Review Article

Review on Medicinal Plants Evaluated for Antipsychotic Activity

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ABSTRACT

Schizophrenia and other psychotic diseases are serious mental illnesses marked by delusions, hallucinations, disordered thinking, and cognitive impairment. Despite the effectiveness of standard antipsychotic medications, long-term usage is frequently linked to side effects such drowsiness, metabolic problems, and extrapyramidal symptoms. As a result, medicinal plants are gaining attention as possible sources of safer and more powerful antipsychotic drugs. By altering dopaminergic, serotonergic, glutamatergic, antioxidant, and anti-inflammatory pathways, a variety of herbal extracts and phytoconstituents have shown antipsychotic-like action in experimental animal models. This review offers a current summary of medicinal plants that have been tested for antipsychotic-like activity using a variety of preclinical models, including conditioned avoidance response tests, stereotypy induced by amphetamine and apomorphine, and behavioral changes induced by ketamine. Numerous therapeutic herbs have shown encouraging neuropharmacological properties, bolstering their historical application in treating mental health conditions. Alkaloids, flavonoids, terpenoids, saponins, and polyphenolic chemicals are the bioactive phytoconstituents that cause these effects. They may do so via modifying the GABAergic, glutamatergic, dopaminergic, and serotonergic neurotransmitter systems. The study also covers potential mechanisms that may underlie antipsychotic-like effects, including neuroprotective properties, antioxidant activity, dopamine D2 receptor antagonism, and anti-inflammatory pathways. Despite promising results, their medicinal translation is limited by issues such low absorption, variability in plant extracts, lack of clinical validation, and inadequate toxicity profile. All things considered, medicinal plants provide a potentially useful supplementary strategy for the creation of new antipsychotic drugs.

Keywords: Psychosis; Schizophrenia; Antipsychotic Activity; Medicinal Plants; Neuroprotection; Phytoconstituents.

INTRODUCTION

A mental illness known as psychosis is typified by a distorted sense of reality. Millions of people worldwide suffer from schizophrenia. Conventional medications have adverse effects yet work by antagonistically affecting dopamine. A distorted perspective of reality is the hallmark of psychosis, a severe mental illness that frequently presents as hallucinations, delusions, disordered speech, impaired cognition, and aberrant behavior. The most common and long-lasting type of psychotic condition, schizophrenia profoundly affects a person's ability to think, feel, and interact with others. Psychotic symptoms are mostly caused by dysregulation of important neurotransmitter systems, namely dopamine hyperactivity in the mesolimbic pathway, as well as changes in the serotonin, glutamate, and GABA systems. The cornerstone of therapy is conventional antipsychotic medications, which are divided into typical and atypical agents.[1]

Alternative and complementary therapy techniques are becoming more popular as a result of these difficulties. Many medical systems have long employed medicinal plants to treat neurological and mental illnesses. The neuropharmacological potential of these plants is progressively being validated by contemporary scientific investigation. Many phytoconstituents, including alkaloids, flavonoids, terpenoids, saponins, and phenolic compounds, have shown promising effects on the central nervous system by modulating neurotransmitter pathways, reducing oxidative stress, and having anti-inflammatory and neuroprotective qualities. Therefore, investigating therapeutic plants with antipsychotic potential is a viable strategy for creating therapeutic medicines that are safer, more effective, and better tolerated. Future medication development for psychotic diseases may greatly benefit from the methodical evaluation and scientific confirmation of these botanicals. Therapeutic plants are widely used in traditional medicine and show neuroprotective and antipsychotic potential.[2]

PATHOPHYSIOLOGY OF PSYCHOSIS:

1) Dopamine hypothesis: The dopamine hypothesis is one of the most widely accepted explanations for the development of psychosis, particularly in schizophrenia. It suggests that psychotic symptoms arise from an imbalance in dopaminergic neurotransmission within specific brain pathways.

Key Mechanisms: a) Mesolimbic Pathway Hyperactivity: Positive psychotic symptoms are linked to excessive dopamine activity in the mesolimbic pathway, which runs from the ventral tegmental region to the nucleus accumbens such as:

- Hallucinations
- Delusions
- Disorganized thinking
- Agitation

b) Mesocortical Pathway Hypoactivity: Reduced dopamine transmission in the mesocortical pathway (projecting to the

prefrontal cortex) contributes to negative and cognitive symptoms, including:

- Social withdrawal
- Lack of motivation (avolition)
- Flattened affect
- Impaired attention and memory

Evidence Supporting the Hypothesis: Dopamine-releasing drugs such as amphetamine can induce psychosis-like symptoms. The majority of antipsychotic medications work by inhibiting dopamine D_2 receptors. Neuroimaging studies have demonstrated increased dopamine synthesis and release in patients experiencing psychosis.[3]

2) Serotonin Hypothesis: The serotonin hypothesis proposes that abnormalities in serotonergic neurotransmission contribute to the development of psychosis. Psychotic symptoms are believed to be primarily caused by overactivation of 5-HT_2A (serotonin) receptors in the brain.

Key Mechanisms: a) Increased 5-HT_2A Receptor Activity: Excessive stimulation of 5-HT_2A receptors in the cerebral cortex can alter perception, cognition, and mood, leading to:

- Hallucinations
- Delusions
- Distorted sensory experiences

b) Interaction with Dopamine:

- Serotonin modulates dopamine release in several brain regions.
- Dysregulated serotonin signaling can indirectly affect dopaminergic pathways, contributing to psychotic symptoms.

Evidence Supporting the Hypothesis: Hallucinogenic drugs such as Lysergic acid diethylamide (LSD) act primarily through 5-HT_2A receptor activation and can produce psychosis-like effects. Many atypical antipsychotics, such as Clozapine and Risperidone, block both dopamine D_2 and serotonin 5-HT_2A receptors, improving psychotic symptoms.

3) Glutamate hypothesis: According to the glutamate hypothesis, psychosis is caused by decreased glutamatergic neurotransmission, namely through hypofunction of the N-methyl-D-aspartate (NMDA) receptor. The primary excitatory neurotransmitter in the brain, glutamate is essential for memory, learning, cognition, and neural communication.

Key Mechanisms: a) NMDA Receptor Hypofunction:

- Decreased activity of NMDA receptors impairs normal excitatory neurotransmission and disrupts neural circuits involved in cognition and perception.
- This dysfunction contributes to cognitive, +ve and -ve symptoms of psychosis.

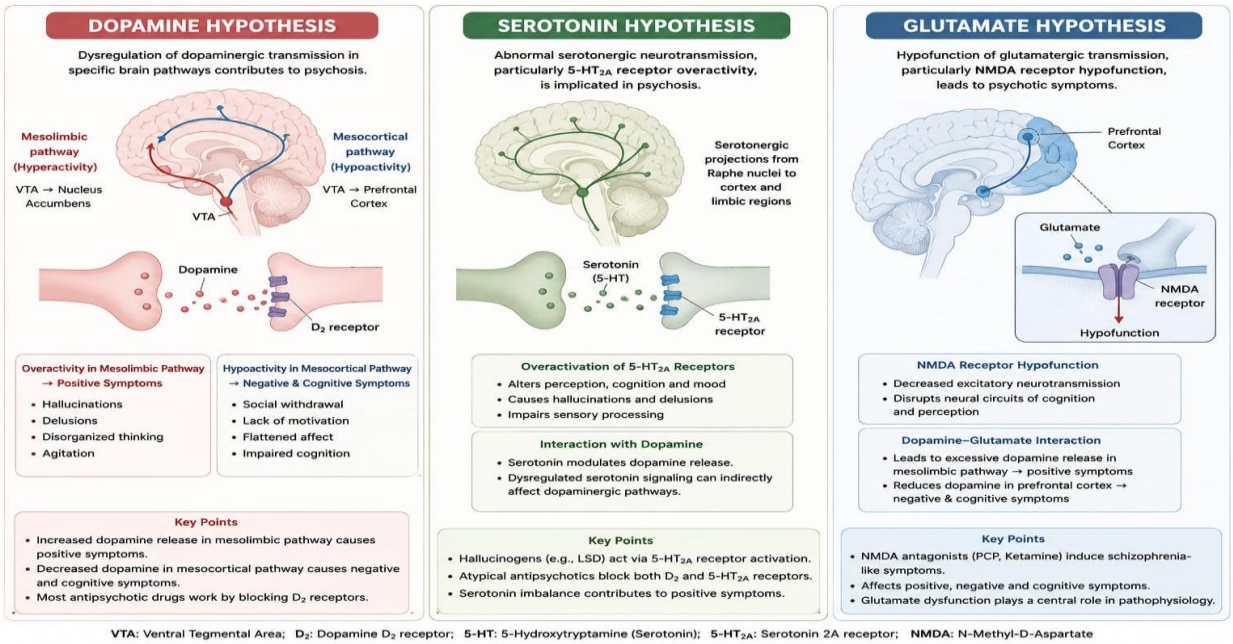
b) Dopamine–Glutamate Interaction:

Positive symptoms like delusions and hallucinations might result from excessive dopamine release in the mesolimbic pathway caused by NMDA receptor hypofunction.

Additionally, it could lessen prefrontal brain dopamine activation, which would exacerbate negative and cognitive symptoms.

Evidence Supporting the Hypothesis: In healthy people, NMDA receptor antagonists like ketamine and phencyclidine (PCP) can cause symptoms similar to those of schizophrenia. These medications cause cognitive, negative, and positive symptoms that are quite similar to those seen in psychotic illnesses.[4]

Table 1: Pathophysiology of Psychosis



VTA: Ventral Tegmental Area; D_2: Dopamine D_2 receptor; 5-HT: 5-Hydroxytryptamine (Serotonin); 5-HT_{2A}: Serotonin 2A receptor; NMDA: N-Methyl-D-Aspartate

ANIMAL MODELS:

1) Amphetamine-induced stereotypy: An experimental animal paradigm for assessing antipsychotic efficacy is the amphetamine-induced stereotypy model. Amphetamine causes excessive dopaminergic activity in the brain, particularly in the mesolimbic pathway, by increasing dopamine release and blocking dopamine absorption. This leads to stereotyped actions in rats that mirror signs of psychosis, such as biting, licking, sniffing, and hyperlocomotion. Before amphetamine, test medications are given to see whether they can lessen these behaviors. A reduction in stereotypy suggests possible antipsychotic action, mostly via antagonistic interactions with dopamine receptors.

2) Apomorphine-Induced Climbing Model: An animal test that is frequently used to screen for antipsychotic action is the apomorphine-induced climbing model. A dopamine D2 receptor agonist called apomorphine enhances dopaminergic activation in the brain, causing mice to exhibit stereotyped behaviors as climbing, sniffing, and repetitive motions.

In this scenario, apomorphine-treated mice exhibit noticeable climbing activity as a result of mesolimbic dopamine system activation. Before administering apomorphine, test substances are administered to see whether they can lessen these behaviors. Potential antipsychotic (dopamine receptor blocking) activity is indicated by a decrease in climbing activity. For comparison, common medications such as haloperidol are utilized. Although it primarily reflects dopaminergic pathways and does not fully account for the complexity of schizophrenia, this model is straightforward, sensitive, and frequently used for assessing dopamine-related antipsychotic effects.[5]

3) Catalepsy test: A popular experimental animal model for assessing the extrapyramidal side effects (EPS) of antipsychotic medications and identifying substances with possible antiparkinsonian or antipsychotic action is catalepsy. Muscular stiffness and the prolonged maintaining of an enforced position are hallmarks of catalepsy. It mimics the motor abnormalities seen in Parkinsonism and neuroleptic-induced EPS and is mostly caused by dopamine D_2 receptor blockage in the nigrostriatal pathway. A popular antipsychotic medication, is frequently used to induce catalepsy in rats. The bar test, which involves placing the animal's forepaws on a horizontal bar raised above the ground and timing how long it takes to correct the forced posture, is typically used to gauge the severity of catalepsy.

Greater cataleptic behavior is indicated by longer periods of immobility. Due to its dependability and ease of use, the horizontal bar test is the most popular technique. This model is useful for evaluating the potential of new medications or extracts from medicinal plants to enhance dopaminergic neurotransmission and lessen extrapyramidal symptoms. Reduced haloperidol-induced catalepsy may indicate antiparkinsonian action or a decreased likelihood of motor side effects. The model is still a crucial tool in neuropsychopharmacology research and has been widely used in preclinical pharmacological investigations.[6]

Table 2: Animal Models

Amphetamine Induced Stereotypy Model	Apomorphine Induced Climbing Model	Catalepsy Model
		
Observation: Repetitive, purposeless behaviors such as oral movements, head bobbing, and sniffing. **Induction:** Amphetamine (5 mg/kg, i.p.) **Use:** Screening for antipsychotic activity and dopaminergic modulation.	**Observation:** Increase in climbing behavior on walls of the cage. **Induction:** Apomorphine (0.2 mg/kg, s.c.) **Use:** Assessment of dopaminergic supersensitivity and efficacy of antipsychotic agents.	**Observation:** Maintenance of imposed posture for an extended period. **Induction:** Haloperidol (1 mg/kg, i.p.) **Use:** Evaluation of extrapyramidal side effects of antipsychotic drugs.

MEDICINAL PLANTS:

1) *Murraya koenigii* (L.):-

Family: Rutaceae

Common Name: kadipatta

Figure 1: *Murraya koenigii* tree

Plant Description:

India and other tropical parts of Asia are home to the little, fragrant *Murraya koenigii* tree. The plant has pinnate leaves with a distinct scent and can reach a height of 4 to 6 meters. Its leaves have historically been employed in traditional medicine for a variety of medicinal uses and are also used as a culinary spice.

Phytochemical Constituents:

Flavonoids, terpenoids, phenolic compounds, essential oils, and carbazole alkaloids (mahanimbine, girinimbine, and koenimbine) are among the many bioactive substances found in the plant. These components are in charge of its various pharmacological actions.

Pharmacological Activities:

Antioxidant, anti-inflammatory, antibacterial, antidiabetic, neuroprotective, hepatoprotective, and antiulcer effects are all demonstrated by *Murraya koenigii*. The plant's powerful antioxidant capacity may aid in preventing oxidative damage to brain cells.

Relevance to Antipsychotic Activity:

Murraya koenigii extracts may have positive benefits on the central nervous system, according to recent experimental research. Its antioxidant and neuroprotective qualities are thought to regulate neurotransmitter imbalance and lessen oxidative stress linked to psychotic illnesses. These results suggest that it may be a natural source for the creation of new antipsychotic drugs, but further clinical and mechanistic research is needed to confirm its safety and effectiveness.[7]

2) *Psidium guajava* L.:-

Family: Myrtaceae (myrtle family)

Common Name: Peru

Plant Description:

Small evergreen trees or shrubs like Psidium guajava are frequently grown in tropical and subtropical climates. The plant has white flowers, tasty fruits, oval leaves, and smooth bark. Traditional medicine has made considerable use of the plant's many components, especially its leaves and fruits, to treat a wide range of illnesses.

Figure 2: *Psidium guajava* L.

Phytochemical Constituents:

Numerous bioactive substances, such as flavonoids, tannins, triterpenoids, saponins, carotenoids, and phenolic acids. Quercetin, guaijaverin, and other polyphenolic compounds contribute significantly to its pharmacological properties.

Pharmacological Activities:

Psidium guajava has hepatoprotective, neuroprotective, antibacterial, anti-inflammatory, antidiabetic, and antioxidant properties. The plant can scavenge free radicals and lessen oxidative stress because of its abundance of phenolic chemicals.

Relevance to Antipsychotic Activity:

Psidium guajava's antioxidant and neuroprotective properties have drawn interest in neuropsychiatric studies. The pathogenesis of psychotic illnesses is thought to be significantly influenced by oxidative stress and neuroinflammation. Psidium guajava may provide beneficial effects in the treatment of psychosis by lowering oxidative damage and modifying brain activity. However, further preclinical and clinical research is required to validate its antipsychotic potential and clarify its underlying processes.[8]

3) *Bacopa monnieri* (L.) Wettst. :-

Family: Plantaginaceae

Common Name: Brahmi

Figure 3: *Bacopa monnieri*

Plant Description:

Bacopa monnieri is a perennial creeping herb commonly found in wetlands and marshy areas throughout India and other tropical regions. It has succulent leaves, small white to

pale purple flowers, and is widely recognized in traditional Ayurvedic medicine as a brain tonic and cognitive enhancer.

Phytochemical Constituents:

Bacosides (bacoside A and B), alkaloids, flavonoids, saponins, sterols, and phenolic compounds are among the plant's bioactive substances. Bacosides are considered the principal constituents responsible for its neuropharmacological effects.

Pharmacological Activities:

Bacopa monnieri exhibits antioxidant, anti-inflammatory, neuroprotective, anxiolytic, antidepressant, anticonvulsant, and memory-enhancing activities. It has been reported to improve cognitive performance and shield brain cells from harm caused by oxidative stress.

Relevance to Antipsychotic Activity:

Experimental studies suggest that *Bacopa monnieri* may influence neurotransmitter systems involved in psychiatric disorders, including dopaminergic, serotonergic, and cholinergic pathways. Its antioxidant and neuroprotective properties may help attenuate neuronal dysfunction associated with psychosis. Furthermore, the plant has demonstrated beneficial effects in behavioral models related to schizophrenia and cognitive impairment, indicating its promise as an additional treatment tool for psychotic conditions. However, more research is needed to confirm its antipsychotic effectiveness and elucidate its mechanisms of action.[9]

4) *Alstonia scholaris* (L.) :-

Family: Apocynaceae

Common Name: Devil, Saptaparni

Figure 4: *Alstonia scholaris*

Plant Description:

Alstonia scholaris is a large evergreen tree widely distributed in India, Southeast Asia, and other tropical regions. The tree is characterized by its whorled leaves, fragrant greenish-white flowers, and milky latex. Indigenous medical systems have long utilized the plant's bark and leaves, among other elements, to treat neurological, gastrointestinal, and respiratory conditions.

Phytochemical Constituents:

Indole alkaloids, such as echitamine, scholaricine, alstonine, and picrinine, are abundant in the plant. Additionally, it includes phenolic chemicals, tannins, triterpenoids, and flavonoids, all of which support its pharmacological actions.

Pharmacological Activities:

According to reports, *Alstonia scholaris* contains anti-inflammatory, antioxidant, antibacterial, antipyretic, analgesic, immunomodulatory, and neuroprotective qualities. Its makeup, which is rich in alkaloids, is primarily responsible for these functions.

Relevance to Antipsychotic Activity:

Alstonine is one of its bioactive components that has drawn interest due to its possible antipsychotic properties. Alstonine can alter serotonergic and dopaminergic neurotransmission, resulting in behavioral effects similar to those of atypical antipsychotic drugs, according to preclinical research. Furthermore, the plant's antioxidant properties may lessen oxidative stress linked to mental illnesses. Although more clinical research is required to validate its therapeutic potential, these results indicate that Alstonia scholaris is a viable source of natural chemicals for the development of new antipsychotic treatments.[10]

5) *Morinda citrifolia* L:-

Family: Rubiaceae

Common Name: cheese fruit

Figure 5: *Morinda citrifolia L*

Plant Description:

Small evergreen trees and shrubs like *Morinda citrifolia* are found across tropical climates, including Southeast Asia, the Pacific Islands, and India. Large, glossy leaves, white tubular flowers, and a characteristic ovoid, segmented fruit with a strong smell are all produced by this plant. Folk medicine systems have long employed a variety of plant parts, including the fruit, leaves, and roots.

Phytochemical Constituents:

Numerous bioactive substances are present in the plant, including (such as deacetylasperulosidic acid), anthraquinones (e.g., damnacanthal), flavonoids, phenolic acids, lignans, and polysaccharides. These constituents are responsible for its broad pharmacological profile.

Pharmacological Activities: Antioxidant, anti-inflammatory, immunomodulatory, analgesic, antibacterial, antidiabetic, and hepatoprotective properties have all been identified for *Morinda citrifolia*. Its strong free-radical scavenging potential contributes significantly to its protective effects on biological systems.

Relevance to Antipsychotic Activity: The neuroprotective and antioxidant properties of *Morinda citrifolia* have attracted interest in neuropsychiatric research. Oxidative stress, neuroinflammation, and neurotransmitter dysregulation are key factors involved in psychotic disorders. Bioactive compounds present in the plant may help modulate neuronal signaling pathways and reduce oxidative neuronal damage, suggesting potential supportive effects in the management of psychosis. However, the majority of the information now available is preclinical, and further research is needed to confirm its antipsychotic effectiveness and underlying processes.[11]

6) *Withania somnifera* (L.) Dunal:-

Family: Solanaceae

Common Name: Ashwagandha

Figure 6: *Withania somnifera*

Plant Description:

The evergreen shrub *Withania somnifera* is found over areas of Africa, the Middle East, and India. The plant usually reaches a height of 30 to 150 cm and produces orange-red berries, little greenish-yellow blooms, and ovate leaves. In traditional Ayurvedic medicine, the roots are the most often employed medicinal component.

Phytochemical Constituents: Along with alkaloids, flavonoids, saponins, and glycosides, the plant also includes a class of steroidal lactones called withanolides, which include withaferin A and withanolide D. Its pharmacological effects are mostly caused by these bioactive substances.

Pharmacological Activities:

Numerous pharmacological effects, including as adaptogenic, anxiolytic, antidepressant, antioxidant, anti-inflammatory, neuroprotective, immunomodulatory, and anti-stress qualities, are displayed by *Withania somnifera*. Its capacity to enhance cognitive function and stress tolerance has been extensively researched.

Relevance to Antipsychotic Activity:

Withania somnifera may affect several neurotransmitter systems, such as the GABAergic, serotonergic, and dopaminergic pathways, according to preclinical research. Its anti-inflammatory and antioxidant qualities aid in lowering neuroinflammation and oxidative stress, both of which are linked to the pathophysiology of psychotic illnesses. Additionally, improvements in schizophrenia-related behavioral paradigms have been shown in experimental animal experiments, suggesting possible antipsychotic-like effects. To validate its effectiveness and safety in psychotic disorders, more study is necessary as there is currently little clinical data.[12]

7) *Centella asiatica* (L.):-

Family: Apiaceae

Common Name: Gotu kola

Figure 7: *Centella asiatica*

Plant Description:

A tiny, creeping perennial plant, Centella asiatica is often found in damp, tropical, and subtropical parts of Asia. The plant features tiny pink to white blooms, thin stolons, and kidney-shaped leaves. It is frequently used for wound healing and cognitive improvement in traditional medical systems including Ayurveda, Siddha, and Traditional Chinese Medicine.

Phytochemical Constituents:

Triterpenoid saponins, namely asiaticoside, madecassoside, asiatic acid, and madecassic acid, are found in the plant. It also contains flavonoids, phenolic compounds, sterols, and essential oils. These constituents are responsible for its neuroactive and protective properties.

Pharmacological Activities:

Centella asiatica exhibits antioxidant, anti-inflammatory, neuroprotective, anxiolytic, antidepressant, wound healing, and memory-enhancing activities. It is widely recognized for improving cognitive function and supporting neuronal regeneration.

Relevance to Antipsychotic Activity:

Experimental studies suggest that Centella asiatica may modulate neurotransmitter systems involved in psychosis, including dopaminergic and serotonergic pathwaysIts potent anti-inflammatory and antioxidant properties aid in

lowering oxidative stress and neuroinflammation, which are linked to schizophrenia and associated conditions. Its potential use as an adjuvant in the treatment of psychotic diseases is supported by preclinical behavioral studies that show protective benefits against cognitive and behavioral deficits.[13]

MECHANISM OF ACTION OF MEDICINAL PLANTS IN ANTIPSYCHOTIC ACTIVITY IN PSYCHOSIS:

1. Modulation of Dopaminergic Pathway: According to the dopamine theory of schizophrenia, the mesolimbic pathway's dopamine D2 receptors are hyperactive. Alkaloids, flavonoids, and terpenoids found in many medicinal plants help restore normal dopamine levels or prevent D2 receptor hyperactivity. Positive symptoms like delusions and hallucinations decrease as a result.

2. Regulation of Serotonergic System: Psychosis is also linked to an imbalance in serotonin (5-HT2A receptors). As serotonin receptor modulators, a number of phytoconstituents enhance mood, perception, and cognitive processes. The way atypical antipsychotic medications work is comparable to this serotonergic stabilization.

3. Influence on Glutamatergic and GABAergic Systems: Cognitive and negative symptoms of schizophrenia are associated with glutamate excitotoxicity and NMDA receptor hypofunction. Medicinal herbs may control glutamate release or increase NMDA receptor activation. Numerous herbal substances also improve GABAergic transmission, which has relaxing and anxiolytic effects.[14]

4. Antioxidant Mechanism: Oxidative stress is a primary cause of neuronal damage in psychosis. Plant-based flavonoids, phenols, and saponins protect neurons by scavenging free radicals and increasing endogenous antioxidant enzymes like superoxide dismutase and catalase.

5. Anti-inflammatory Action: In schizophrenia, neuroinflammation with increased cytokines (IL-6, TNF-α) is frequently seen. Medicinal herbs reduce neuroinflammatory damage by reducing inflammatory mediators and preventing microglial activation.

6. Neuroprotective and Synaptic Modulation: Numerous phytochemicals support neurogenesis, synaptic plasticity, and neuronal survival. This lessens the unpleasant symptoms and cognitive impairments linked to psychosis.[15]

ADVANTAGES OF MEDICINAL PLANTS USED FOR ANTIPSYCHOTIC ACTIVITY:

1. **Multitarget Pharmacological Action:** Plant-derived compounds often act on multiple biological pathways simultaneously, including dopaminergic, serotonergic, glutamatergic, and GABAergic systems. This multitarget profile is particularly beneficial in complex disorders like psychosis, where multiple neurotransmitter imbalances are involved.

2**. Reduced Adverse Effects:** Compared to conventional antipsychotic drugs, many medicinal plants are associated with fewer and milder side effects. This improves patient compliance, especially in long-term therapy where extrapyramidal symptoms, weight gain, and metabolic disturbances are common concerns with synthetic drugs.

3. **Antioxidant and Neuroprotective Properties:** Many medicinal plants include polyphenols, flavonoids, and alkaloids that have strong antioxidant action. These compounds help reduce oxidative stress and neuronal damage, which are becoming recognized as important factors in the pathophysiology of schizophrenia.[16]

4**. Anti-inflammatory Effects:** The onset and development of psychotic illnesses are significantly influenced by neuroinflammation. Many plant-based substances have anti-inflammatory qualities that may help control cytokine levels and lessen inflammatory reactions in the brain.

5. **Natural Availability and Cost-Effectiveness:** Medicinal plants are widely available in nature and can be cultivated at relatively low cost. Because of this, they are a more cost-effective treatment alternative, especially in underdeveloped nations where access to contemporary psychiatric drugs may be restricted.

6. **Potential for Drug Development:** Bioactive compounds isolated from medicinal plants serve as lead molecules for the development of new antipsychotic drugs. They provide a valuable resource for discovering novel mechanisms of action and safer therapeutic alternatives.[17]

LIMITATIONS:

Although medicinal plants show promise in treating psychosis, their extensive therapeutic use is currently limited by a number of issues. A major barrier is the lack of sufficient scientific validation and closely watched clinical trials to confirm their efficacy, safety, and consistent dosage in humans. Most currently available research is limited to in vitro or animal models, which may not accurately reflect human reactions. The variation in the chemical makeup of plant extracts brought about by variations in geographic location, harvesting circumstances, and extraction techniques, which results in uneven pharmacological effects, is another important problem.[18]

Furthermore, it is challenging to link the actions of many medicinal plants with certain neurotransmitter systems implicated in psychosis since their precise mode of action is still unknown. Their low capacity to cross the BBB and poor bioavailability further lessen their therapeutic efficacy.[19] When used with traditional antipsychotic drugs, there is also a chance of herb-drug interactions, which might have unexpected consequences. Standardization, quality assurance, and regulatory clearance of herbal medications continue to be significant obstacles. Their therapeutic adoption is further limited by financial and large-scale production limitations as well as a lack of knowledge among medical experts. Therefore, in order to properly establish medicinal plants as dependable antipsychotic medicines,

more thorough study and technical developments are needed.[20]

FUTURE SCOPE:

1) The creation of innovative antipsychotic medications derived from plants that are safer and have fewer adverse effects than synthetic ones.
2) Advanced phytochemical characterization and isolation to pinpoint the active ingredients causing antipsychotic actions.
3) Using medication delivery methods based on nanotechnology to improve plant extract bioavailability and brain targeting.
4) Using in silico research (molecular docking and simulation) to comprehend receptor interactions (glutamate, serotonin, and dopamine pathways).
5) Using proven animal models of psychosis in more carefully planned preclinical research to verify effectiveness.
6) Encouragement of clinical studies on herbal products to determine human safety, dose, and medicinal efficacy.
7) Examining how plant extracts and traditional antipsychotic medications can work together to lower dose requirements and adverse effects.
8) Standardizing herbal extracts to guarantee constant potency, purity, and repeatability in studies and treatments.
9) Enhancing the synthesis of bioactive chemicals in medicinal plants by genetic engineering and biotechnology.
10) The creation of polyherbal remedies that target many neurotransmitter systems implicated in psychosis.[21]

CONCLUSION

Several medicinal plants, such as *Murraya koenigii*, B*acopa monnieri, Alstonia scholaris, Withania somnifera, Centella asiatica, Morinda citrifolia*, and Panax ginseng, have important neuropharmacological characteristics that may contribute to antipsychotic-like effects, according to the evidence reviewed in this paper. Their many phytoconstituents, including alkaloids, flavonoids, terpenoids, saponins, and phenolic chemicals, are mostly responsible for these effects. Dopaminergic, serotonergic, glutamatergic, and GABAergic neurotransmission modulation, as well as antioxidant, anti-inflammatory, and neuroprotective effects, seem to be some of the processes behind these plants' antipsychotic potential. Compared to traditional antipsychotic medications, these multitarget effects may be advantageous, especially when it comes to treating the intricate pathophysiology of psychosis and perhaps minimizing side effects.

The translation of these herbal remedies into clinical practice is still restricted despite promising results from experimental investigations because of a lack of human trials, a lack of standardization, variations in phytochemical composition, and an inadequate comprehension of their mechanisms of action. Thus, it is crucial to do further research on the separation of bioactive compounds, pharmacological validation, toxicity evaluation, and carefully planned clinical trials. In conclusion, medicinal plants have a lot of potential as supplemental or alternative methods for treating psychosis and might help create safer, more efficient, and more reasonably priced antipsychotic treatments in the future. To fully grasp their therapeutic potential and develop evidence-based applications in psychiatric healthcare, more scientific research is essential.

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