animals. In the acute study drugs/vehicles were administered 60 min prior to the experiments. In the chronic study drugs/vehicles were administered for 14 days and the last dose was given on the 14th day, 60 minutes prior to experiment. Forced Swim Test and Tail Suspension Test were used for testing antidepressant activity.

57. **Jothimanivannan C et al., (2017)**[78] *Justiciagenda russa* Burm is an herbal plant that has several therapeutic effects. It also heals depression, grief, nervous stress and tension. In the present study we evaluated anti-depressant effect of ethanolic extract from Justiciagendarussa Burm by using Forced Swimming Test (FST). Methods: Two doses of ethanolic extract of Justiciagenda russa Burm (250 mg/kg and 500 mg/kg) was injected intra peritoneally. Immobility time and swimming time were measured after 30 min of injection and compared with negative control and imipramine as a positive control. The ethanolic extract (500 mg/kg) was found to be effective and it exhibited activity similar to that of the conventional drug imipramine (p).

58. **Udit Narayan et al., (2017)**[79] *Cassia torais* a traditional medicinal plant known as Charota. This plant has been used for the treatment of a variety of diseases. The leaves of Cassia toras howed antirheumatic activity. The roots of Cassia torawere found effective in wound healing. This study was undertaken to evaluate the possible antidepressant effect of Cassia tora leaf extract using Tail suspension test(TST) & Forced swim test (FST). 24 swiss albino mice of either sex weighing between 20-25 gms were randomly selected and divided into 4 equal groups. Group-I (control) received saline (5 mg/ml),Group-II received Piracetam120 mg/kg and Group- III & IV received Cassia tora (C. tora) in doses of 200,400 mg/kg orally (P.O.) respectively. Drug treatment was given for five successive days. Cassia tora produced significant antidepressant like effect at dose of 200 & 400 mg/kg administered for 5 consecutive days as indicated by reduction in immobility times of Mice in TST & FST.

59. **Shashikumara. et al., (2018)**[80] To evaluate the ***in vivo*** antidepressant activity of Ethanolic extract of***Alangiumsalviifolium (L. f.) Wangerin*** leaves (EASL) in Swiss albino mice. Ethanolic extract of ***Alangiumsalviifolium (L. f.) Wangerin*** (EASL) leaves were prepared by a continuous method using Soxhlet apparatus**.** The extract was subjected to phyto-chemical screening followed by acute oral toxicity studies in mice. EASL in the doses of 100 and 200 mg/kg body weight was administered to test groups 1 and 2 respectively. Imipramine hydrochloride 15mg/kg body weight was administered to Standard group by oral route. Test group 3 received 100mg/kg (Per. Oral) of EASL + 10mg/kg (Per.oral) of Imipramine. Control group received Normal saline 10ml/kg body weight. Antidepressant activity was identified by using modified Forced Swimming Test (FST) and Tail Suspension Test (TST).

60. **Shehu Aishatu et al., (2018)**[81] Depression is a heterogeneous mood disorder affecting both people in developing and developed countries. The drugs used in its management are associated with adverse effects and delayed response which compromise their therapeutic benefits. This makes it worthwhile to look for antidepressants plants with proven advantage and favourable benefit-to-risk ratio. ***Ficusplaty phylla*** is used traditionally in West Africa for the management of mental illnesses. The aim of this study was to evaluate the antidepressant potential of the methanol stem bark extract of ***F.platyphylla***. Thin layer chromatographic finger prints of the extract was established. The oral median lethal dose of the extract was estimated using OECD 420 guidelines.

3. OBJECTIVE OF THE WORK

AIM

To study the Anxiolytic and Antidepressant effects of whole plant extract of *Mimosa Pudica* linn.

OBJECTIVES

Depression is a common mental disorder. Its mostly affected Men and Women.

This Symptoms include lack of joy and reduced intrest in things that used to bring a person happiness life events, produce mood changes that can usually be distinguished from the features of depression. The main causes of depression are not fully understood but are likely to be a complex combination of genetic, biological, environmental, and psychosocial factors. Depression is a treatable mental illness.

The Management of depression psychotherapy, known as cognitive behavioral therapy. Drug treatment includes Anti depressants available on prescription come into use for moderate to severe depression, but are not recommended for children, and will be prescribed only with caution for adolescents. Because a warning from the food and drug administration says that "Anti depressant medications may increase suicidal thoughts or actions in some children, teenagers, and young adults within the first few months of treatments"

The severe cases of depression that have not respond to drug treatment may benefit from electroconvulsive therapy. This is particularly effective for psychotic depression.

From the detailed literature scanning the herb of *Mimosa Pudica* linn was subjected to the following pharmacological screening using suitable animal models.

The objective of the current study is to evaluate the anxiolytic activity of whole plant of *Mimosa Pudica* linn

- Extraction by maceration technique
- Preliminary phytochemical screening
- Exploring the acute toxicity studies
- Screening the Anxiolytic activity by Elevated Plus Maze and Y Maze test model
- Screening the Anti Depressant activity by Open Field Test Model in Mice

4. PLAN OF THE WORK

- ✓ Collection of the whole plant of *mimosa pudica*
- ✓ Authentication of the plant
- ✓ Extraction with the suitable solvent- Aqueous extraction
- ✓ Preparation of extract
- ✓ Phytochemical screening of the extract

- **Analytical studies**

  - ➢ HPTLC method

- ***Invivo* studies**

❖ Acute oral toxicity test – Validation

  - ➢ OECD guideline 423

❖ Anti Anxiety Activity

  - ➢ Elevated Plus Maze Test in Albino Mice

- Anti Depressant Activity

  - ➢ Study of Open Filed Test in Albio Mice

EXTRACTION

- ➢ Aqueous extraction of the crude powdered whole plant of *Mimosa Pudica* by Meceartion.

5. PLANT AUTHENTICATION CERTIFICATE

Dr. V. NANDAGOPALAN
Controller of Examinations
Associate Professor in Botany

NATIONAL COLLEGE (Autonomous)
Nationally Re-Accredited with A+ Grade by NAAC
College with Potential for Excellence by UGC
Tiruchirappalli – 620 001, Tamil Nadu, India
e-mail: veenan05@gmail.com

PLANT AUTHENTICATE CERTIFICATE

This is to certify that, the given plant sample by **Mr.M.Tamil Selvan M.Pharm.,** Periyar College of Pharmaceutical science, Tiruchirappalli - 21, is ***Mimosa pudica L.*** belongs to the sub-family ***Mimosoideae*** and comes under the family ***Leguminosae.***

Yours Faithfully,

(V.NANDAGOPALAN)

5.1 PLANT PROFILE

COLLECTION OF PLANT

The fresh whole plant of *Mimosa pudica* linn were collected as mature plant in around the town of Kolli hills in Tamilnadu, India.

FIG NO :6 WHOLE PLANT OF *MIMOSA PUDICA*

Taxonomical Classification

Preferred Scientific Name	**:**	Mimosa pudica
Preferred Common Name	**:**	sensitive plant
Domain	:	Eukaryota
Kingdom	:	Plantae
Phylum	:	Spermatophyta
Subphylum	:	Angiospermae
Class	:	Dicotyledonae
Family	:	Fabaceae

Vernacular Names of *Mimosa Pudica* linn

Tamil	:	Thottacchurungi
English	:	Sensitive Plant
Malayalam	:	Tintamani
Assamese	:	Nilajban
Bengali	:	Lajjabati
Hindi	:	Chui mui
Kannada	:	Muttidare Muni

5.2. Description of the plant

The stem is erect in young plants, but becomes creeping or trailing with age. It can hang very low and become floppy. The stem is slender, branching, and sparsely to densely prickly, growing to a length of 1.5 m (5 ft).The leaves are bipinnate compound, with one or two pinnae pairs, and 10–26 leaflets per pinna. The petioles are also prickly. Pedunculate (stalked) pale pink or purple flower heads arise from the leaf axils in midsummer with more and more flowers as the plant gets older. The globose to ovoid heads are 8–10 mm in diameter (excluding the stamens). On close examination, it is seen that the floret petals are red in their upper part and the filaments are pink to lavender. The fruitconsists of clusters of 2–8 pods from 1–2 cm long each, these being prickly on the margins. The pods break into 2–5 segments and contain pale brown seeds some 2.5 mm long. The flowers are insect pollinated and wind pollinated.[10] The seeds have hard seed coats which restrict germination and make osmotic pressure and soil acidity less significant hindrances. High temperatures are the main stimuli that cause the seeds to end dormancy.

5.3. Chemical Constituents

- Mimosine
- Alkaloids
- Flavonoid
- C-Glycosides
- Sterols
- Terpenoids
- Tannins
- Fatty acids.
- D-glucuronic acid

5.4. Morphological Characteristics of the Plant

Root

Cylindrical, tapering rependant, with secondary and tertiary branches, varying in length up to 2-cm thick, surface more or less rough or longitudinally wrinkled; grayish-brown to brown, cut surface of pieces pale yellow, fracture hard, woody, bark-fibrous; odor, distinct; taste, slightly astringent.

Stem

Cylindrical, up to 2.5 cm in diameter; sparsely prickly, covered with long, weak bristles longitudinally grooved, external surface light brown, internal surface grey, bark fibrous; easily separable from wood.

Leaf

Digitately compound with one or two pairs of sessile, hairy pinnae, alternate, petiolate, stipulate, linear lanceolate; leaflets 10–20 pairs, 0.6–1.2-cm long, 0.3–0.4-cm broad, sessile, obliquely narrow or linear oblong; obliquely rounded at base, acute, nearly glabrous; yellowish green.

Flower

Pink, in globose head, peduncles prickly; calyx very small; corolla pink, lobes 4, ovate oblong; stamens 4, much exerted; ovary sessile; ovules numerous.

Fruit

Lomentum, simple, dry, 1–1.6-cm long, 0.4–0.5-cm broad, with indehisced segments and persistent sutures having —two to five seeds with yellowish spreading bristle at sutures, 0.3-cm long, glabrous, and straw colored.

Seed

Compressed, oval-elliptic, brown to gray, 0–0.3-cm long, 2.5-mm broad, having a central ring on each surface.[81]

Therapeutic uses of *Mimosa pudica*

- Wound healing activity
- Regeneration of sciatic nerve
- Anticonvulsant action
- Hypoglycemic effect
- Diuretic effect
- Effect on uterine bleeding
- Antifertility activity
- Spasmogenetic potential
- Antihepatotoxic
- Antioxidant potential
- Anti venom activity
- Antimicrobial properties
- Antifungal activity
- Antiviral properties
- Aphrodisiac property

6. METHODOLOGY

6.1. COLLECTION OF HERB

The herb *Mimosa pudica* linn was collected from in Kolli hills Tamilnadu, India. The whole plant were shade dried and coarsely powdered for extraction.

6.2. EXTRACTION[82]

Extraction is the process of removing or extracting or separating of active constituents from the crude drugs by using suitable solvents such as water, alcohol , solvent ether etc. This is the basic principle involved in extraction process . The active ingredients that have been extracted from the crude drugs are known as extractives and the preparation so obtained are known as extracts .

Extraction of plant material

Whole plant of *Mimosa pudica* linn was collected, dried material was ground into coarse powder, which was used for further study to extraction with various non polar and polar solvents.

AUQEOUS EXTRACT

The Coarse powder of the plant was macerated with 3 liters of water (0.25%) in a narrow mouthed bottled for 3 days . After completion of extraction, it was filtered and the solvent was removed by under reduced pressure. The extract was then stored in dessicator A brownish green powder was obtained .

The above extract was used for further studies, such as,

- Phytochemical Screening
- HPTLC Analysis
- Acute Toxicity Studies
- Pharmacological studies.

6.3. QUALITATIVE PHYTOCHEMICAL ANALYSIS[83]

The extracts of *Mimosa pudica* (Linn.) was subjected tothe following chemical tests for the identification ofvarious active constituents.

Tests for Carbohydrates:

1. Fehling's test

To 1 ml of the extract, add equal quantities of Fehling's solution A and B, upon heating formation of a brick red precipitate indicates the presence of carbohydrates.

Benedict's test: To 5 ml of Benedict's reagent, add 1 ml of extract solution and boil for 2 minutes and cool.Formation of a red precipitate shows the presence ofcarbohydrates.

Tests for Alkaloids

1. Dragendorffs test

To 1 ml of the extract, add 1ml Dragendorffs reagent, an orange red precipitate indicates the presence ofalkaloids.

2. Wagner's test

To 1 ml of the extract, add 2 ml of Wagner's reagent, the formation of a reddish brown precipitate indicates thepresence of alkaloids.

3. Mayer's test

To I ml of the extract, add 2 ml of Mayer's reagent, a dull white precipitate reveals the presence of alkaloids.

Tests for Proteins and Amino acids

1. Biuret test

To 1ml of the extract add 1ml of 40% sodium hydroxide solution and 2 drops of I % copper sulphate solution. Formation of violet colour indicates the presence of proteins.

2. Xanthoprotein test

To 1ml of the extract add I ml of concentrated nitricacid. A white precipitate is formed, it is boiled andcooled. Then, 20% of sodium hydroxide or ammonia isadded. Orange colour indicates the presence of aromaticamino acids.

3. Lead Acetate test

To the extract, I ml of lead acetate solution is added.Formation of a white precipitate indicates the presenceof proteins.

Tests for Tannins and Phenolics

To I ml of the extract, add ferric chloride, formation of adark blue or greenish black colour product shows the presence of tannins.

To the extract, add potassium dichromate solution,formation of a precipitate shows the presence of tannins.

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Test for Flavonoids

1. Shinoda Test

To 1 ml of the extract, add magnesium turnings and 1-2drops of concentrated hydrochloric acid formation of red colour shows the presence of flavonoids.

2. Test for Triterpenoids

Dissolve two or three granules of tin metal in 2 mlthionyl chloride solution. Then, add 1 ml of the extractinto the test tube. The formation of a pink colour indicates the presence of triterpenoids.

Tests for Steroids

1. Libermann Burchard test

Dissolve the extract in 2 ml of chloroform in a dry testtube. Add 10 drops of acetic anhydride and 2 drops of concentrated sulphuric acid. The solution becomes red,then blue and finally bluish green, indicates the presence of steroids.

2. Salkowski test

Dissolve the extract in chloroform and add equa lvolumes of concentrated sulphuric acid. Formation of bluish red to cherry red colour in chloroform layer and green fluorescence in the acid layer represents the steroid components in the tested extract.

Liebermannreaction:

Mix 3ml – extract with 3ml acetic anhydride, heat and cool, add few drops of concentrated sulphuricacid, blue colour appears.

Test for Saponins

About 1 ml of extract is diluted separately with distilled water to 20 ml, and shaken in a graduated cylinder for 15minutes. A 1cm layer of foam indicates the presence ofsaponins.

Tests for fixed oils

Spot test: Press a small quantity of extract between twofilter papers. Oil stains on paper indicate the presence of fixed oils.

Saponification test

To 1 ml of the extract add few drops of 0.5 N alcoholic potassium hydroxide along with a drop of phenolphthalein. Heat the mixture on a water bath for 1-2 hours. The formation of soap or partial neutralization indicates the presence of fixed oils.

Tests for Glycosides

Legal test: Dissolve the extract in pyridine and add sodium nitroprusside solution to make it alkaline. Theformation of pink red to red colour shows the presence of glycosides.

1. Baljet test

To 1 ml of the test extract add I ml sodium picrate solution and the yellow to orange colour reveals thepresence of glycosides.

2. Borntrager's test

Add a few ml of dilute sulphuric acid to 1ml of theextract solution. Boil, filter and extract the filtrate with chloroform. The chloroform layer is treated with I ml of ammonia. The formation of red colour shows the presence of anthrax quinine glycosides.

3. Keller Kiliani test

Dissolve the extract in acetic acid containing traces of ferric chloride and transfer to a test tube containing sulphuric acid. At the junction, formation of a reddish brown colour, which gradually becomes blue, confirms the presence of glycosides.

Test for Gums

Hydrolyse the test solution using dilute HCl. PerformFehling's or Benedict's test. Red colour is developed.

Test for Mucilages

- Powdered drug material shows red colour with ruthenium red.

HPTLC Fingerprinting

CAMAG HPTLC system equipped with linomat 5 applicator, TLC SCANNER 3, repro star 3with 12 bit CCD camera for photo documentation, controlled by WinCATS-4 software were used. All the solvents used for HPTLC analysis were obtained from MERCK. A total of 100mg extract was dissolved in 5ml of ethanol and used for HPTLC analysis as test solution.

The sample (5,10, 15µl) were spotted in the bands of width 8mm with a Camag microliter syringe on pre- coated silica gel glass plate 60 F-254.The sample loaded plate was kept in TLC twin trough developing chamber with respective mobile phase and the plate was developed up to 83 mm in the respective mobile phase.

Linear ascending development was carried out in 10 cm X 10 cm twin trough glass chamber saturated with the mobile phase and the chromatoplate development with the chamber saturation time for mobile phase was 30 min at room temperature. The developed plate was dried by hot air to evaporate solvents from the plate.

The plate was photo-documented at UV 254and 366 nm and Visible light using photo documentation chamber. Finally, the plate was fixed in scanner stage and scanning was images under white light, UV light at 254 and 366 nm. Densitometric scanning was performed on Camag TLC scanner III and operated by CATS software (V 3.15, Camag).

HPTLC Finger printing of Aqueous Extract of *Mimosa pudica*

Test Solution : The Coarse powder of the plant was macerated with 3 liters of water (0.25%) in a narrow mouthed bottled for 3 days . After completion of extraction, it was filtered and the solvent was removed by under reduced pressure.

Stationary Phase : Merck, TLC Plates Siliga Gel 60 F254

Mobile Phase : Acetone : Water : Con. Ammonia (90: 7: 3 v/v/v)

Procedure : Applied 5,10,15 µl of test solution spotted on a Siliga gel 60 F254 HPTLC Plate of uniform thickness 0.2mm using Linomat 5 sample applicator. Devoloped the plate in the solvent system to a distance of 8cm. Observed the plateunder UV Light 254nm & 366nm using CAMAG REPROSTAR3.

Animal Expermentation

Pharmacological evaluation of the aqueous extract of *Mimosa pudica* was carried out in the Department of Pharmacology, Periyar college of Pharmaceutical Sciences, Tiruchirappalli, Tamilnadu, India. Animal facility of this institute is approved by CPCSEA. The experimental protocols for the anti-ulcer activites have been approved by the Insitutional Animal Ethics Committee and conducted according to the guidelines of Indian National Sciences Academy for the use and care of experimental animals. IAEC approved this proposal with approval number PCP/IAEC/002/2019. The animals were maintained at well ventilated, temperature contolled 30ºC ± 1ºC animal room for 7 days prior to the experimental period and approved with food and water. The animals were acclimated to laboratory conditions before the test. Each animal was used only once.

ETHICAL COMMITTEE APPROVAL

The Institutional Animal Ethics Committee (IAEC) has approved the experimental protocols for the anti-ulcer activity and approval number is PCP/IAEC002/2019.

6.4. INSTITUTIONAL ANIMAL ETHICS COMMITTEE APPROVAL

The Institutional Animal Committee (IAEC) has approved the experimental protocols for the anxiolytic and anti depressant activity and approval number is PCP/ IAEC/002/2019.

6.5. TOXICITY STUDIES

6.4.1. Acute Oral Toxicity[84]

Acute Toxic Class Method – Guideline number 423

The set out in this guidline is a step wise procedure with the use of three animals of a single sex per step. Depending on the mortality and or the moribund status of the animals, an average of 2-4 steps may be necessary to allow judgment on the acute toxicity of the test substance.

The test substance will be administered orally to a group of experimental animals at one of the defined doses. The substance will be tested using a stepwise procedure, each step using three animals of a single sex (normally females). Absence or presence of compound – related mortality of the animals dosed at one step will determine the next step, i.e.

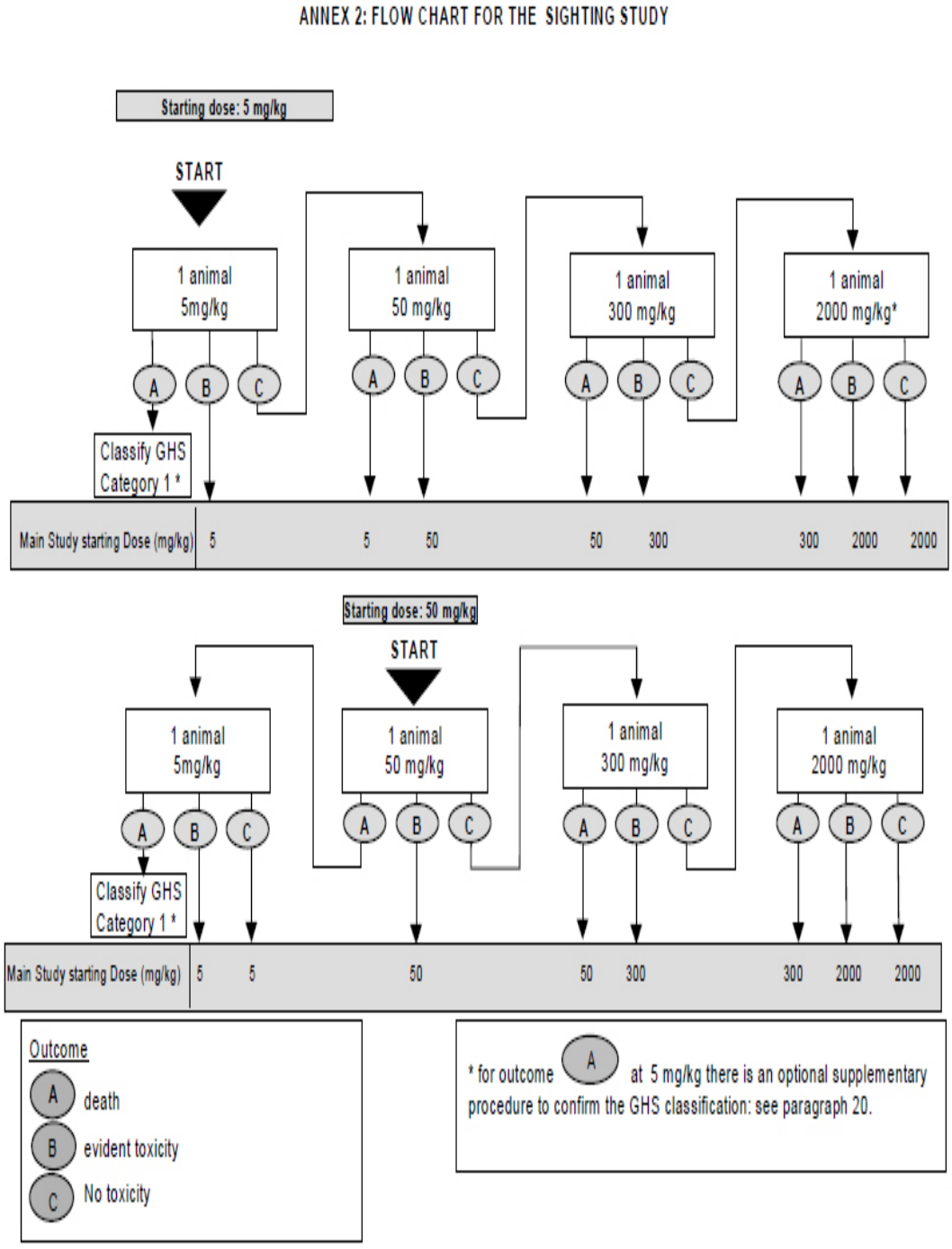
- No further testing in needed
- Dosing of three additional animals, with the same dose
- Dosing of three additional animals at the next higher of the next lower dose level.

Healthy young female rats are used. The test substance will be administered in a single dose by gavage using a stomach tube. The dose level to be used as the starting dose will be selected from one of four fixed levels, 5, 50,300 and 2000 mg/kg body weight. The starting dose level should be that which is most likely to produce mortality in some of the dosed animals. The time interval between treatment groups will be determined by the onset, duration, and sevetity of toxic signs.

Treatment of animals at the next dose should be delayed until one is confident of survival of the previously dosed animals. Animals will be observed individually after dosing at least once during the first 30 minutes, periodically during the first 24 hours, with special attention given during the first 4 hours and daily thereafter, for a total of 14 days.

Observations should include changes in skin and fur, eyes, and mucous membranes, and also respiratory, circulatory, autonomic and central nervous systems, and somatomotor activity and behavior pattern. Attention should be directed to observations of tremors, convulsions, salivation, diarrhea, lethargy,sleep and coma. In addition, behavioral changes, histopathological studies and biochemical parameters were also observed.

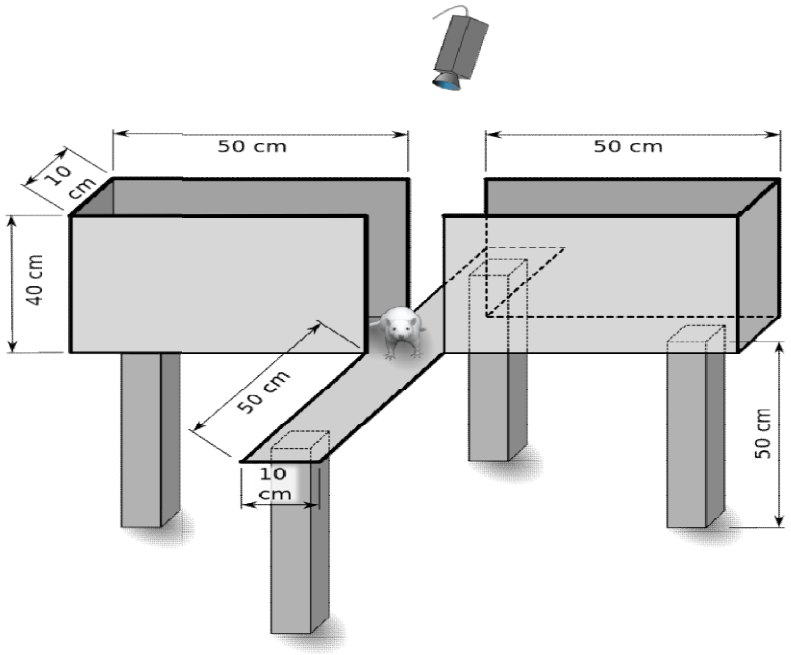
Fig No : 7 Test procedure with a starting dose of 2000mg/kg body weight



6.5. *IN VIVO* ANXIOLYTIC ACTIVITY[85]

6.5.1. ELEVATED PLUS MAZE FOR MICE

Fig No: 8 Elevated Plus Maze Apparatus



Elevated Plus Maze

The elevated plus maze task is a simple method to assess anxiety-like behaviors in rodents. This version describes the procedure used in mice. The apparatus used for the elevated plus maze test is in the configuration of a + and comprises two open arms (25 x 5 x 0.5 cm) across from each other and perpendicular to two closed arms (25 x 5 x 16 cm) with a center platform (5 x 5 x 0.5 cm). The open arms have a very small (0.5 cm) wall to decrease the number of falls, whereas the closed arms have a high (16 cm) wall to enclose the arm.

Animal : Albino mice (25-30 g)

Treatment :

- Group I served as vehicle control
- Group II served as standard and received diazepam (1 mg/kg/p.o.)
- Groups III received *M. Pudica* (200 mg/kg/p.o.)

Materials and Reagents

- Laboratory-bred plus maze and mice
- Mice housed in groups of 4-5 per cage, kept in an environment with controlled temperature (around 23 °C) and humidity under a 12-12 h light-dark cycle with food and water ad libitum.
- Paper towels and 70% ethanol for cleaning.

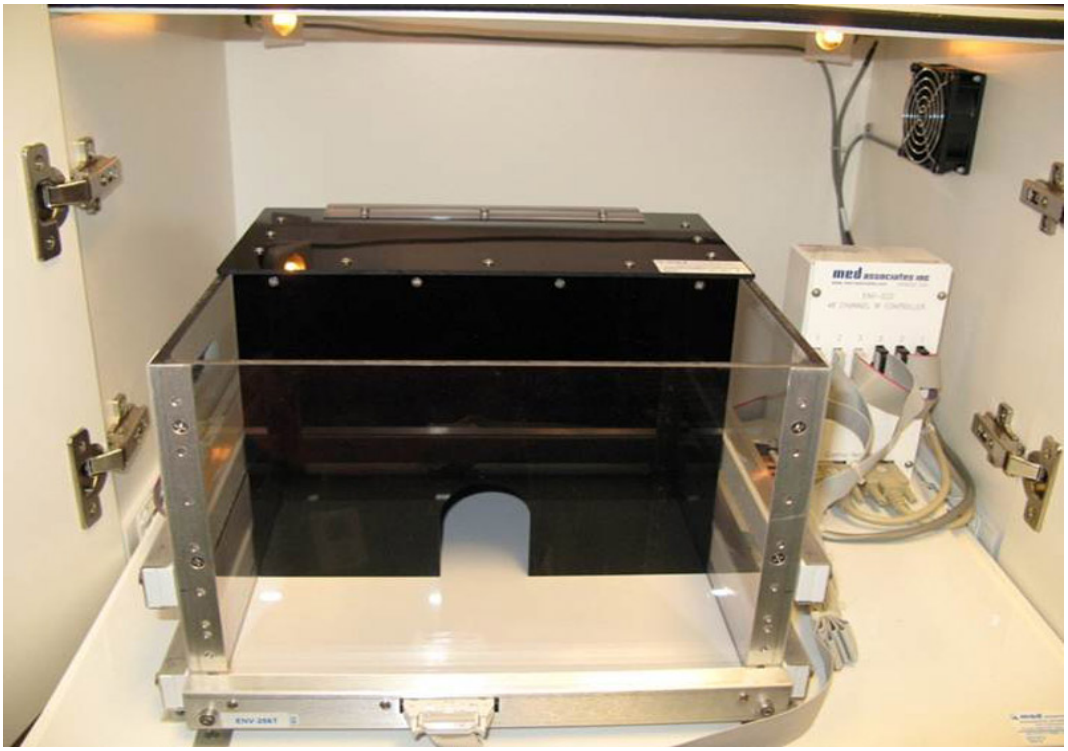
Procedure for Elevated Plus Maze test for Mice

- Mice were divided into seven groups consisting of 6 animals per group. Animal were treated with vehicle (2% v/v tween 80),
- Aqueous extract of Mimosa Pudica (200mg/kg, p.o.) and other group treated with standard drug Diazepam (1mg/kg, p.o.).
- All animal treated for 14 days and except the first group which served as vehicle control. On the 14 day each mice was placed at the end of open arm, facing away from the central platform, Transfer latency was recorded.
- If the animals did not enter into one of the covered arms with 90 sec, it was gently pushed in to one of the two covered arms and transfer latency was assigned as 90 sec. The mice was allowed to explore the maze for 10 sec and returned to the home cage.

- The measurement of transfer latency. Entries in closed arm and time spent in closed arms and measure the total locomotion on the maze .Entries in open arms and time spent in open arms used as inverse measures of anxiety, that is to say, reduced open arm avoidance reflects lower levels of anxiety.
- Test values expressed as ± standard error of the mean. Test of the significance was analyzed by one way ANOVA followed by Dunnett's test.

6.5.2. LIGHT- DARK BOX METHOD[86]

Fig No : 9 Light-Dark Box Apparatus



Animal : Albino mice (25-30 g)

Treatment :

- Group I served as vehicle control
- Group II served as standard and received diazepam (1 mg/kg/p.o.)
- Groups III served as test group and received *M. Pudica* (200 mg/kg/p.o.)

Light/dark test procedure

- Behavioral testing occurred between 1200–1630 hr. Dams were tested on day 7 or 8 postpartum (***n*** = 4) with the day of parturition assigned as day 0.
- The light-dark box was made of white and black opaque Plexiglas (20 × 30 × 30 cm light chamber, 30 × 30 × 30 cm dark chamber).
- The chambers were connected by a 10 × 10 cm door in the middle of the wall separating the two chambers. Animals were placed in the middle of the light chamber facing a side away from the door and then released.
- Rats were tested in Kinderlocomotor boxes (40 cm × 40 cm × 40 cm) with black plastic inserts (20 cm × 40 cm × 40 cm) that occupied half of the locomotor box. Both age groups were tested in the same locomotor boxes.
- The two compartments were connected by a small opening (7.5 cm × 8.5 cm) that was covered by a sliding door.
- The room was lit by two incandescent lamps so that brightness of the light side of each box averaged 65 lx.
- Rats were placed in the dark half of the box and testing began as the door to the light side of the box was raised. Time (s) and distance traveled (cm) in each compartment were measured for 15 min.
- Mice are housed with a 12-h light/dark cycle (lights on at 7:00 a.m.), as previously described. Behavioral testing is performed between 9:00 a.m. and 6:00 p.m.. All the experimental mice are transferred to the behavior testing room 30 min prior to beginning the first trial to habituate to the condition of the behavior testing room.
- Animals were maintained according to the guidelines of the Committee for the Purpose of Control and Supervision of Experiments Animals **(CPCSEA).**

Behavioral Variables

Behaviors in the light-dark box analyzed included the duration of time spent in the light chamber, number of full-body transitions between chambers, frequency of rears in the light chamber, frequency of stretches from the dark chamber into the light chamber (at least part of the head but not all four feet in the light chamber), the latency from the beginning of testing to enter the dark chamber, and the latency to re-enter the light chamber after the first bout spent in the dark chamber (non-responders were assigned a latency of 600 s). These behaviors have all previously been measured as a reflection of anxiety in this apparatus.

6.6. *IN VIVO* ANTI DEPRESSANT ACTIVITY

6.6.1. Y MAZE MODEL IN MICE[87]

Fig No : 12 Y Maze Apparatus

Y maze task is used to measure the spatial working through the spontaneous alternation of behavior. The maze is made of black painted wood. Each arm is 40cm long, 13cm high, 3 cm wide at the bottom, 10cm wide at the top, and converges at an equal angle.

Animal : Albino mice (25-30 g)

Treatment :

- Group I served as vehicle control
- Group II served as standard and received fluoxetine (1 mg/kg/p.o.)
- Groups III served as test group and received *M. Pudica* (200mg/kg/p.o.)

Experimental procedure[88]

- Each mouse is placed at the end of one arm and allowed to move freely through the maze during an 8 min session . Mice tend to explore the maze systematically, entering each arm in turn. The ability to alternate requires that the mice know which arm they have already visited.
- The series of arm entries, including possible terurns into each arm, are recorded visually.
- Alternation is defined as the number of successive entries into the three arms, on overlapping triplet sets.
- The percentage of alternation is calculated as the radio of actual alternations, defined as the total number of arm entries minus two, and multiplied by 100.
- The values expressed as ± standard error of the mean. Test of significance was analyzed by one way ANOVA followed by Dunnett's test.

6.6.2. OPEN FIELD TEST IN MICE[89]

Fig No : 11 Open Field Test Apparatus

Animal : Albino mice (25-30 g)

Treatment :

- Group I served as vehicle control
- Group II served as standard and received fluoxetine (1 mg/kg/p.o.)
- Groups III served as test group and received *M. Pudica(* 200 mg/kg/p.o).

Materials

- Subjects: Any strain of mice. No prior training is required, though subjects should be acclimated to testing environment and experimenter before testing.
- Apparatus: Large square box (76 x 76 x 50cm) with white floor.
- Privacy blinds: Placed around apparatus to eliminate external room cues.
- Standing lamps with white light bulbs (4): Placed at corners outside privacy blinds pointed away from apparatus.

Standard Operating Procedure

- Animal placed in testing room for at least 1hr before testing to minimize effects of stress on behavior during testing.
- Animal is placed in corner of arena and allowed to move freely for 10min. Trial begins immediately and ends when defined duration has elapsed. Animal is returned to home cage and number of fecal pellets is recorded. Arena is cleaned with Virkon between trials.[90]

Data Analysis

The following parameters are collected for analysis:

- Distance moved
- Mean velocity
- Time spent in each zone (if multiple).

7. RESULTS

7.1. Preliminary Phytochemical Studies

Table No : 1 Data showing the nature of the phytoconstituents present in *Mimosa pudica*

Phytoconstituents	Observation
Carbohydrates	+ +
Alkaloids	+ +
Proteins & Amino acids	+ +
Tannins & Phenolics	+ +
Flavonoids	+ +
Triterpenoids	– –
Steroids	+ +
Glycosides	– –
Fixed oils	+ +
Mucilages & Saponins	+ +

(++) Indicates the presence of chemical constituents
(--) Indicates the absence of chemical constituents

HPTLC Fingerprinting

Table No. 5 Data Showing the HPTLC of *Mimosa Pudica* Rf Value at 254 nm

Peak	R_fValue (5µl)	R_fValue (10µl)	R_fValue (15µl)
1	0.83	0.84	0.84
2	0.52	0.54	0.48
3	0.42	0.51	0.36

Table No. 6 Data Showing the HPTLC of *Mimosa Pudica* Rf Value at 366 nm

Peak	R_fValue (5µl)	R_fValue (10µl)	R_fValue (15µl)
1	0.91	0.95	0.97
2	0.89	0.89	0.90
3	0.85	0.85	0.85
4	0.55	0.53	0.51
5	0.40	0.39	0.36

Fig No : 6 HPTLC Fingerprinting Chromotogram

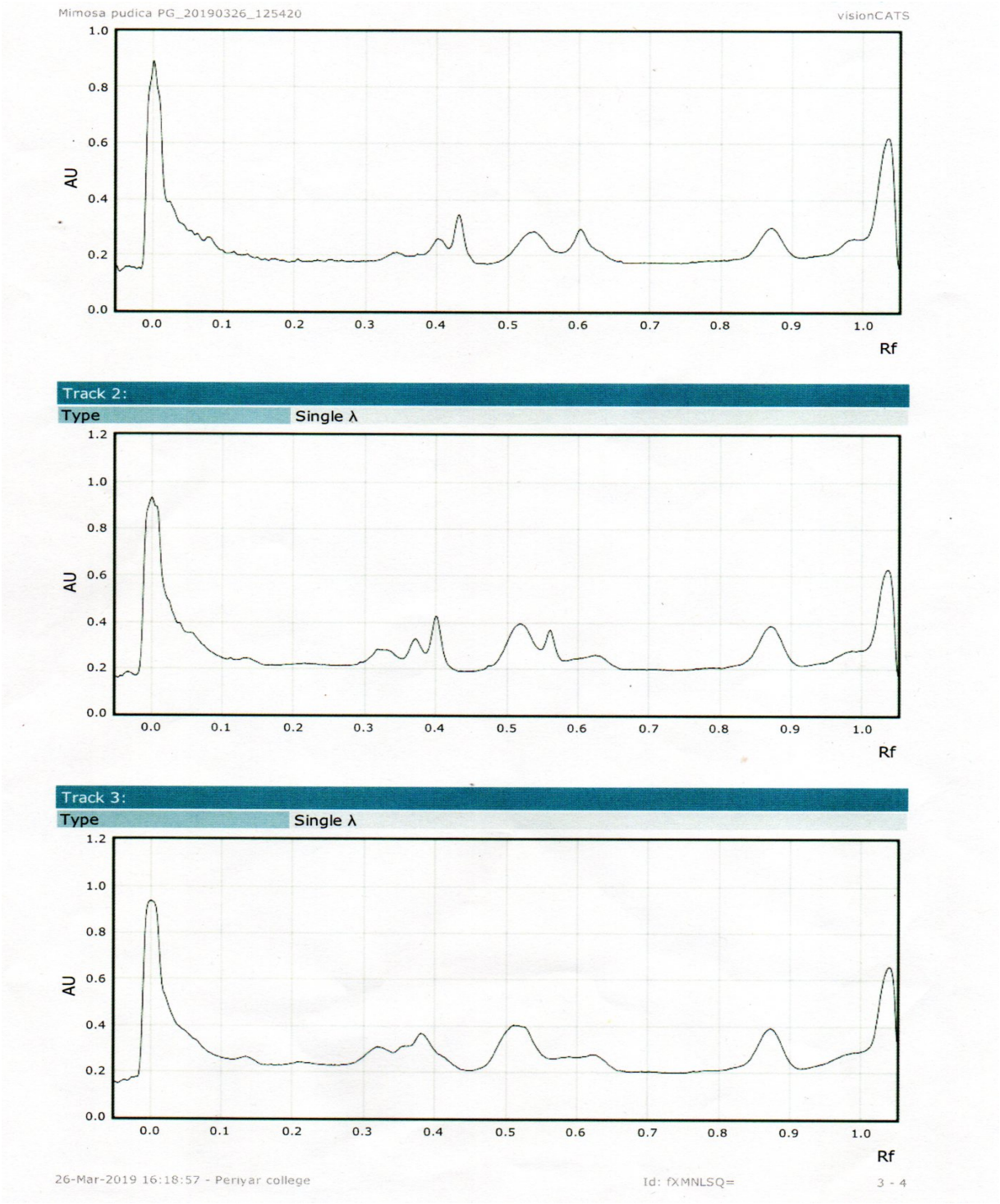
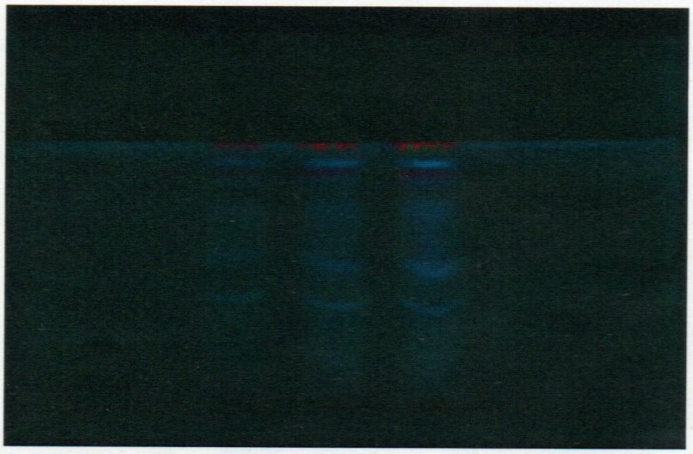
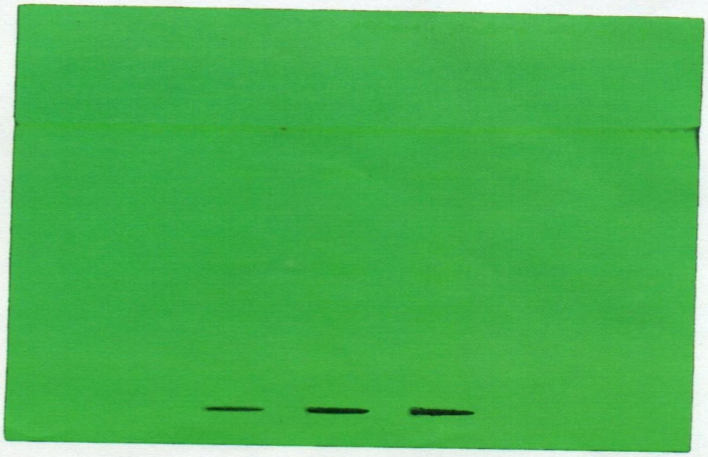


Fig No : 7 HPTLC Fingerprinting Profile

***Mimosa pudica* Leaf Extract**

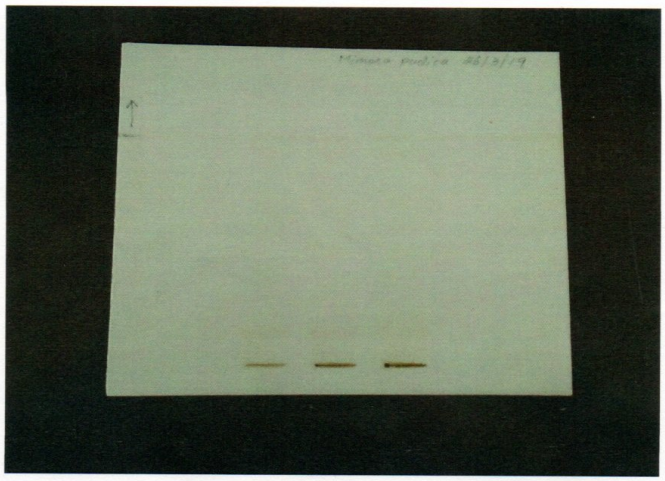


HPTLC under UV light (366nm)

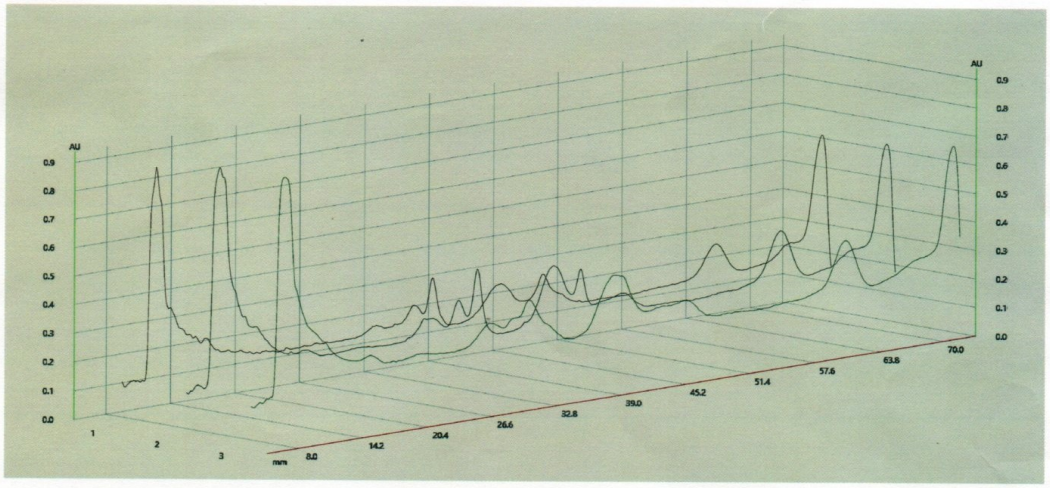


HPTLC under UV light (254nm)

Fig No : 8 HPTLC of Mimosa Pudica Extract



HPTLC under Visible light



HPTLC of Mimosa pudica Extract

(All tracks of Wavelength)

7.2. Pharmacological Evaluation

7.2.1. Toxicity studies – Acute Oral Toxicity

Table No : 2 Behavioral changes in Acute Oral Toxicity in Albino mice

S.No	Symptoms	Control (Normal Saline 5ml/kg, *p.o)*	Aqueous extract of *Mimosa Pudica* (2000mg/kg, *p.o*)
1.	Death	-	-
	Autonomous Nervous system	-	-
2.	Head movements	-	-
3.	Scratching	-	-
4.	Altered reactivity to touch	-	-
5.	Loss of righting reflex	-	-
6.	Loss of corneal reflex	-	-
7.	Defection/Diarrhea	-	-
8.	Salivation	-	+
9.	Lacrimation	-	-
10.	Myosis/ Mydriasis	-	-
11.	Loss of traction	-	-
	Central nervous system	-	-
12.	Convulsion	-	-
13.	Tremor	-	-
14.	Straub tail	-	-
15.	Sedation	-	-
16.	Excitation	-	-
17.	Jumping	-	-
18.	Abnormal gait	-	-
19.	Motor in co-ordination	-	-

20.	Akinesia	-	-
21.	Catalepsy	-	-
22.	Loss of balance	-	-
23.	Fore-paw treating	-	-
24.	Writhing	-	-
25.	Stereotypy	-	+
26.	Altered respiration	-	-
27.	Aggression	-	-
28.	Analgesia	-	-
29.	Body Temperature	-	-

Table No : 3 Effect of Test compound on Body Weight in Acute oral toxicity in Albino mice

S.No	Group	Body weight (gm)	
		Initial	**At the end of the study**
1.	**Control** (Normal Saline 2ml/kg, p.o.)	30.66 ± 6.09	32.50 ± 4.43
2.	**Test drug** (Aqueous extract of Mimosa Pudica linn 2000mg/mL, p.o.)	30.66 ± 5.57	32..83 ± 7.70

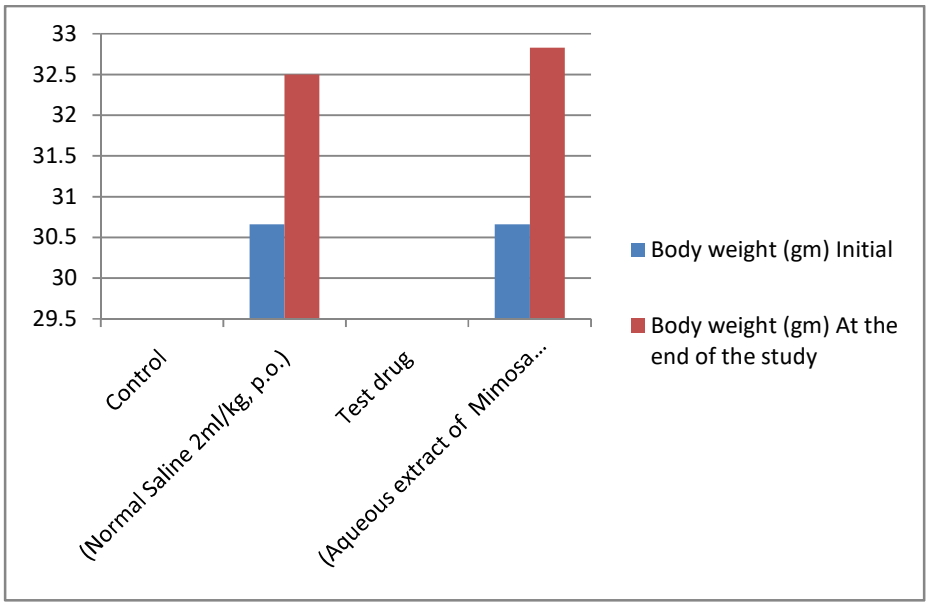
N=4 Values are expressed as ± S.E.M.

Table No : 4 Effect of Test compound on Biochemical parameters in Acute oral toxicity in Albino mice

S.No	Biochemical Parameters	Control (Normal Saline 5ml/kg)	Test Drug Aqueous extract of *Mimosa Pudica* (2000mg/ml *p.o.)*
1.	Glucose (mg/dl)	155.33 ± 1.08	136.66 ± 0.49
2.	Blood Urea (mg/dl)	14.34 ± 0.06	14.16 ± 0.30
3.	Total cholesterol (mg/ml)	80.00 ± 0.25	80.66 ± 0.33
4.	SGOT (U/I)	111.00 ± 0.85	114.00 ± 0.25
5.	SGPT (U/I)	74.83 ± 0.30	76.00 ± 1.12
6.	Albumin (gm/dl)	3.32 ± 0.06	3.50 ± 0.09

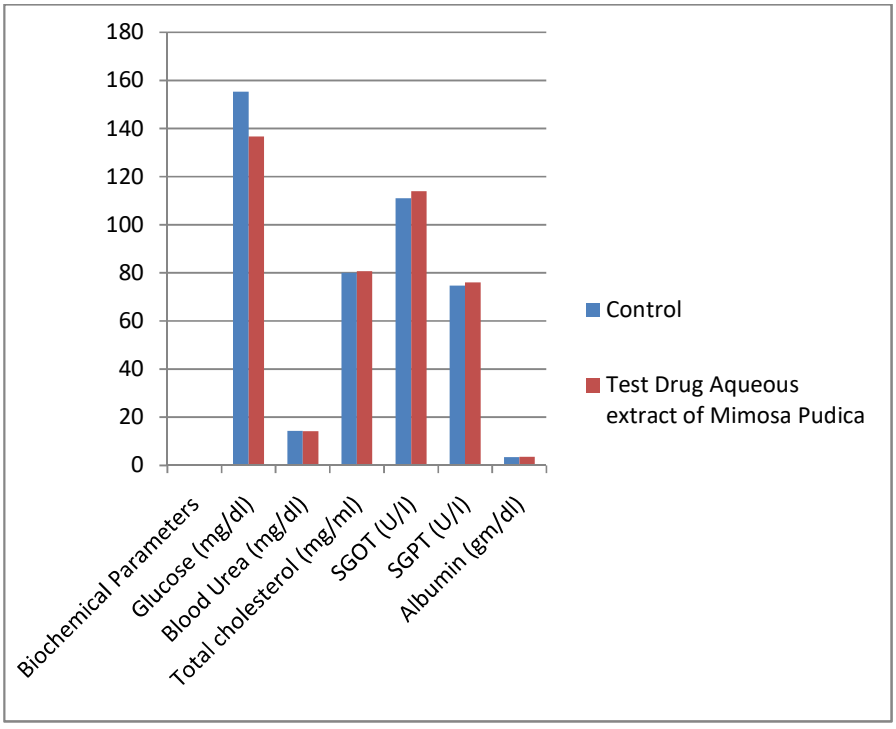
N=4Values are expressed as ± S.E.M.

Fig No : 9 Effects on Test compound on Body Weight in Acute Oral Toxicity in Albino Mice



N=4 Values are expressed as ± S.E.M

Fig No : 10 Effects on Test compound on Biochemical Parameters in Acute Oral Toxicity in Albino Mice



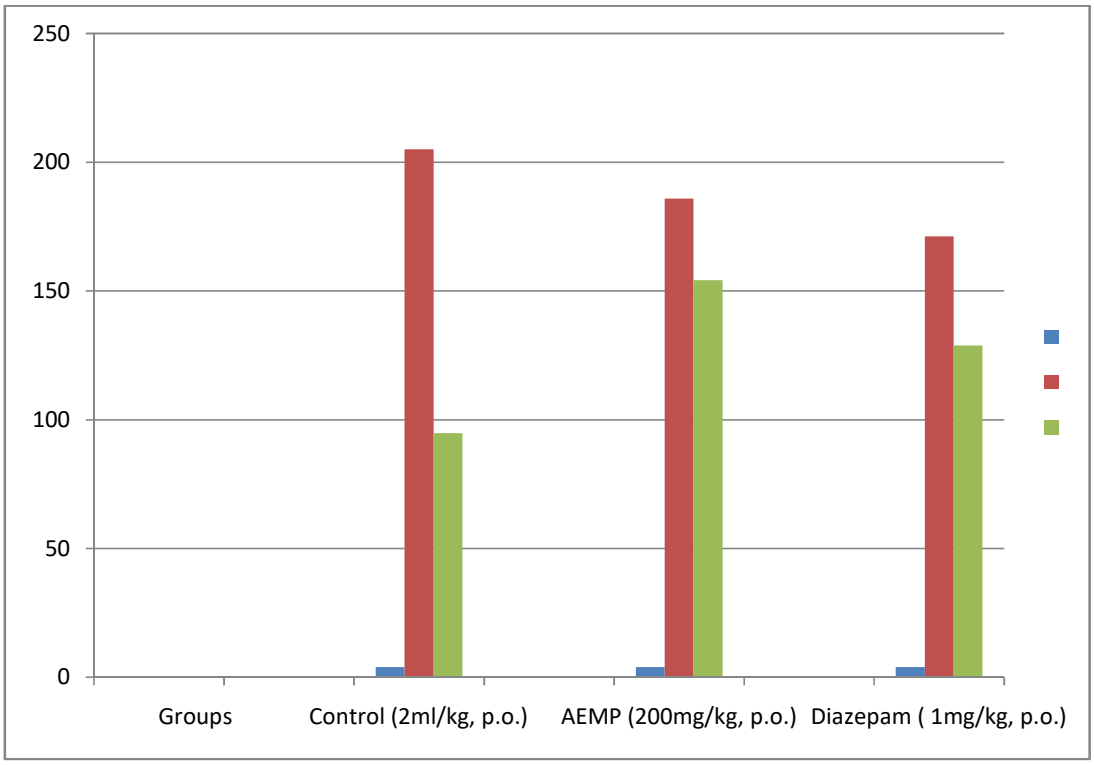
N=4 Values are expressed as ± S.E.M

Table No : 7 Anti-anxiety effect of AEMP in the Elevated Plus-Maze test in Albino Mice

S.No	Groups	No. of Animals	Time Spent in Enclosed arms (Sec.)	Time Spent in Open arms (Sec.)
1.	Control (2ml/kg, p.o.)	4	205.1 ± 12.6	94.8 ±12.6
4.	AEMP (200mg/kg, p.o.)	4	149.9 ± 20.3	154.1 ± 20.3[a]
5.	Diazepam (1mg/kg, p.o.)	4	171.2 ± 8.6[a]	128.9 ± 8.3[a]

Effect of the AEMP is difference between open arm visits into enclosed arms into 3 groups. (N=4 in each group). AEMP (200mg/kg, p.o.) and diazepam (1mg/kg, p.o.). Each values represents mean ± SEM of mice. The data was Analyzed ANOVA followed by Dunnett's test, *** P.a < 0.001 ** P < 0.01.

Fig No.: 11 Anti-anxiety effect of AEMP in the Elevated Plus-Maze test in Albino Mice



Effect of the AEMP is difference between open arm visits into enclosed arms into 3 groups. (N=4 in each group). AEMP (200mg/kg, p.o.) and diazepam (1mg/kg, p.o.). Each values represents mean ± SEM of mice. The data was Analyzed ANOVA followed by Dunnett's test, *** P.a < 0.001 ** P < 0.01.

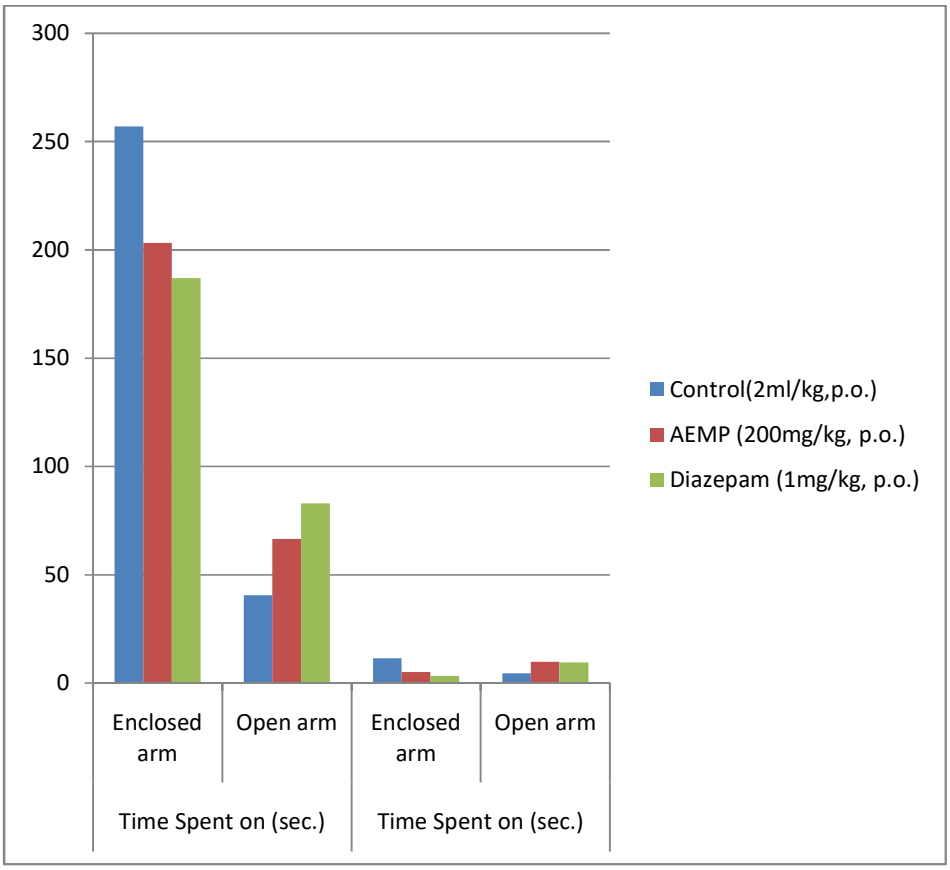
- Control (2ml/kg, p.o.)
- AEMP (200mg/kg, p.o.)
- Diazepam (1mg/kg, p.o.)

Table No : 8 Anti-anxiety effect of AEMP in the Elevated Plus-Maze test in Albino Mice

S.NO	Treatment	Time Spent on (sec.)		Entries on (N)	
		Enclosed arm	Open arm	Enclosed arm	Open arm
1.	Control (2ml/kg, p.o.)	257.00±5.19	40.50±5.16	11.41±1.92	4.41±1.78
2.	AEMP (200mg/kg, p.o.)	203.33±4.17	66.50±4.50**	5.16±0.75**	9.83±2.40**
3.	Diazepam (1mg/kg, p.o.)	187.00±4.96	83.00±3.89**	3.33±1.63**	9.50±2.16**

Effect of the AEMP on the Number of times spend and Number of entries in the open and enclosed arms in mice. AEMP (200mg/kg, p.o.) and diazepam (1mg/kg, p.o.). Each values represents mean ± SEM of mice. The data was Analyzed ANOVA followed by Dunnett's test, *** P.a < 0.001 * P < 0.01. (N=4 each group). Show significant different as compared to vehicle control group I.

Fig No : 12 Anti-anxiety effect of AEMP in the Elevated Plus-Maze test in Albino Mice



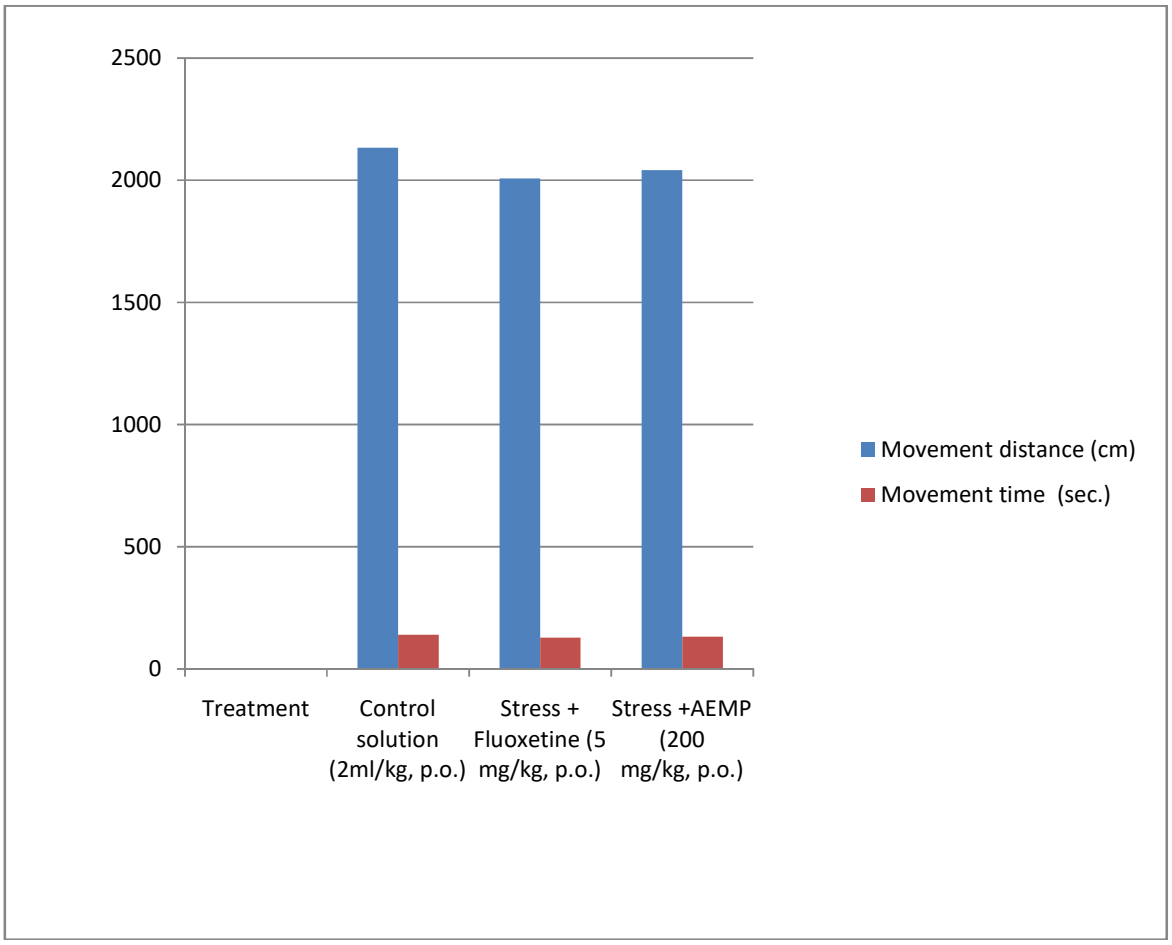
Effect of the AEMP on the Number of times spend and Number of entries in the open and enclosed arms in mice. AEMP (200mg/kg, p.o.) and diazepam (1mg/kg, p.o.). Each values represents mean ± SEM of mice. The data was Analyzed ANOVA followed by Dunnett's test, *** P.a < 0.001 * P < 0.01. (N=4 each group). Show significant different as compared to vehicle control group I.

Table No : 9 Effect of AEMP Anti Depressant activity by movement distance and movement time in open field test in mice

Treatment	Movement distance (cm)	Movement time (sec)
Control Solution (2ml/kg, p.o.)	2133.14±12.32	139.09± 7.86
Stress + Fluoxetine (5 mg/kg, p.o.)	2008.45±21.42**	127.72±8.99**
Stress +AEMP (200 mg/kg, p.o.)	1715.92±13.49**	111.33±4.23**

Effect of the AEMP on the transfer latency and step down latency in mice. AEMP (200mg/kg, p.o.) and fluoxetine (5mg/kg, p.o.). Each values represents mean ± SEM of mice. The data was Analyzed ANOVA followed by Dunnett's test, ** P.a < 0.01 * P < 0.05. (N=4 each group). Show significant different as compared to vehicle control group I.

Fig No : 13 Effect of AEMP Anti Depressant activity by movement distance and movement time in open field test in mice



Effect of the AEMP on the transfer latency and step down latency in mice. AEMP (200mg/kg, p.o.) and fluoxetine (5mg/kg, p.o.). Each values represents mean ± SEM of mice. The data was Analyzed ANOVA followed by Dunnett's test, ** P.a < 0.01 * P < 0.05. (N=4 each group). Show significant different as compared to vehicle control group I.

7.2 DISCUSSION

8.1 Extraction of plant materials

Whole plant of *Mimosa pudica* linn was collected, dried material was ground into coarse powder. The Coarse powder of the plant was macerated with 3 liters of water (0.25%) in a narrow mouthed bottled for 3 days . After completion of extraction, it was filtered and the solvent was removed by under reduced pressure. The extract was then stored in dessicator A brownish green powder was obtained .

8.2 Preliminary Phytochemical Studies

As a part of preclinical study of the Aqueous extract of *Mimosa Pudica,* the presence of Carbohydrate, Protein, Steroids, Flavonoids, Alkaloids, Saponins, Tannins, Amino acids, were confirmed and shown in **Table No :1**

8.3 HPTLC Analysis Data of the Aqueous extract of Mimosa Pudica

The HPTLC finger printing confirmed the presence of Carbohydrate, Protein, Steroids, Flavonoids, Alkaloids, Saponins, Tannins, Amino acids. These are done after indication test and the Stationary and Mobile phase are selected based on the identification test.

8.4 Pharmacological Screening

8.4.1 Toxicity Studies- Validation

In acute oral toxicity studies, aqueous extract of *Mimosa Pudica* Linn did not produce mortality at a dose of 2000mg/kg body weight in albino mice and hence $1/10^{th}$ of LD50 (i.e.) 200mg/kg was considered as the dose level for further pharmacological screening. The parameters observed were behavioral changes, biochemical parameters, body weight, histopathological studies and mortality.

8.4.2 Behavioral Changes

Behavioral changes observed were Death, Altered reactivity to touch, Loss of righting reflex, Motor in co-ordination, Abnormal gait, Altered respiration, Catalepsy, Body Temperature, Aggression, Sedation, Akinesia, Straub tail, Convulsion, Myosis/ Mydriasis, Tremor and shown in **Table No.: 2**

8.5 Anxiolytic Activity

8.5.1 Effect of Aqueous Extract of *Mimosa Pudica* on Anxiolytic models of Elevated Plus Maze Test, Light Dark Box Test and Y Maze Test in Albino mice

In elevated plus maze normally mice tend to take 20-25 entries in five minutes trials on the elevated plus maze, as exhibited by the control (group I). There was a significant increase in the number of entries due to salient anxiolytic activity. However, the presence of anxiolytic effect in group II of *mimosa pudica*, there was a decrease in the number of entries. When compared with diazepam, thus mimosa pudica was significantly (** $P < 0.001$) reducing the number of entries (group III) & the results are presented in **Table No:8, Fig No.12**

8.6 Anti Depressant activity

8.6.1 Effect of AEMP on OFT and brain transmitter in stress-induced mice

The movement distance and movement time in open field test, was significantly reduced after treatment with AEMP (200mg/kg, p.o.) and fluoxetine (5mg/kg, p.o.) as compared to stress control group. The results are mentioned in **Table No: 9.**

8. CONCLUSION

From the study entitled Anxiolytic and Anti depressant effects whole plant extract of *Mimosa Pudica* linn the following conclusions could be drawn.

- The plant study has thus supported the traditional use of aqueous extract of *Mimosa Pudica* for Anxiolytic and Anti depressant activity.
- Apart from the research works enlisted in discussion part absence of acute toxicity may also offer a new hope for safe treatment.
- Preliminary phytochemical study Aqueous extract of *Mimosa Pudica* was found to contain Carbohydrate, Protein, Steroids, Flavonoids, Alkaloids, Saponins, Tannins and Amino acids .
- Presence of phytochemicals in Aqueous extract was concluded in **HPTLC** Analysis. .Though present in small quantities it was found to produce considerable effects.
- The results of present study indicate that the Aqueous extract of *Mimosa Pudica* was non toxic upto dose level of (2000mg/kg, p.o.) body weight in albino mice as acute oral toxicity studies. $1/10^{th}$ of the LD50 Dose is (200mg/kg, p.o.) is used for pharmacological screening.
- Evaluation of Anxiolytic and Anti depressant activity Aqueous extract of *Mimosa Pudica* showed significant Antidepressant active property by obtained significant results against open field test, Elevated Plus Maze test and Y Maze Test. It may be concluded that compound at the (200mg/kg, p.o.) body weight displays a significant Anti depressant activity compared to standard drug fluoxetine.

- In future further investigation might provide an insight to identify the functional groups in the Aqueous extract of *Mimosa Pudica* active responsible for the Anxiolytic and Anti depressant effects and to elucidate the exact mechanism of action which is responsible for the observed significant activity with low toxicity and better therapeutic index.

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