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# Ethno-pharmacological Activities of Some Important Medicinal Plants on Mental Health

**Swetza Singh[1] and Rajiv Gupta[1*]**

*School of Pharmacy, BBD University, Ayodhya Road, Lucknow – 226028, Uttar Pradesh, India.*

[*]rajiv961@rediffmail.com (Corresponding Author)

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ABSTRACT

**Background:** From ancient times, plants have been prized for their prophylactic, pain-relieving, and healing properties, and today we still rely on the curative properties of these medicinal plants. Natural resources, including plants, have played a vital role for human beings from the past to the present. Healing with plants is one of the indispensable approaches implemented by mankind since the existence of humanity.

**Purpose:** The majority of the world's population, especially in developing countries, obtains the necessary source for their food and health from natural resources, including plants. All of those customs and medical procedures, whether they date back to the time of the apothecaries or not, are attempts to improve the quality of life by overcoming disease and suffering.

**Methods:** Numerous plant species found all over the world are used medicinally because they contain active ingredients that operate directly on the body pharmacologically. Known for their effectiveness in treating central nervous system disorders, some well-known and established medicinal plants of Indian origin are discussed in this review.

**Results:** Researchers have identified a number of benefits of traditional medicine, including its diversity, adaptability, accessibility, applicability in developing nations, growing appeal in wealthy nations, relative affordability, and low frequency of adverse effects from medicinal plants. According to estimates from the WHO, central nervous system disorders affect more than one billion people globally. These conditions include multiple sclerosis, Parkinson's disease, epilepsy, Alzheimer's disease and other dementias, migraine and other headache disorders, neuro-infections, brain tumors, and traumatic nervous system diseases. Mental disorders, on the other hand, are psychiatric illnesses or diseases (i.e., anxiety, depression, behavioral disturbances, etc.). These include *Bacopa monniera, Centella asiatica, Convolvulus pluricaulis, Withania somnifera, Ocimum sanctum*, and *Emblica officinalis*. A few of the most promising ones include *Alternanthera sessilis, Clerodendrum infortunatum, Argyreia nervosa, Moringa oleifera, Cassia tora, Elaeocarpus ganitrus, Spinacia oleracea, and Chenopodium album*, which are also listed in old Indian scriptures from the time of Charaka.

**Conclusion:** The focus is an attempt to compile all scientific publications pertinent to the topic so as to serve as a ready reference for future researchers working in the field of natural resources and its effect on mental health..

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## 1. Introduction

Worldwide, neurological and mental illnesses pose a serious risk to public health, particularly in poorer nations where access to conventional treatment is restricted and cultural norms have encouraged the use of alternative remedies (Ratheesh *et al.*, 2017). The herbal medication industry is founded on the ethno medical uses of plants. Indian expertise in Ayurveda and Siddha, two traditional medical systems, has helped produce herbal remedies with minimal adverse effects. The significance of medications made from natural sources has also been acknowledged by the WHO (Sahoo *et al.*, 2018). Unfortunately, there is a dearth of ethno pharmacological characterization of the traditional medications used to treat these illnesses (Saki *et al.*, 2014). According to the estimates from the World Health Organization (WHO), over a billion people worldwide suffer from illnesses of the central and peripheral nervous systems (CNS/PNS). These illnesses include schizophrenia, epilepsy, Parkinson's disease, and the majority of people rely on traditional medications for their basic healthcare needs; nonetheless, neurological conditions are frequently not recognized as common illnesses, and stigma and prejudice associated with mental health conditions, such


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as epilepsy, severely damage many of these individuals. The most prevalent severe chronic brain condition, epilepsy, is thought to impact at least 10 million individuals worldwide. Others include stroke, meningitis, Parkinson's disease, and Alzheimer's (Pathak *et al*., 2021). Mood, memory, speech, breathing, and mobility are all impacted by nervous diseases. Promising outcomes from ethno medicine and ethno pharmacology might enhance the nation's extremely abundant natural resources.

It is thought that study in the fields of ethno medicine and ethno pharmacology is necessary given the current understanding of the therapeutic qualities of plants for the treatment of neurologic illnesses (Haider *et al*., 2014). Researchers studying ethno pharmacology and ethno medicine can benefit from the use of medicinal plants that have the potential to treat neurological diseases in patients.

## 2. Need for Mental Health in the Post-COVID-19 Era

The COVID-19 outbreak has changed human life and activity. Due to the COVID-19 epidemic, a large number of us are staying indoors more and engaging in less social and physical activity. Your physical and emotional health may suffer as a result. According to several tests and studies, 20% or more of COVID-19 individuals suffer mental health problems. However, the truth is that everyone who saw and experienced this pandemic is psychologically affected, with symptoms ranging from mild mood swings to severe forms of anxiety and depression. An increase was seen in the occurrence of somatic symptoms, sleep disorders, delirium, psychosis, self-mutilation, and suicide, in addition to milder forms of anxiety, depression, and panic disorder (Greenberg *et al*., 2020). In addition to the previously listed causes, other variables contributing to these mental health problems include lack of knowledge and access to treatments that have been scientifically established, fear of getting sick, dread of the disease's severe economic implications, and uneasiness about the future. When psychiatric care was interrupted, when they were placed in home confinement, or when their daily routine was altered, people with pre-existing mental problems reported increased symptoms, relapse, and suicidal behavior (Costa *et al*., 2022). The lockdown's unpredictable and uncertain environment, together with its many limitations, unemployment, and shifting standards of living, have made it harder for those who already have tenuous access to mental health treatments.

Furthermore, the populace is now carrying a heavy psychological load as a result of these concerns. As a result, it was found that previously healthy people had higher rates of mental problems, and those who already had mental disorders worsened (Moreno *et al*., 2020).

### *2.1. Mental Health Issues after COVID-19 Recovery*

Mental health issues related to the COVID-19 pandemic are continuing to spread rapidly and invisibly, similar to the Corona virus. The necessary public health measures to encourage social distancing and reduce the spread of the Corona virus have led to increased social isolation (Liu *et al*., 2021). Delirium is frequently seen in people who needed to be hospitalized after contracting COVID-19 during the acute phase of the illness. Survivors of critical illness experience persistent psychological impairment one year following discharge, with notable levels of anxiety, sadness, and post-traumatic stress disorder experienced (Fullana *et al*., 2020). After a year, the majority of patients suffering from severe acute respiratory distress syndrome experienced neurocognitive impairment, encompassing issues related to mental processing speed, attention, focus, and memory (Kramer *et al*., 2022).

## 3. Major Behavioral Disturbances

### *3.1. Behavioral Disturbances*

A widespread and significant hallmark of dementia is neuropsychological manifestation, which includes behavioral deformities and symptoms such as sadness, anxiety, psychosis, agitation, violence, disinhibition, and disturbed sleep. These behavioral abnormalities affect between 30% and 90% of dementia patients. Behavioral abnormalities, psychological problems, and cognitive deficiencies interact in a complicated way (Volicer *et al*., 2007). Dementia and posttraumatic stress disorder (PTSD) have been linked to some behavioral abnormalities. To measure the effectiveness of therapy, a plethora of standardized, trustworthy, and well-validated tools have been created for evaluating the behavioral and psychological symptoms of dementia. To enhance patients' quality of life, several pharmaceutical, psychological, educational, psychotherapeutic, and social interventions have been created (Seligman & Ollendick, 1998).

### *3.2. Anxiety*

The most common mental health conditions and a major contributor to impairment are anxiety disorders (Murray *et al*., 2009). The co-morbidity of depressive illnesses with anxiety disorders, particularly panic disorders or generalized anxiety disorders, is rather prevalent. Due in large part to growing awareness of the consequences of untreated disease, there has been a surge in scientific interest in anxiety disorders during the last ten years. Existence of an anxiety condition is associated with an increased risk of developing other anxiety and mood disorders, according to clinical evaluations (Cryan & Holmes, 2005).

### *3.3. Depression*

One of the most common mental diseases among youth is depression. Major depression is a type of mood illness marked by feelings of hopelessness, melancholy, diminished activity, pessimism, and unhappiness. These symptoms can seriously interfere with a person's life and can even lead to suicidal thoughts or attempts (Grant *et al.*, 2010). In addition to other spheres of life, depression can cause issues at work, in the community, at home, and in the classroom. A person's functioning can be affected by an episode of depression, and the severity and quantity of symptoms can determine whether the episode is light, moderate, or severe.

### *3.4. Learning and Memory*

Every person's process of learning is different. The process of learning is how we get to know things about the world. Even though this definition is sophisticated, it doesn't really tell us what to study (Darcet *et al.*, 2014). Learning is a slightly better term for a more or less permanent change in behavior brought about by practice. Memory and learning are essential components of human intellect. Our self-awareness is fundamentally based on these processes. Learning is the consequence of experience and is defined as a modification of behavior or potential behavior (Burriss *et al.*, 2008).

## 4. Impact in Case Untreated

Seeking assistance might be challenging when dealing with debilitating anxiety. It makes sense. Studies reveal that anxiety symptoms left untreated or improperly managed can result in a worse quality of life in social, professional, and educational contexts. According to a research source, persistent worry and stress can alter specific brain regions. For instance, the hippocampus, which is in charge of memory and learning. Dementia and other neurological illnesses may become more likely as a result. Depression is a mental illness, yet it may nevertheless have physical effects on the body (Jackson *et al.*, 2011).

Depression's physical side effects sometimes develop gradually and occasionally for no apparent reason at all. One may start feeling extremely exhausted even after getting a full night's sleep, as well as experiencing aches and pains that don't seem to have a purpose (Vanek *et al.*, 2020).

Additionally, depression may have an impact on one's sexual life by lowering libido or sexual arousal (Schoenhuber & Gentilini, 1988). For example, a literature review suggested that depression is linked to a significantly greater chance of myocardial infarction and coronary heart disease.

The side effects of depression on the brain can, in turn, affect emotional well-being. This not only includes human favorite activities and jobs but also personal and professional activities (Devinsky *et al.*, 2004).

When a person lives with untreated depression, notice his/her productivity decline. Depression's impacts on attention and memory skills may also have an impact at work or school (Castaned *et al.*, 2008). For example, you can find it challenging to remember something you've just learned. Isolation may result from anxiety and despair that are left untreated. A person can start skipping get-togethers with close friends or family and feel like staying home more frequently. Keeping up with social media might leave you feeling exhausted and overwhelmed (Lang *et al.*, 2019).

## 5. Role of Medicinal Plants in Mental Health

Including medicinal plants in one's own diet and healthcare regimen is a fantastic method to improve mental wellness. Numerous plants have long been used to treat a range of neurological conditions. The herbal products are very advantageous in terms of cost-effectiveness, ease of use, and nonexistent or minimum adverse effects. These days, there is a lot of focus on herbal treatments for brain illnesses, which gives people who suffer from brain disorders fresh hope (Amoateng *et al.*, 2018). With more than 60 million people in India suffering from brain illnesses and the nation trailing behind in treatment and hospital expenditure for mental cures, it is imperative that we consider and anticipate the development of an alternative medical system.

According to this survey, one in seven Indians suffered from a mental illness in 2017, ranging in severity from moderate to severe. Between 1990 and 2017, the percentage of mental illnesses in India's overall disease burden nearly quadrupled. Of the mental illnesses that often show symptoms in adulthood, depression and anxiety disorders account for the largest disease burden in India, with schizophrenia and bipolar disorder following closely behind. Conduct disorder and autism spectrum disorders are the three mental diseases that generate the greatest disease burden among those that manifest mostly in infancy and adolescence (Ayeni *et al.*, 2022). Many medicinal plants have been used to treat a wide range of mental illnesses, including anxiety, Parkinson's disease, epilepsy, depression, paralysis, and Alzheimer's disease. Mental illnesses are becoming a major global public health concern. When treating brain illnesses, synthetic medications have severe side effects; require lengthy courses of therapy, and result in low patient compliance (Sharifi-Rad *et al.*, 2020).

## 6. Some Important Medicinal Plants

### *6.1. Bacopa monniera*

In traditional practices such as Ayurveda, *Bacopa monniera* was used to relieve one's agitation and anxiety and bring balance, clarity, and calmness. In recent studies, this effect was proven in two 12-week studies. Their findings showed that taking up to 300 mg of *Bacopa monniera* daily significantly lowered anxiety levels because *Bacopa monniera* is an adaptogenic herb and regulates major neurotransmitter levels; it helps to resist the effects of stress and elevates mood (Banerjee *et al*., 2021). Another study also shows that *Bacopa monniera* contains "apigenin," which is responsible for its soothing effect. A different study showed that *Bacopa monniera* also contains flavonoids called "wogonin," the same compound in the American Skullcap herb, which is used to calm nerves. For ages, Ayurvedic physicians have utilized *Bacopa monniera* for a number of conditions, including epilepsy, anxiety reduction, and memory enhancement (Jeyasri *et al*., 2020). Strong chemicals found in *Bacopa monniera* may have antioxidant properties. Free radical damage has been related in studies to a number of chronic illnesses, including diabetes, heart disease, and several types of cancer. For instance, it has been demonstrated that the primary active ingredients in *Bacopa monniera*, known as "bacosides," neutralize free radicals and stop fat molecules from interacting with them. Lipid peroxidation is the process that fat molecules go through when they interact with free radicals. A number of illnesses, including Parkinson's, Alzheimer's, and other neurodegenerative diseases, are associated with lipid peroxidation. *Bacopa monniera* may be able to lessen the harm this procedure causes (Singh *et al*., 2020).

### *6.2. Centella asiatica*

It is a popular medicinal plant in Ayurveda. It is a crucial component of several chemical compositions used to treat gastrointestinal, cutaneous, and central nervous system illnesses. It is also used alone and has been considered "Vagbhatt," the finest herb for improving memory and intellect. It belongs to the group of drugs known as psychotropic drugs and is also known as Brahmi (GK & MS Bharath, 2011). The exact meaning of the term "Brahmi" is "one that strengthens intellect and memory." For this reason, *C. asiatica* has many other neuroprotective properties, the main ones being enzyme inhibition, preventing the formation of amyloid plaque in Alzheimer's disease, reducing oxidative stress, and preventing dopamine neurotoxicity in Parkinson's disease. Asiaticoside, which is included in the extract, suppressed the activities of phospholipase A2 (PLA2) subtypes in primary cultures of rat cortical neurons. This evaluation was conducted using a water extract of *C. asiatica* (Subathra *et al*., 2005). Acute Asiatic acid treatment resulted in better learning and memory in male Sprague-Dawley rats. By reducing the alterations in an animal model, such as abnormal neurobehavioral and neurochemical features, the plant is known to use neuroprotective effects (Sabaragamuwa *et al*., 2014).

### *6.3. Convolvulus pluricaulis*

Results from network pharmacology show that *C. pluricaulis* interacts with compounds from a variety of proteins, neurosynapses, signaling pathways, and serotonergic synapses. These interactions are important for increased serotonin concentration in synapses, neurotransmission, persistent depression, Alzheimer's disease, alcohol addiction, cognitive impairments, and psychiatric disease (Sharma *et al*., 2022). Numerous in vitro and in vivo neuro pharmacological effects of the crude herb and its metabolites have been demonstrated, including the ability to improve memory, reduce anxiety, calm down, reduce stress, counteract neurodegenerative diseases, reduce inflammation, reduce seizures, analgesic, sedative, and reverse the effects of Alzheimer's disease (Bihaqi *et al*., 2009). Prominent phytoconstituents include kaempferol, b-sitosterol, N-hexacosanol, taraxerol, taraxerone, delphinidine, and hydroxy-cinnamic acid. These are compounds that have been shown to be present in higher amounts. Sankhpuspine, an extracted alkaloid that serves as this species' chemotaxonomic identification, was also produced by this plant. Convolamine, convosine, convoline, convolvine, confoline, evolvine, phyllabine, subhirsine, and sankhpuspine are some of the other alkaloids present in the plant. The plant contains a variety of chemicals, including phenolic compounds, steroids, flavonoids, kaempferol, quercetin, polysaccharides, coumarins, ayapanin, scopoletin, and rhamnose (Hannan *et al*., 2022).

### *6.4. Withania somnifera*

Known by many as ashwagandha or Indian ginseng, this herb has been used for thousands of years in Ayurveda to treat a variety of neurological problems. It is extensively available in Yemen, China, India, and Nepal (Sandhir & Sood, 2017). Many brain disorders have historically been treated using active phytoconstituents found in plant roots, mainly withanolides, alkaloids, and sitoindosides. We found that *W. somnifera* relieves a variety of neurological diseases, including anxiety, tardive dyskinesia, Parkinson's disease, Alzheimer's disease, Huntington's disease, and stroke, after conducting a thorough examination of the literature (Dar *et al*., 2020).

### *6.5. Ocimum sanctum*

Phytochemical components, alkaloids, flavonoids, phenolics, essential oils, tannins, and saponins are all heavily utilized in herbal medicine. *Ocimum's* bioactive components, which give it a variety of therapeutic benefits Age-induced memory impairments in mice and the amnesic impact of scopolamine (0.4 mg/kg) were both reduced by an alcoholic extract of *Ocimum sanctum* (OS) (Raghavendra *et al*., 2009). Step-down latency (SDL) and acetylcholinesterase inhibition were both markedly enhanced by OS extract. As a result, OS can be used to treat cognitive conditions including dementia and Alzheimer's disease. Using phenytoin as the reference drug, several extracts from the stem, leaf, and leaves of OS were examined for their anticonvulsant potential using the maximum electroshock model (Singh *et al*., 2013). Transocular electroshock-induced toxic convulsions were found to be effectively prevented by ethanol and chloroform extracts of the leaf and stem. In rats given pentobarbitone, OS-fixed oil (2–3 ml/kg i.p.) has reportedly been shown to have anticonvulsive properties (Zahra *et al*., 2015).

### *6.6. Emblica officinalis*

Both young and old rats' memory improved in a dose-dependent manner when given amla churna. It reversed the amnesia brought on by diazepam and scopolamine. Because amla churna has so many positive benefits, including improving cognition and reversing memory problems, it may be an effective treatment for Alzheimer's disease (Sharma *et al*., 2009). Numerous phytoconstituents, including greater concentrations of polyphenols like gallic acid and ellagic acid, various tannins, minerals, vitamins, amino acids, fixed oils, and flavonoids like rutin and quercetin, are present in the extracts from different portions of *E. officinalis*, particularly the fruit. It has been determined that the plant or extract is effective in treating neurological conditions. These functions are ascribed to either antioxidant properties that shield cells from oxidative damage or control of different molecular pathways implicated in several path physiologies (Husain *et al*., 2019).

### *6.7. Alternanthera sessilis*

Known by most as Gudari saag, Matsyaakshi is an herbaceous branching plant with considerable medicinal significance that is found in warmer regions of India and may reach elevations of 1200 meters. It functions as a galactogogue, lactogogue, febrifuge, and abortifacient (Gupta & Singh, 2012). Saturated hydrocarbons, aliphatic esters, stigma sterol, and ß-sitosterol are abundant in the plant. It has been reported that nonacosane, 16-hentriacontane, ß-sitosterol, stigmasterol, and handianol may be extracted from plants using petroleum ether. Using the raised plus maze model, the ethanolic extract of *Alternanthera sessilis* significantly ($P<0.01$) enhanced memory (Khamphukdee *et al*., 2021). The aerial portions of *Alternanthera sessilis* have been found to have high nootropic potential in both aqueous and ethanolic extracts. This is due to their facilitation impact on the retention of acquired learning. Using the oxidative stress model of Parkinsonism with rotenone, the anti-parkinsonian activity of *Alternanthera sessilis* (EEAS) ethanolic extract and its silver nanoparticles (ASAgNPs) was assessed. Rotenone (12 mg/kg) was administered to induce Parkinsonism. AgNPs (20 mg/kg) and EEAS (200 mg/kg) were evaluated using antioxidant tests such as lipid peroxidation and glutathione (Singh *et al*., 2023).

### *6.8. Clerodendrum infortunatum*

Known by most as Bhat, this important and extensively used medicinal plant has been used extensively in North India's rural areas as a tonic and anthelmintic agent. It is said to have an active bitter component called clerodin. According to Ayurveda, the plant has a strong, bitter taste and is tonic, aphrodisiac, antipyretic, and anthelmintic. It is also beneficial for conditions like biliousness, "kapha," "tridosha," leucoderma, thirst, burning feelings, bad odor, and blood disorder (Vazhayil *et al*., 2017). The initial screening of *Clerodendrum infortunatum* for phytochemicals Carbs, starch, mucilage, saponins, flavonoids, tannins, and phenolic substances were all present in linn root. Methanolic extract from demonstrated anticonvulsant properties. Mice exposed to leaf saponin exhibit both analgesic and anticonvulsant properties. In Swiss albino mice, saponins extracted from an aqueous extract of *Clerodendron infortunatum* leaves may have anticonvulsant properties. The ethanol-based leaf extract from *Clerodendrum infortunatum* has antioxidant properties because of flavonoids (Sen *et al*., 2020).

### *6.9. Argyreia nervosa*

Also referred to as Vridha daraka. Ayurveda frequently uses it to treat neurological issues; as a result, several studies have demonstrated that *A. nervosa* has nootropic and memory-enhancing properties. At doses of 100 and 200 mg/kg, aqueous root extract enhanced memory and effectively reversed memory loss brought on by a variety of medications, including scopolamine and diazepam (Paulke *et al*., 2014). Significant nootropic action confirms that the brain's acetylcholine esterase activity also improved at the same time. Using the Morris water maze and radial arm maze tests, the effects of a hydroalcoholic extract of *A. speciosa* root (200 mg and 400 mg/kg) on learning and memory in mice were also investigated. Piracetam is the prescribed medication. According to Ayurvedic literature, the root of

*A. speciosa* is said to be beneficial in treating a variety of neurological disorders. The root's hydroalcoholic extract in an alternative animal convulsion model (Yoon *et al*., 2018). Using pentylenetetrazole and the maximum-electroshock-induced convulsion paradigm, the anticonvulsant effects of a 10-day therapy with hydroalcoholic extracts (100, 200, and 400 mg/kg) were assessed. According to the findings, the extract considerably reduces seizures and may have anticonvulsant properties. The anxiolytic and locomotor effects of *A. speciosa* hydroalcoholic root extract (100, 200, and 400 mg/kg) were investigated (Patel *et al*., 2011).

## *6.10. Moringa oleifera*

Currently, a small number of experimental studies have documented *M. oleifera's* neuroprotective benefits against symptoms associated with neurotoxicity, dementia, Alzheimer's disease, Parkinson's disease, and stroke. Furthermore, *M. oleifera* has been shown to contain a number of neuroprotective phytochemicals, suggesting that it may have promising neuroprotective effects (Ghimire *et al*., 2021). The data from research reveal that the ethanol extract of *Moringa oleifera* leaves contains CNS depressive and anticonvulsant properties likely mediated through the increase of a central inhibitory mechanism involving the release γ-aminobutyric acid (GABA). The outcomes somewhat supported the extract's traditional usage in the treatment of epilepsy. Evaluations were conducted on the effects of scopolamine, diazepam, and aging on mice's memory impairments caused by aqueous extract (Sutalangka *et al*., 2013). Both the passive avoidance paradigm and the elevated plus maze were used to evaluate both short- and long-term memory. Acetylcholinesterase (AChE) activity across the whole brain was measured in an effort to define the potential mechanism by which it elicits the anti-amnesic effects. For six days straight, mice of various ages were administered an aqueous extract of MO orally at two distinct doses (100 and 200 mg/kg, p.o.).

In both young and old mice, MO increased step-down latencies and lowered transfer latencies. Amyloid (100 and 200 mg/kg, p.o.) effectively restored amnesia brought on by scopolamine, diazepam, and aging. The total brain homogenate's AChE levels were considerably lowered by MO, suggesting that it may be able to mitigate learning and memory impairments, particularly in older mice (Hannan *et al*., 2014).

## *6.11. Chenopodium album*

Traditionally, the *Chenopodium* plant has been used as a herbal medicine for a variety of ailments, such as piles, throat problems, stomach discomfort, heart, spleen, and blood disorders. Numerous phytoconstituents are available from the plant, such as protein, carbs, suberin, glucoside, flavin, and trace quantities of sugar and oil. Flavonoids such as phenolic amide, saponin, cinnamic acid amide, apocortinoid, xyloside, phenols, and lignans are also present in it (Chludil *et al*., 2008). The pharmacological activity of plant extracts derived from different portions of the plant includes antibacterial, antipruritic, laxative, aphrodisiac, antinociceptive, anthelmintic, antinutritional, and functional potential for use in human diets. Several studies on metabolic extract have demonstrated the capacity of antioxidant components to scavenge free radicals and protect human health.

For these potentially helpful plants's processing parameters, no substantial investigation has ever been done (Yadav *et al*., 2021). Based on the available data, it is evident that this species has been well investigated across all dimensions; nonetheless, further comprehensive bioactivities on this species are required. The pharmacological research included in this study supports *Chenopodium album's* medicinal benefits. But about the phytoanalytic qualities of this plant, much less is known. Studies on phytochemicals have been reported, but more work has to be done. When the claims made by the ethnobotanical statements are thoroughly investigated, they can offer practical treatments and help people suffering from a range of neurological conditions.

## *6.12. Cymbopogon citrates*

Various papers addressed the potential anxiolytic effects of *C. citrates* report that in healthy people exposed to anxiogenic situations, a small amount of *C. citrates* essential oil inhaled can produce anxiolytic effects very soon after therapy (De Sousa *et al*., 2021). Patients placed in an anxiogenic environment were able to boost anxiolytic effects immediately after the medicine was provided (baseline anxiety levels), even if there was no suppression of the anxious reaction to the task. *C. citrates* produced an anxiolytic effect and reduced spontaneous motor activity and social interaction in animal models through behavioral studies conducted in mice (Bakhshaei, 2017).

Rupert *et al*. (2019) showed that zebra fish showed a statistically significant reduction in anxiety, which is probably because GABA receptors were activated.

## *6.13. Lavandula officinalis*

Though various studies with *L. officinalis* were double-blind controlled randomized clinical trials, the majority of the research was done on people. In the majority of these trials, the measured scores changed in a way that was statistically significant, resulting in lower anxiety rates and better sleep duration and quality.

The study by Velasco-Rodriguez *et al.* (2019) was an exception, as it solely examined changes in blood levels of melatonin, a hormone that induces sleep and may be linked to both excellent sleep quality and length. Regarding the effects of lavender on sleep, research utilizing the herbal drug Silexan® shows that the sedative impact of lavender is a secondary effect mediated by its anxiolytic function rather than a direct effect. The clinical trials also showed antidepressants effects.

## *6.14. Matricaria chamomilla*

*M. chamomilla*, all clinical trials showed a significantly greater reduction in the anxiety symptoms among patients diagnosed with anxiety disorder associated with depression when compared with patients only diagnosed with GAD. In addition, attenuation of the symptoms was shown in patients with GAD, although with no change in the disease relapse risk. (Mao *et al.*, 2016) noticed reductions in the anxiety symptoms, from severe and moderate to mild. It is worth highlighting that treatment with *M. chamomilla* for eight weeks or consecutive weeks was considered safe, as no severe adverse effects were observed.

## *6.15. Piper methysticum*

Kava - Kava studies evaluating the effects of *P. methysticum* were included in this review: one was a clinical trial and the other, a pre-clinical trial. (LaPorte *et al.*, 2011) assessed the efficacy of *P. methysticum* aqueous extract against GAD in a study involving 171 patients, although this extract did not show to be effective for this condition. In a study conducted with zebra fish, observed reductions in all the parameters and associated this finding with a dose-dependent sedative effect. Both studies assessed the risk for herb-induced liver injury and, although the patients in the clinical study who received *P. methysticum* presented more frequent anomalies in the liver function tests, no participant met the criteria for herb-induced liver injury.

## *6.16. Melissa officinalis*

The preclinical studies showed the dose-dependent sleep-inducing effect of lemon balm. Hydroalcoholic extract, similar to that of diazepam, reduces time to sleep initiation and increases sleep duration, in addition to reducing anxiety and depressive behavior. In addition to that, lemon balm extract inhibited oxidative stress and apoptosis pathways in the prefrontal cortex and hippocampus of mice. Selected 100 participants were diagnosed with premenstrual syndrome and noticed improvements in the symptoms related to anxiety, sleep disorders, and social function disorders. The authors considered treatment with *M. officinalis* as a good alternative to the use of synthetic psychotropic drugs, with the possibility of being used to treat anxiety, insomnia, and depression. In turn, (Ghazizadeh *et al.*, 2021) studied the effects of this plant on fighting against psychosomatic symptoms in patients with stable angina, observing an improvement in the anxiety, depression, stress, and sleep scores when compared to the control group.

## *6.17. Passiflora incarnata*

Also known as Passion Fruit. The effects of *P. incarnata* were evaluated in various types of studies, both in animals and in humans. The sedative effect of *P. incarnata* was evaluated in animal models, noticing an increase in total sleep time in addition to increased eyelid closure time and immobility in rodents and a sleep-inducing effect. In turn, the assessment of the anxiolytic effect revealed that rodents treated with *P. incarnata* presented lower anxiety levels and significantly reduced levels of corticortrophin-releasing hormone and glucocorticoid receptors. Passion fruit had anxiolytic and sedative properties comparable to those of diazepam in the (Fonseca *et al.*, 2020). Treating animals with *P. incarnata* extract also led to an increase in the brain-derived neutrophic factor and in the melatonin blood levels, as well as an improvement in memory.

## *6.18. Valeriana officinalis*

*Valeriana* studies evaluated the effects of *V. officinalis*, most of them being clinical trials. The plant induced a significant anxiolytic and relaxing effect during extraction of the third molar in humans, and, contrary to Midazolam, no adverse effects such as blood pressure reduction or retrograde amnesia were observed, although *Valerian* was less effective than Midazolam. *Valeriana* was also able to reduce suicidal thoughts and improve sleep and anxiety in a study conducted with HIV-positive patients using Efavirenz, a medication that causes adverse psychiatric effects. In studies using rest EEG and TMS in humans, *Valerian* extract showed anxiolytic capacity through changes in the brain circuits and reduced intracortical facilitation (Chandra Shekhar *et al.*, 2024). In the preclinical experimental studies involving animal models, *Valerian* extract did not induce any significant sedative effect in zebrafish, although it was able to reverse the effects of pentylenetetrazole, an anxiogenic agent. In fruit flies, *Valerian* extract was able to reduce locomotive activity, showing a sedative effect.

Marker compounds isolated from above mentioned plants useful in mental health are tabulated in Table 1.

**Table 1:** Some Useful Plants for Mental Health along with Marker Compounds

| Plants | Marker Compounds | References |
|---|---|---|
| *Bacopa monniera* | Bacoside, Bacogenins, Jujubogenin, Bisdesmosides, Bacopasaponins E and F, pseudojujubogenin, Bacopasides I and II, Phenylethanoid glycosides, monnierasides I–III. | (Mahato *et al.*, 2000) |
| *Centella asiatica* | Triterpenoids 6, Vallarine, Asiaticoside, Sitosterol, Tannin, Oxyasiaticoside, etc. | (Sabaragamuwa *et al.*, 2023) |
| *Convolvulus pluricaulis* | Hydroxy-cinnamic acid, delphinidine, kaempferol, B-sitosterol, N-hexacosanol, tartaric acid, and tartaricone, among others. | (Balkrishn *et al.*, 2020) |
| *Withania somnifera* | Isopellletierine, Anaferine,Withanolides, Withaferins, Sitoindosides, etc. | (Sharifi-Rad *et al.*, 2021) |
| *Ocimum sanctum* | Oleanolic acid, Rosemarinic acid, Ursolic acid, Eugenol,Linalool,Carvacrol, B-elemene, B-carophyllene, Germacrene, etc. | (Panchal *et al.*, 2019) |
| *Emblica officinalis* | Gallic acid, Ellagic acid, Chebulinic acid, Quercitin, Apigenin, Corilagin, Methyl gallate, Luteolin, Isostrictinin, etc. | (Variya *et al.*, 2016) |
| *Alternanthera sessilis* | α-spinasterol, β-spinasterol, stigmasterol, β-sitosterol, Oleanotic acid, etc. | (Hwong *et al.*, 2022) |
| *Clerodendrum infortunatum* | Clerodolone, Clerodone, Clerodol Phenols, Steroids, Flavonoids, Terpenes, Volatile oils, etc. | (Kekuda *et al.*, 2019) |
| *Argyreia nervosa* | Ergine, Ergometrine , Lysergol , Lysergic acid,Elymoclavine, Chanoclavine, etc. | (Paulke *et al.*, 2014) |
| *Moringa oleifera* | Gallic acid, Cholorogenic acid, Luteolin, Epicatechin, Quercetin, Caffeic acid, etc. | (Ma *et al.*, 2020) |
| *Chenopodium album* | Different bioactive compounds found in *C. album* are phenolics, flavonoids, tannins, betalains, anthocyanins carotenoids, sterols, and glucosinolate Different bioactive compounds found in *C. album* are phenolics, flavonoids, tannins, betalains, anthocyanins carotenoids, sterols, and glucosinolate phenolics, flavonoids, tannins, betalains, anthocyanins carotenoids, sterols, and glucosinolates β-carotene, xanthotoxin, stigmasterol, n-triacontanol, gallocatechin, catechin, p-coumaric acid, ferulic acid, β-sitosterol, and campesterol | (Chamkhi *et al.*, 2022) |

## 7. Conclusion

The cause of many neurodegenerative diseases is still a mystery. The use of herbal medicine has gained a lot of interest for their prophylactic therapeutic potential for many decades. The current review substantially elucidates the important role of medicinal plants in the various neurological disorders. Most of the identified plants have been scientifically confirmed to possess promising neuro- and psychopharmacological properties and, after further studies, may serve as templates for future drug development. The identified medicinal plants are a potential source of a novel class of drugs for the management of mental and neurological disorders. The bulk of the plant species that have been studied for their pharmacologic effects on the central nervous system (CNS) have been shown to have analgesic, anxiolytic, or anticonvulsant qualities. As previously stated, the etiology of several neurodegenerative illnesses is yet unknown. The neurodegenerative disorders such as Alzheimer's disease, Parkinson's disease, anxiety, depression, etc. and others share common features at cellular and subcellular levels as well as sharing mostly common molecular signaling pathways that may lead to apoptosis, necroptosis, and inflammation.

## 8. Future Prospects

In the future, the use of phytochemicals may be a promising approach for neurodegenerative disorders due to their anti-inflammatory, anti-oxidative, and anti-cholinesterase activities. In general, using herbal medicine offers prospective alternatives for existing neurodegenerative disease treatments. To fully comprehend the molecular processes behind their neuroprotective properties, more research is necessary in the future. This review is an attempt to compile major plants of considerable interest for future researchers working in the field of mental health management through natural resources.

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## Authorship Contribution

Swetza Singh (SS): Data collection & compilation, critical analysis of collected data, manuscript preparation, proofreading of galley proof, approval of final proof.

Rajiv Gupta (RG): Conceptualization of the manuscript and title, Overall supervision and guidance, proof reading, corrections and editing in proof copy, approval of final proof.

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## Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of the article.

## Declaration

It is an original article and has neither been sent elsewhere nor communicated or published anywhere else.

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