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## A REVIEW ON HERBAL PLANTS SHOWING ANTIDEPRESSANT ACTIVITY

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### ABSTRACT

Depression is a heterogenous mood disorder that has been classified and treated in variety of ways. Although a number of synthetic drugs are being used as standard treatment for clinically depressed patient, they have adverse effects that can compromise the therapeutic treatment. Thus, it is worthwhile to look for antidepressant from plants with proven advantage and favorable benefit to risk ratio. A number of medicinal plants and medicine derived from these plants have shown antidepressant properties by virtue of combined effect of their medicinal constituents. The causes of depression are decreased brain levels of monoamines like noradrenaline, dopamine and serotonin. Therefore, drugs restoring the reduced levels of these monoamines in the brain either by inhibiting monoamine oxidase or by inhibiting reuptake of these neurotransmitters might be fruitful in the treatment of depression. The present review is focused on the medicinal plants and plants based formulations having antidepressant activity in animal studies and in humans.

#### Keywords:

Depression,  
Medicinal plants,  
Antidepressants,  
Herbal medicine

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**INTRODUCTION:** According to world health report, about 450 million people suffer from a mental or behavioral disorder<sup>1</sup>. By the year 2020, depression is expected to constitute the second largest source of global burden of disease after heart disease<sup>2</sup>. Depression is whole body illness which involves not only mood or emotion but also the physical body and thought process. The symptoms of depression are intense feelings of sadness, hopelessness, and despair, as well as the inability to experience pleasure in usual activities, changes in sleep patterns and appetite, loss of energy, and suicidal thoughts<sup>3</sup>.

There are two types of mental depression, namely unipolar depression, in which mood swings are always in the same direction and is common (about 75% of cases) non familial, clearly associated with stressful life events and accompanied by symptoms of anxiety and agitation. The second type is bipolar depression (about 25% of cases) sometimes also called as endogenous depression, shows a familiar pattern,

unrelated to external stresses and usually appears in early adult life, results in oscillating depression and mania over a period of a few weeks<sup>4</sup>. Patients with depression have symptoms that reflect decrease in brain monoamine neurotransmitters, specifically norepinephrine, serotonin and dopamine. 500,000/year is diagnosed as suffering from depression.

Although a number of synthetic drugs are being used as the standard treatment for clinically depressed patients, they have adverse effects that can compromise the therapeutic treatment, these common adverse effect include dry mouth, fatigue, gastrointestinal or respiratory problems, anxiety, agitation, drowsiness, and cardiac arrhythmias. Several drug-drug interactions can also occur. These conditions create an opportunity for alternative treatment of depression by used of medicinal plant<sup>5</sup>. **Table 1** summarizes the various medicinal plants used for there anti-depressant activity.

TABLE 1: MEDICINAL PLANTS AS ANTI- DEPRESSANTS:

Plant Herbal	Common Name	Part Used	Uses	Reference
<i>Glycyrrhiza uralensis</i>	Mulethi	Root	Anti-Inflammatory, Antithrombotic, Antiviral And Antiulcer	6
<i>Lafoensia pacari</i>	Didal	Leaves	Antibacterial, Anti-Inflammatory, Analgesic, Antioedematous, Antinociceptive	7
<i>Siphocampylus verticillatus</i>	Siphocampylus	Aerial Parts	Arthritis	8
<i>Schinus molle</i> L	Peruvian Pepper Tree	Leaves	Antioxidant, Anticancer Activity	9
<i>Tabebuia Avellaneda</i>	Lapacho, Taheboo Tree	Bark	Antitumor, Anti inflammatory, Anti-bacterial, Antifungal	10
<i>Curcumalonga</i>	Turmeric	Rhizome	Antiseptic, Alzheimer's Disease, Cancer, Arthritis	11
<i>Bupleurum falcatum</i>	Chai Hu, Hare's ear root	Root	Anti-Inflammatory, Antitussive	12
<i>Piper laetispicum</i>	Piper	Stem And Root	Antinociceptive Activity; Analgesic, Insecticidal, Anti-Inflammatory,	13
<i>Allium macrostemon</i>	Chinese Garlic	Bulb	Immunomodulatory, Antitumor	14
<i>Hypericum reflexum</i> L.	Hypericum	Aerial Part	Analgesic, Anti-Inflammatory, Antimicrobial	15
<i>Mitragyna speciosa</i>	Kratom	Leave	Diabetes And Improve Blood Circulation	16
<i>Hypericum canariense</i> L. and <i>Hypericum glandulosum</i>	Canary Island St .john wort	Aerial Part	Antimicrobial, Antioxidant, Sedative, Diuretic, Wound Healing,	17
<i>Piper tuberculatum</i>	Black pepper	Fruit	Anxiolytic, Antimicrobial	18
<i>Rosmarinus officinalis</i>	Rosemary	Fresh Juice	Antioxidant, Healing Activity, Alzheimer's Disease	19
<i>Salvia elegans</i>	Pineapple sage	Leave	Anxiety	20
<i>Asparagus Racemosus</i>	Satavari	Root	Adaptogenic Activity, Diabetes	21
<i>Polygala sabulosa</i>	Polygala	Aerial Part	Antinociceptive, Anxiolytic , Anti- convulsant	22
<i>Berberis aristata</i>	Indian Barberry	Root	Antihyperglycaemic And Antioxidant	23
Magnolia bark And Ginger rhizome	Magnolia, Ginger	Bark, Rhizome	Anti-Stress, Anti-Allergic, Anti-Inflammatory	24
<i>Valeriana officinalis</i>	Valerian	Root	Anxiolytic Effect	25
<i>Marsilea minuta</i>	Dwarf Water clover	Root	Anxiolytic Effect	26
<i>Aloysia polystachya</i>	Lemon Verbena	Aerial part	Anxiolytic Effect	27
<i>Tagetes lucida</i>	Marigolds	Aerial part	Antibacterial, Antifungal Activity	28
<i>Emblica Officinalis</i>	Amla	Fruit	Antimicrobial	29
<i>Bacoba monnieri</i>	Brahmi	Aerial Part	Memory Enhancer	30
<i>Clitoria ternatea</i>	Butterfly Pea	Root ,Bark	Anxiolytic, Anticonvulsant Nootropic	31
<i>Cimicifuga racemosa</i>	Black Bugbane	Roots And Rhizomes	Analgesic, Sedative, And Anti-Inflammatory	32
<i>Crocus sativus</i>	Saffron	stigma	Antitussive, Antispasmodic, Carminative, Stomachic	33
<i>Ginkgo biloba</i>	Ginkgo, Maidenhair Tree	Leaves	Memory Enhancer, Dementia	34
<i>Oscimum sanctum</i>	Tulsi	Aerial Part	Anti-Oxidant, Anti Cancer	35
<i>Withania somnifera</i>	Ashwagandha	Aerial Part	Anti-Stress, Immunomodulator	36
<i>Rhazya stricta</i>	White Henna	Leaves	Anti-Fungal Activity, Anti-Oxidant	37
<i>Tinospora cardifolia</i>	Guduchi	Whole Part	Anti-Oxidant, Anti-Neoplastic, Anti-Diabetic	38
<i>Kaempferia parviflora</i>	Kava kava	Kava Root/Rhizome	Antiallergic	39
<i>Momordica charantia</i>	Bitter Gourd / Bitter Melon	Fruit	Antihelmintic, Antimalarial	40
<i>Sphaeranthus Indicus</i>	East Indian Globe Thistle	Whole part	Anti-Diabetic, Gout	41
<i>Hippeastrum vittatum</i>	Amaryllis	flower	Anxiolytic, anti-convulsant	42
<i>Glycyrrhiza glabra</i>	Mulethi	Root	Antimicrobial	43
<i>Valeriana wallichii</i>	Indian Valeriana	Root bark	Anti-spasmodic, stimulant, carminative, antiseptic	44
<i>Paeonia lactiflora</i> Pall	Garden peony	Root	Anti-spasmodic	45
<i>Morinda officinalis</i>	Indian mulberry	Root	Antihypertensive, Laxative	46
<i>Mimosa pudica</i>	Sensitive Plant	Leave	Leucoderma, Ulcers, Dysentery, Inflammations, Jaundice, Asthma	47
<i>Allium sativum</i>	Garlic	Rhizome	Antihypertensive	48
<i>Apocynum venetum</i>	Dogbane	Aerial part	Cardiotonic, diuretic	49
<i>Areca Catechu</i>	Betel nut	fruit	Anemia, Schizophrenia	50

**Medicinal plants as anti- depressants:** The plants proved to possess antidepressant property are:

***Glycyrrhiza uralensis*:** Many flavonoids extracted from nature plants have been reported to exert antidepressant-like effect in animal studies. The present study was designed to observe the effects of liquiritin, a flavones compound derived from *Glycyrrhiza uralensis*, on the behaviors of chronic variable stress induced depression model rats and to explore the possible association between its antidepressant-like effect and antioxidative activity by measuring erythrocyte superoxide dismutase (SOD) activity and plasma malondialdehyde (MDA) level of the experimental animals<sup>6</sup>.

***Lafoensia-pacari*:** *Lafoensia pacari* A. St.-Hil. (Lythraceae) has been referred in Brazilian traditional medicine for the treatment of different diseases, among them depression. Nevertheless, there are not studies about this possible effect on the central nervous system (CNS)<sup>7</sup>.

***Siphocampylus verticillatus*:** The antidepressant-like effect of the hydroalcoholic extract obtained from aerial parts of *Siphocampylus verticillatus*, a Brazilian medicinal plant, was investigated in two models of depression in mice and against synaptosomal uptake of serotonin, noradrenaline and dopamine. The immobility times in the forced swimming test (FST) and in the tail suspension test (TST) were significantly reduced by the extract (dose range 100–1000 mg/kg, i.p.), without accompanying changes in ambulation when assessed in an open-field. Its action seems to involve an interaction with adrenergic, dopaminergic, glutamatergic and serotonergic systems<sup>8</sup>.

***Schinus molle* L.:** *Schinus molle* L. (Anacardiaceae), among other uses, is popularly employed for the treatment of depression. In this study, the antidepressant-like effect of the hexanic extract from leaves of *S. molle* was investigated in the mouse tail suspension test (TST), a predictive model of depression. These results provide evidence that the extract from *S. molle* shares with established antidepressants some pharmacological effects, at least at a preclinical level<sup>9</sup>.

***Tabebuia avellanedae*:** The antidepressant-like effect of the ethanolic extract obtained from barks of

*Tabebuia avellanedae*, a plant widely employed in folk medicine, was investigated in two predictive models of depression: forced swimming test (FST) and tail suspension test (TST) in mice. Additionally, the mechanisms involved in this antidepressant-like action and the effects of the association of the extract with the antidepressants fluoxetine, desipramine and bupropion in the TST were investigated<sup>10</sup>.

***Curcuma longa*:** *Curcuma longa* (turmeric) is a well-known indigenous herbal medicine. The aqueous extracts, when administered orally to the mice from 140 to 560 mg/kg for 14 days, were able to elicit dose-dependent relation of immobility reduction in the tail suspension test and the forced swimming test in mice. The effects of the extracts at the dose of 560 mg/kg were more potent than that of reference antidepressant fluoxetine. The activity of *C. longa* in antidepressant may mediate in part through MAO A inhibition in mouse brain<sup>11</sup>.

***Bupleurum falcatum*:** In traditional Oriental medicine, some herbal combinations that include *Bupleurum falcatum* (BFM) as a major ingredient are known to effectively treat depressive-like disorders. In the present study, the antidepressant-like effect of methanolic extract of BFM and its neuropharmacological mechanism were investigated in mice. After oral administration of BFM extract, a tail suspension test (TST) and open field test (OFT) were performed to assess the antidepressant activity and psychostimulant side-effects, respectively<sup>12</sup>.

***Piper laetispicum*:** In the present work, we studied the effect of laetispicine, an amide alkaloid isolated from the stems of *Piper laetispicum* (Piperaceae), in forced swimming, open field, acetic acid writhing and formalin tests in KM mice to assess antidepressant and antinociceptive effects. Results from writhing and formalin tests showed that laetispicine reduced the number of writhing in mice in a dose-dependent manner, attenuated the licking and spitting time of the injected paw in the first phase of formalin test. The antinociceptive effect of laetispicine was not affected by pre-treatment (i.p.) with naloxone (2 mg/kg). In conclusion, we showed that laetispicine possessed significant antidepressant and antinociceptive properties, making this drug potentially useful in depression and pain<sup>13</sup>.

***Allium macrostemon*:** The aim of this study was to identify the effects of water extracts of *Allium macrostemon* Bunge (AM-W), a traditional herb, in mice. The antidepressant-like activities of AM-W were evaluated through behavioral despair in forced swimming test and tail suspension test<sup>14</sup>.

***Hypericum reflexum* L.:** We previously reported that oral administration of the methanol extract obtained from the aerial part in blossom of *Hypericum reflexum* L. fill. was active in the tetrabenazine and forced swimming test. Antidepressant activity was detected in the butanol and chloroform fractions of this species using the forced swimming test since both fractions induced a significant reduction of the immobility time, producing no effects or only a slight depression on spontaneous motor activity when assessed in a photocell activity meter. Taken together, these data indicate that the butanol and chloroform fractions from *Hypericum reflexum* possess antidepressant-like effects in mice, providing further support for the traditional use of these plants in the Canary Islands folk medicine against central nervous disorders<sup>15</sup>.

***Mitragyna speciosa*:** *Mitragyna speciosa* Korth. Leaves have been used for decades as a traditional medicine to treat diarrhea, diabetes and to improve blood circulation by natives of Malaysia, Thailand and other regions of Southeast Asia. Mitragynine is the major active alkaloid in the plant. The present investigation evaluates the antidepressant effect of Mitragynine in the mouse forced swim test (FST) and tail suspension test (TST), two models predictive of antidepressant activity and the effect of mitragynine towards neuroendocrine system of hypothalamic-pituitary-adrenal (HPA) axis by measuring the corticosterone concentration of mice exposed to FST and TST<sup>16</sup>.

***Hypericum canariense*, *H. glandulosum*:** The aim of the present study was to investigate several neuropharmacological effects of the methanol extract of the aerial parts in blossom of *Hypericum canariense*, *H. glandulosum*, *H. grandifolium* and *H. reflexum* (Hypericaceae). These extracts did not alter significantly the locomotor activity, body temperature or the pentobarbital-induced sleeping time, with the exception of *H. reflexum* which significantly potentiated pentobarbital-induced sleeping time at both doses assayed (500 and 1000 mg/kg p.o.). These

observations suggest that the methanol extract of the *Hypericum* species in doses of 500–1000 mg/kg p.o. possess antidepressant activity in mice, without inducing significant muscle relaxation, anticholinergic and sedative properties<sup>17</sup>.

***Piper tuberculatum*:** In the present work, we studied the effects of pipartine (PIP), an amide alkaloid isolated from the roots of *Piper tuberculatum* (Piperaceae), in the elevated plus maze, open field, rota rod, pentylenetetrazole (PTZ)-induced seizures, and forced swimming tests, in mice (Swiss, male, 25 g) to assess Anxiolytic, sedative, muscle relaxant, anticonvulsant and antidepressant effects, respectively. Furthermore, a significant and dose-dependent decrease in the immobility time, as evaluated by the forced swimming test, was observed after PIP administration (41% and 75% decrease, at the doses of 50 and 100 mg/kg, respectively), suggesting an antidepressant effect, similarly to that observed with imipramine, a classical antidepressant drug used as standard. In conclusion, we showed that PIP presents significant Anxiolytic and antidepressant activities, making this drug potentially useful in anxiety and depression<sup>18</sup>.

***Rosmarinus officinalis* L.:** Rosemary, *Rosmarinus officinalis* L. (Labiatae) has several therapeutic applications in folk medicine in curing or managing a wide range of diseases, including depression. In this study, the effect of the hydroalcoholic extract of the stems and leaves of this plant was investigated in two behavioral models, the forced swimming test (FST) and tail suspension test (TST) in mice. The results suggest that the antidepressant action of the extract of *R. officinalis* is mediated by an interaction with the monoaminergic system and that this plant should be further investigated as an alternative therapeutic approach for the treatment of depression<sup>19</sup>.

***Salviaelegan* Vahl:** Behavioral effects of a hydroalcoholic (60% ethanol) extract from the leaves of *Salvia elegans* Vahl (Lamiaceae) were studied in male Sprague Dawley rats. The extract was administered intraperitoneally and its effects on spontaneous motor activity (total motility, locomotion, rearing and grooming behavior) were monitored. Putative Anxiolytic and antidepressant properties of *Salvia elegans* were studied in the elevated plus-maze

test (EPM) and in the forced swimming test (FST), respectively. These results suggest that some of the components of the hydroalcoholic extract of *Salvia elegans* have psychotropic properties, which deserve further investigation<sup>20</sup>.

***Asparagus racemosus* Linn:** *Asparagus racemosus* Linn. (AR) is an Ayurvedic rasayana used as an adaptogen. Adaptogenic drugs are those which are useful as anti-stress agents by promoting non-specific resistance of the body. Hence, the present investigation evaluates the antidepressant effect of methanolic extract of roots of AR (MAR) standardized to saponins (62.2% w/w). Rats were given MAR in the doses of 100, 200 and 400 mg/kg daily for 7 days and then subjected to forced swim test (FST) and learned helplessness test (LH). The results show that MAR decreases immobility in FST and increases avoidance response in LH indicating antidepressant activity. MAR also reversed changes to the endogenous antioxidant system induced by FST. Thus, MAR has significant antidepressant activity and this effect is probably mediated through the serotonergic and the noradrenergic systems and augmentation of antioxidant defenses<sup>21</sup>.

***Polygalasa bulosa*:** The relationship between depression and monoaminergic systems has been hypothesized for many years. In this study, we have investigated the possible antidepressant-like effect of scopoletin, a coumarin from *Polygalasa sabulosa* in the tail suspension test and forced swimming test. Moreover, the ability of scopoletin to reverse the depression-like behavior in the forced swimming test induced by immobility stress in mice was evaluated. The results indicate that its antidepressant-like effect is dependent on the serotonergic (5-HT<sub>2A</sub> receptors), noradrenergic ( $\alpha_1$ - and  $\alpha_2$ -adrenoceptors) and dopaminergic (dopamine D<sub>1</sub> and D<sub>2</sub> receptors) systems<sup>22</sup>.

***Berberis aristata*:** Berberine, an alkaloid isolated from *Berberis aristata* Linn. has been used in the Indian system of medicines as a stomachic, bitter tonic, antiamoebic and also in the treatment of oriental sores. Evidences have demonstrated that Berberine possesses central nervous system activities, particularly the ability to inhibit monoamine oxidase-A, an enzyme involved in the degradation of

norepinephrine and serotonin (5-HT). With this background, the present study was carried out to elucidate the antidepressant-like effect of Berberine chloride in different behavioral paradigms of despair. Berberine (5, 10, 20 mg/kg, i.p.) inhibited the immobility period in mice in both forced swim and tail-suspension test, however, the effect was not dose-dependent. Nitric oxide pathway and/or sigma receptors are involved in mediating its antidepressant-like activity in mouse forced swim test<sup>23</sup>.

***Magnolia bark and ginger rhizome:*** Magnolia bark and ginger rhizome is a drug pair in many prescriptions for treatment of mental disorders in traditional Chinese medicine (TCM). However, compatibility and synergism mechanism of two herbs on antidepressant actions have not been reported. We evaluated antidepressant-like effects of mixture of honokiol and magnolol (HMM), polysaccharides (PMB) from magnolia bark, essential oil (OGR) and polysaccharides (PGR) from ginger rhizome alone, and the possibility of synergistic interactions in their combinations in the mouse forced swimming test (FST) and tail suspension test (TST)<sup>24</sup>.

***Valeriana officinalis:*** Extracts of *Valeriana officinalis* L. s.l. are used for treating mild sleep disorders and nervous tension. Using the forced swimming and the horizontal wire test the latter two extracts were additionally tested for antidepressant and myorelaxant properties. Additionally and different from its primary extract (35% ethanolic extract) phytofin Valerian 368 showed antidepressant activity in the forced swimming test after subacute treatment. Myorelaxant effects were not observed in dosages up to 1000 mg/kg bw. Due to these findings it is proposed that not sedative but Anxiolytic and antidepressant activity, which was elaborated particularly in the special extract phytofin Valerian 368, considerably contribute to the sleep-enhancing properties of valerian<sup>25</sup>.

***Marsilea minuta:*** *Marsilea minuta* Linn. (Marsileaceae) has been referred in Indian traditional medicine system (Ayurveda) for the treatment of insomnia and other mental disorders. Marsiline isolated from *Marsilea minuta* was reported to have sedative and anticonvulsant property. The ethanol extract of *Marsilea minuta* was standardized for marsiline (1.15%, w/w) and studied for its antidepressant activity<sup>26</sup>.

***Aloysia polystachya***: The aim of the present work is to evaluate the putative antidepressant-like effects of a hydro-ethanolic extract (CEAp) and their fractions from the aerial parts of *Aloysia polystachya* (Griseb.) Moldenke (Verbenaceae) on the performance of male mice in the forced swimming test (FST). These results indicate an antidepressant-like profile of action for the hydro-ethanolic extract and the component(s) of the ethyl acetate fraction obtained from *A. polystachya*, which deserve further investigation<sup>27</sup>.

***Tagetes lucida***: *Tagetes lucida* (Asteraceae), has been referred in Mexican traditional medicine for the treatment of different central nervous system (CNS) diseases, mainly depression. Nevertheless, the available scientific information about this species is scarce and there are no reports related to its possible effect on the CNS. In this work, the antidepressant-like effect of extract of *Tagetes lucida* was evaluated in rats, as well as its potential adverse effects on male sexual behavior (MSB)<sup>28</sup>.

***Embllica officinalis***: 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. The present study was undertaken to evaluate the antidepressant potential of acute and chronic administration of EO in forced swim test (FST) and tail suspension test (TST). The antidepressant activity of EO was comparable to that of standard drug imipramine. The results of the present study indicate the potential for use of EO as an adjuvant in the treatment of depression<sup>29</sup>.

***Bacopa monnieri***: *Bacopa monniera* Wettst. (Syn. *Herpestis monniera* L.; Scrophulariaceae) is a commonly used Ayurvedic drug for mental disorders. The standardized extract was reported earlier to have significant anti-oxidant effect, Anxiolytic activity and improve memory retention in Alzheimer's disease. Presently, the standardized methanolic extract of *Bacopa monniera* (bacoside A - 38.0+/-0.9) was investigated for potential antidepressant activity in rodent models of depression. The effect was compared with the standard antidepressant drug imipramine (15 mg/kg, ip).

The extract when given in the dose of 20 and 40 mg/kg, orally once daily for 5 days was found to have significant antidepressant activity in forced swim and learned helplessness models of depression and was comparable to that of imipramine<sup>30</sup>.

***Clitoria ternatea***: The present investigation was aimed at determining the spectrum of activity of the ethanolic extract of *Clitoria ternatea* (CT) on the CNS. The CT was studied for its effect on cognitive behavior, anxiety, depression, stress and convulsions induced by pentylenetetrazole (PTZ) and maximum electroshock (MES). In conclusion, the extract was found to possess Nootropic, Anxiolytic, antidepressant, anticonvulsant and anti-stress activity. Further studies are necessary to isolate the active principle responsible for the activities and to understand its mode of action<sup>31</sup>.

***Cimicifuga racemosa***: Ethanolic- and isopropanolic-aqueous extracts of *Cimicifuga racemosa* are used for the treatment of climacteric complaints. In addition, an ethanolic-aqueous extract of *C. racemosa* was studied in the tail suspension test (TST), a behavioral test indicative for antidepressant activity. A significant decrease of the period of immobility was observed after treatment with 30 mg/kg body weight (bw) imipramine or with 50 or 100 mg/kg body weight *Cimicifuga* extract. These findings in pharmacological activities tests a reduction of the frequency of hot flush equivalents and hints on antidepressant activity of *Cimicifuga* extracts-are in good agreement with the therapeutical responses in climacteric women<sup>32</sup>.

***Crocus sativus***: The aim of this study was to investigate the antidepressant properties of stigmas and corms of *Crocus sativus* L. The aqueous ethanol extract of *C. sativus* corms was fractionated on the basis of polarity. The data indicate that antidepressant-like properties of aqueous stigma extracts may be due to crocin 1, giving support to the validity of the use of this plant in traditional medicine.

All these results suggest that the low polarity parts of *C. sativus* corms should be considered as a new plant material for curing depression, which merit further studies regarding anti-depressive- like activities of chemical compounds isolated from the two fractions and mechanism of action<sup>33</sup>.

***Ginkgo biloba***: Lipophilic extracts of *Ginkgo biloba* L. leaves were tested for their possible role on rodent models of depression and stress. Lipophilic extracts of Ginkgo leaves (LEG) at (50 and 100 mg/kg, p.o.) exhibited dose dependent, significant antidepressant activity in the behavioral despair test and learned helplessness rodent model of depression. The current findings suggest that intact carboxylic acid groups containing 6-AS are the bioactive components of the lipophilic extract of Ginkgo leaves with antidepressant and anti-stress activities<sup>34</sup>.

***Ocimum sanctum***: 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. Therefore, the present study was undertaken to evaluate the antidepressant potential of acute and chronic administration of OS in forced swim test (FST) and tail suspension test (TST). The antidepressant activity of OS was comparable to that of standard drug imipramine. The results of the present study indicate the potential for use of OS as an adjuvant in the treatment of depression<sup>35</sup>.

***Withania somnifera***: The roots of *Withania somnifera* (WS) are used extensively in Ayurveda, the classical Indian system of medicine, and WS is categorized as a rasayana, which are used to promote physical and mental health, to provide defence against disease and adverse environmental factors and to arrest the aging process. The present study investigated the Anxiolytic and antidepressant actions of the bioactive glycowithanolides (WSG), isolated from WS roots, in rats. WSG also exhibited an antidepressant effect, comparable with that induced by imipramine, in the forced swim-induced 'behavioral despair' and 'learned helplessness' tests. The investigations support the use of WS as a mood stabilizer in clinical conditions of anxiety and depression in Ayurveda<sup>36</sup>.

***Rhazya stricta***: Immobility induced by forced swimming is well known as an animal model of depression. Using this paradigm, we have, in the present work, tested the possibility that the medicinal plant *Rhazya stricta*, which has previously been found to affect the monoamine oxidase inhibitory activity in

rat brain, may have an antidepressant-like action. It is concluded that *R. stricta* extract [or component(s) thereof] may possess an antidepressant-like effect<sup>37</sup>.

***Tinospora cordifolia***: The present study was taken up to investigate the effect of petroleum ether extract of *Tinospora cordifolia* (Wild.) Miers on depression in mice. The extract (50, 100 and 200 mg/kg, p.o.) was administered for 14 successive days to Swiss young albino mice (either sex) and evaluated for antidepressant-like activity using tail suspension test and forced swim test. Moreover, petroleum ether extract also reduced the mouse whole brain monoamine oxidase (MAO-A and MAO-B) activities as compared to control, resulting in increase in the levels of brain monoamines. Therefore, the extract may have potential therapeutic value for the management of depressive disorders<sup>38</sup>.

***Kaempferia parviflora***: To date, the search for novel pharmacotherapy from medicinal plants for psychiatric illnesses has significantly progressed. The present study was performed to evaluate the Anxiolytic and antidepressant like activities of the *K. parviflora* rhizome extract. These results suggested the anti-depression activity of the plant extract. Therefore, *K. parviflora* may be served as a potential resource for natural psychotherapeutic agent against depression<sup>39</sup>.

***Momordica charantia***: Methanol extract of dried leaves of *Momordica charantia* Linn. (Cucurbitaceae) was investigated for Anxiolytic, antidepressant and anti-inflammatory activities in animal models. Behavior despair test was used to assess antidepressant activity of methanol extract of *M. charantia* Linn leaves. The extract treatment showed antidepressant effect by decreasing mobility time of subjected rats to forced swimming dose of 300 mg/kg extract, the swimming behavior of the animals was comparable to the standard drug imipramine<sup>40</sup>.

***Sphaeranthus Indicus***: To investigate the effects of a hydroalcoholic extract of the *Sphaeranthus Indicus* (SIE) against experimentally induced anxiety, depression and convulsions in rodents. *Sphaeranthus Indicus* demonstrated Anxiolytic, central nervous depressant, and anticonvulsant activities in rodents, thus supporting the folk medicinal use of this plant in nervous disorder<sup>41</sup>.

***Hippeastrum vittatum*:** Compounds isolated from different members of the Amaryllidaceae family are becoming relevant options for the treatment of neurological disorders and neurodegenerative diseases. In particular, species of the *Hippeastrum* genus are important source of alkaloids with a wide profile of putative therapeutically applications. There results suggest that montanine, as other alkaloids isolated from Amaryllidaceae species, has psychopharmacological activities including Anxiolytic, anti-depressive and anticonvulsive effects <sup>42</sup>.

***Glycyrrhiza glabra* L.:** The present study was undertaken to investigate the effects of aqueous extract of *Glycyrrhiza glabra* L. (Family: Fabaceae), popularly known as liquorice, on depression in mice using forced swim test (FST) and tail suspension test (TST). This suggests that antidepressant-like effect of liquorice extract seems to be mediated by increase of brain norepinephrine and dopamine, but not by increase of serotonin. Monoamine oxidase inhibiting effect of liquorice may be contributing favorably to the antidepressant-like activity. Thus, it is concluded that liquorice extract may possess an antidepressant-like effect <sup>43</sup>.

***Valeriana wallichii*:** Three extracts of *Valeriana wallichii* DC (Valerianaceae) rhizome and fluoxetine were studied for antidepressant-like activity in two behavioral models, namely the forced swim test (FST) and the tail suspension test (TST). Since the methanolic and aqueous extracts were active in the tests, it is suggested that the antidepressant-like action of this herbal plant is not contingent upon its terpenoid constituents. <sup>44</sup>

***Paeonia lactiflora* Pall:** The present study investigated the antidepressant effect of ethanol extract of *Paeonia lactiflora* (EPL) in mice using forced swim test, tail suspension test, open-field test and reserpine test. Our results showed that intragastric administration of EPL at the doses of 250 and 500 mg/kg for seven days significantly reduced the duration of immobility in both forced swim test and tail suspension test. EPL at the dose of 500 mg/kg was as effective as the positive control (chlorimipramine, 20 mg/kg) in these tests. However, these treatments did not affect the number of crossing and rearing in the open-field test. Treating mice with EPL at the doses of 250 and 500 mg/kg

significantly antagonized reserpine-induced ptosis and hypothermia. However, at the dose of 125 mg/kg, EPL antagonized only the hypothermia but not ptosis induced by reserpine. The results clearly demonstrated the antidepressant effect of *Paeonia lactiflora* in animal models of depression. The action of *Paeonia lactiflora* may be mediated via the central monoaminergic neurotransmitter system <sup>45</sup>.

***Morinda officinalis*:** The present study observed the antidepressant-like action of the medicinal plant *Morinda officinalis*. The plant extract (25-50 mg/kg), similar to clinically effective antidepressant drug desipramine (5-10 mg/kg), significantly reduced response rate and efficiency ratio while at the same time increasing reinforcement rate. These findings provide further support for the conclusion that *Morinda officinalis* extract possesses the antidepressant effect <sup>46</sup>.

***Mimosa pudica*:** In Mexico, aqueous extracts from dried leaves of *Mimosa pudica* are employed to alleviate depression. In this study, the behavioral actions of aqueous extracts of *M. pudica* at various concentrations were tested. *M. pudica* therefore produced an antidepressant-like profile similar to two tricyclic antidepressants <sup>47</sup>.

***Allium sativum*:** The present study was undertaken to investigate the effect of the ethanolic extract of *Allium sativum* L. (Family: Liliaceae), commonly known as garlic, on depression in mice. Ethanolic extract of garlic (25, 50 and 100 mg/kg) was administered orally for 14 successive days to young Swiss albino mice of either sex and antidepressant-like activity was evaluated employing tail suspension test (TST) and forced swim test (FST) <sup>48</sup>.

***Apocynum venetum*:** An extract of the leaves of *Apocynum venetum* L. (Apocynaceae) markedly shortened the immobility time of male rats in a forced swimming test (FST) in a dose range of 30—125 mg/kg, indicating a possible antidepressant activity. This result confirms the assumption that the antidepressant effect of an *Apocynum* extract in the FST is specific <sup>49</sup>.

***Areca catechu*:** We report on the antidepressant activity in the ethanol extract of *Areca catechu*. Antidepressant activity was evaluated in rodents using the forced swimming and tail suspension tests.



The ethanol extract (4–80 mg/kg) caused a significant reduction in the immobility time without affecting the spontaneous motor activity<sup>50</sup>.

**CONCLUSION:** The collection of herbal plants showing the antidepressant activity were tabulated from the various journals and were reported above as we can conclude that herbal plants are very rich source of substance which are responsible of increasing the antidepressant activity.

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