International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 02-01-2022, Accepted: 17-01-2022, Published: 02-02-2022
Volume 7, Issue 2, 2022, Page No. 51-59

Potential of night-flowering jasmine in the treatment and management of depression: A review

Monika Kaushik[1], Ankit Kumar Yadav[1*], Neetesh Kumar Jain[2]
[1] Amity Institute of Pharmacy, Amity University Madhya Pradesh, Maharajpura, Gwalior, Madhya Pradesh, India
[2] Department of Pharmacology, Faculty of Pharmacy, Oriental University, Indore, Madhya Pradesh, India

Abstract
A ray of hope has arisen for the patient suffering from the depression in the form of herbal and polyherbal medications. As the herbal medication coming from the plants from the nature, they tend to show lesser ADRs in comparison to the medicines of synthetic origin. Several herbs have been reported to show positive effect on the patients suffering from the depression with minute to low ADRs. Out of the many reported herbs, the Night Flowering Jasmine belong to the family *Oleaceae* with botanical name *Nyctanthesarbor-tristis* is the source of many chemical constituents effective against a variety of medical conditions includingdepression. The aqueous and non-aqueous extracts from the leaves and the flowers of the *Nyctanthes arbor-tristis* haveshown positive response in the laboratory animals induced with the depression using various pharmacological tools. The animals administered with the extract of *Nyctanthesarbor-tristis* were observed to show improved behavioural changes with the ones abstained from. In the present work a systematic review of the medical potential of the extract of leaves and flowers of *Nyctanthesarbor-tristis*, available chemical constituents in the leaves and flowers, method of extraction of chemical constituents, available synthetic treatment for depression and the ADRs associated with the same and research work carried out for the evaluation of the effect of the antidepressant activity of *Nyctanthesarbor-tristis* in the animals' models has been summarised and reported.

Keywords: depression, antidepressant, *Nyctanthesarbor-tristis*, night flowering jasmine, adrs of antidepressant drugs, extraction of chemical constituents

Introduction
Depression being one of the most common illness around the globe affects around 3.8% of the total population, raising to a figure of 280 millionpeople worldwide. Depression is most common in the adults and in the people older than 60 years of age[1-2].The recurrent and severe intensity of the depression may worsen the mental health of the individuals leading to the mental disability, development of suicidal tendency and suicide on later stages. Around the globe, suicide is the fourth most common cause of the death among the individuals ranging between the age of 15-29 years. Over around 0.7 million people die globally due to the suicide [3-4]. Illness related to the major depressive disorders is found among all the region of the world, cases ranging from low to high based on the geographical distribution as given in figure 1.

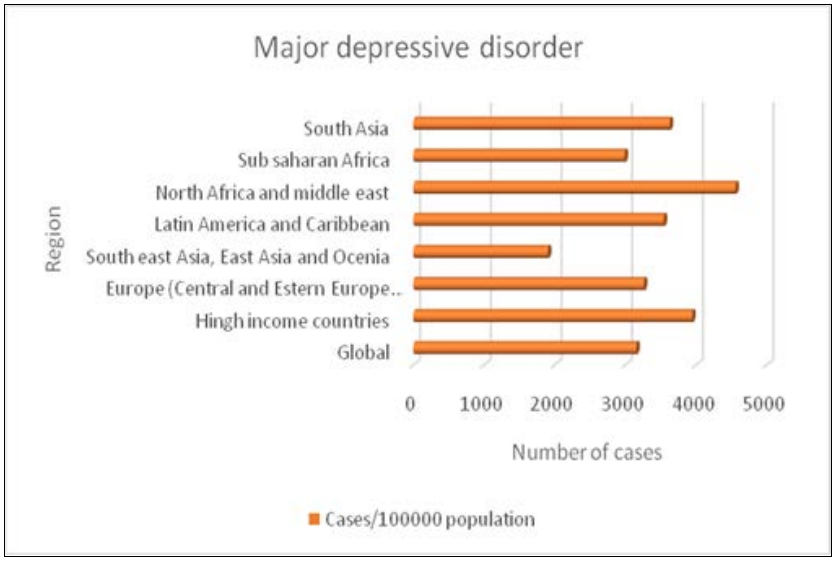


Fig 1: Worldwide occurrence of cases related to major depressive disorders [3]

Depression can be treated effectively with the available effective treatment. However, low to middle income group of the population remains far away from receiving the proper treatment due to one to more reasons such as lack of awareness, social stigma, lack of resources, untrained health care personnel, lack of diagnosis, incorrectly prescribed medication and of course the financial crisis [4].

Cost of depression

The illness of depression costs not only the financial burden to the patient and the family but disturbance in the mental state of his or her surroundings [5]. The most widely reported effects on the personal life of the patient of depression is presented in figure 2.

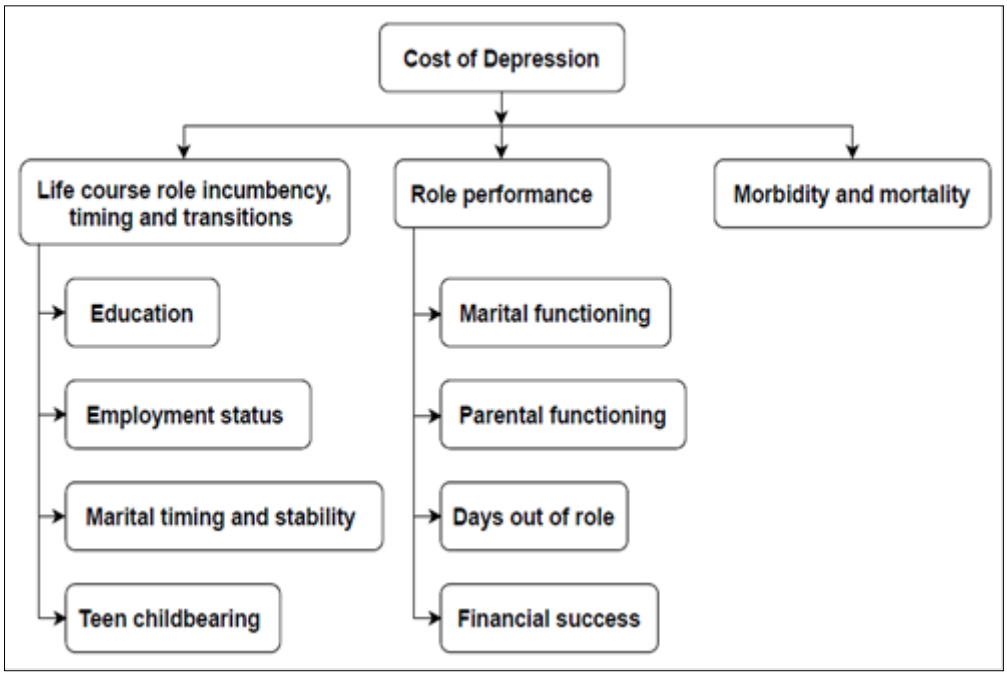


Fig 2: Cost of depression [5].

Management of depression

Depression, if diagnosed within time can be cured and managed with the aid of the medicinal treatment as well as long term therapies. World Health Organisation (WHO), for the treatment of depression recommends several therapies and published manual over the same, out of the which few of the selective publications by the WHO are listed below.

Group Interpersonal Therapy (IPT)

The group IPT is a functional programme designed by Gerald L Klerman and Myrna M Weissman, published and recommended by WHO for the management of depression. The basic structure of IPT consists of the 6-8 members and the experts or facilitators who help the groups members to find out the link between their current life problems and depression. The facilitators help the group members to develop interpersonal skills and effective management. According to the IPT manual the depression may be developed due to one of the following reasons such as grief, disputes, life changes, and loneliness or social isolation. The focus of IPT is to help the people to overcome the current depression, establish the link between the person's depression and current life problems, influence of problems on their relationships and solution to deal with the problems [6].

Thinking healthy (cognitive-behavioural technique)

An evidence based psychological intervention specially designed to tackle with the perinatal period of depression developed in the females. The approach involves the initiation of the empathic, sensitive, and clear communication and remove the thanking gap between the females and their families. The recommended manual by the WHO for thinking healthy includes the focus on psychological intervention, general principles of care during the pregnancy, psychological education, cognitive behavioural therapy, reactivation of social network and communication, overall wellbeing and providing the necessary adjunct therapy to the females [7].

Problem Management Plus (PM+)

Developed and designed by the various experts working with WHO, the problem management plus programme focuses on the psychological problems such as stress, fear and feeling of helplessness and practical problems including livelihood and conflicts in the family of an individual. The structure of the programme involves the interventional sessions with individuals in the schedule of 1 session per week continuously for 5 weeks. The programme is also suitable to tackle with the emotional problems of the individuals suffering from depression [8].

mhGAP *Intervention Guide* (mhGAP-IG)

The guideline is basically applicable to the all the primary care doctors, nurses and other members of healthcare workforce dealing with the patients of various health conditions including the ones with mental, neurological and substance use. The guideline outlines the basic protocol to deal with the diseases of the patient contributing to the physical and mental disability [9].

Medications for depression

The use of medication for the treatment and management of depression should not be the first choice of treatment. Medications should only be used judiciously, however, due to the lack of awareness among the healthcare providers and the patients seeking immediate relief from the practice of use of medicines for depression has been increased. The drug used for the management of depression are mainly from the pharmacological classes of Selective Serotonin Reuptake Inhibitors (SSRIs), Serotonin and Norepinephrine Reuptake Inhibitors (SNRIs), Monoamine Oxidase Inhibitors (MAOIs) and tricyclic drugs [10]. The majority of drugs available in the market for the treatment of depression are given in table 1.

Table 1: Marketed medicinal products for the treatment of depression.

Sr. No.	Category	Drug Name	Brand Name
1.	Selective serotonin inhibitors (SSRIs)	Buspirone	BuSpar
		Citalopram	Cipramil
		Gepirone	Travivo
		Ispapirone	---
		Sertaline	Lustral
2.	Serotonin and Norepinephrine Reuptake Inhibitors(SNRIs)	Atomoxitine	Strattera
		Dulomoxetine	Cymbalta
3.	Monoamine Oxidase Inhibitors (MAOIs)	Phenelzine	Nardil
		Tranylcypromine	Parnate
		Isocarboxazid	Marplan
		Moclobemide	Aurorix
4.	Tricyclic drugs	Clomipramine	Clomipramine, Clomidel
		Trimipramine	Trimipramine
		Imipramine	Imipramine Hydrochloride
		Doxepin	Doxepin, Toxep
		Amitriptyline	Amitriptyline Hydrochloride

Limitation associated with the existing medicines

Although the medicinal treatment available for the management of the depression acts at lifesaving in the severe cases, however, they suffer from major limitation of generation of moderate to severe Adverse Drug Reactions (ADRs) which may lead to the discontinuation of treatment. The common ADRs associated with the medication available for the treatment of depression includes the ADRs such as abdominal pain, aggression, amnesia, anger, blurred vision, chest pain, cold sweat, confusional state, constipation, depersonalization, depression, diarrhoea, disturbance in attention, dizziness, dry Mouth, dysgeusia, excitement, hallucination, insomnia, libido increased, mania, migraine, musculoskeletal pain, nasal congestion, nausea, nervousness, paraesthesia, pharyngolaryngeal pain, rash, sedation, sleep disorder, somnolence, tachycardia, tremor, vomiting and suicidal tendency on dose shifting and variation [11-14].

Night-flowering jasminein the management of depression

To overcome the limitations associated with the synthetic medications available for the treatment and management depression, the research paradigm is being shifted towards the use of herbs and the medications based on the herbal origin. There are plenty of medicinal plants being reported to have better safety and efficacy in the patient suffering from depression. However, one of the most commonly available medicinal plant in Indian habitat named night-flowering jasmine with the botanical name nyctanthesarbor-tristisis reported to have multiple pharmacological activities with potent antioxidant and antidepressant activities [15-17].

Botanical description

Night-flowering jasmine, an indigenous plant of India, commonly known as Coral Jasmine (Night Jasmine, Har Singar, or Tree of Sorrow) is a shrub belonging to the family Oleaceae (Jasmine family) with the botanical name *Nyctanthesarbor-tristis*is reported to be the miracle plant in the ancient literature for the cure of many severe diseases. In the Indian habitat the plant is found around the country with the flowering time of throughout the year. The plant of *Nyctanthesarbor-tristis* is expected to be grown upright or erect up to a height of 4 to 6 metres with the branches spreading to a width of 2 to 4 metres andlong-life expectancy. The hight of the plant and the width of the branches depends upon the nurturing method and provided environmental conditions, it may grow like a tree or remain like a large shrub. Night-flowering jasmineis normally planted for aesthetic purpose and fragrance in the parks, walkways and home gardens. The plant is also known with its regional names in the

different states of India in their regional languages as Parijat in Marathi and Gujarati, Harsinghar in Hindi, Parijatukam in Malayalam, Parjatamu in Telugu, Sephalika, Harsinghar and Seuli in Bengali, and ManjatpuPavelam in Tamil. The flowers of *Nyctanthesarbor-tristis* are small and attractive with white petals and orange-red tube in centre. The flowers possess a sweet light fragrance of jasmine. The plant is possessing the unique character of growing and glowing its flowers in the night and losing or dropping them early in the morning leaving a pleasant bed of flowers spread around, giving it the nick name of tree of sorrow[16,18-19].

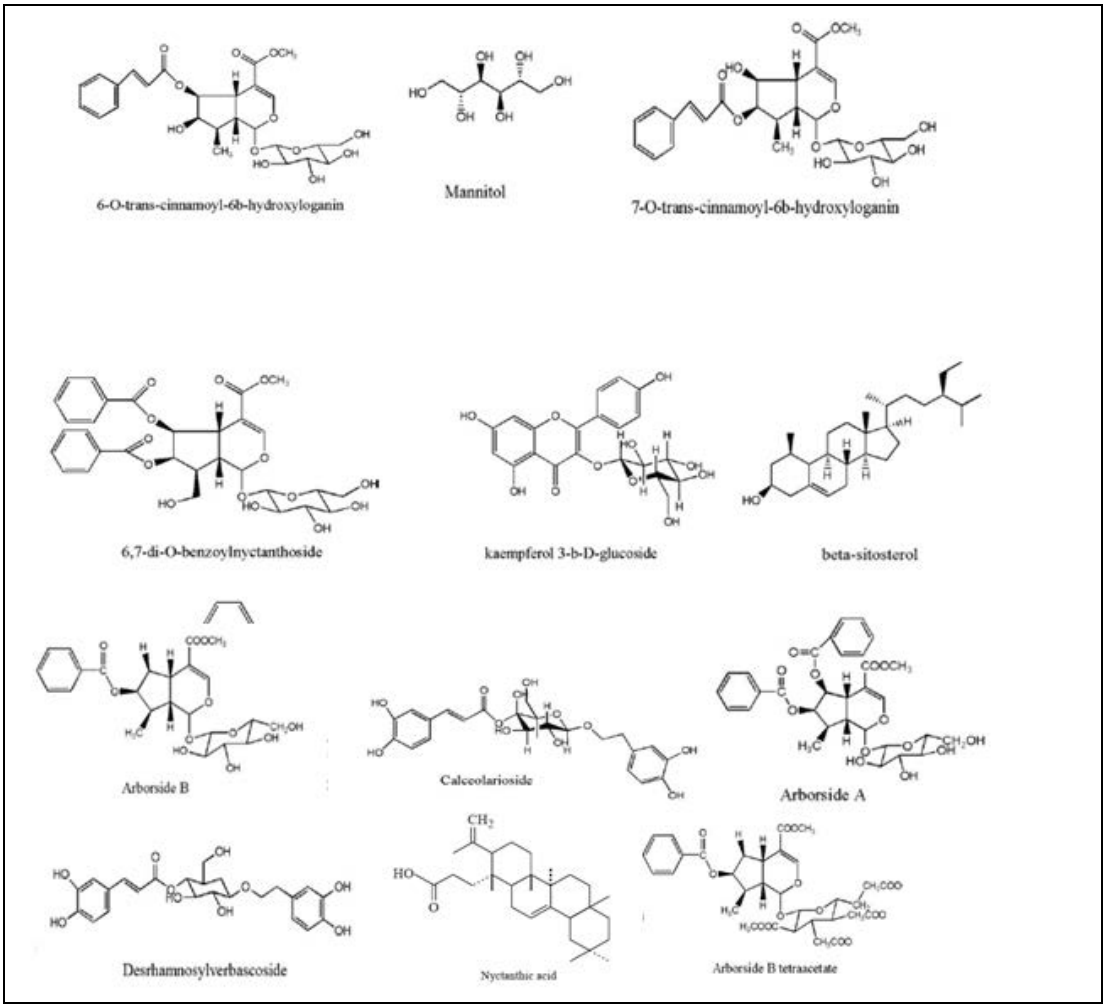
Chemical constituents

Nyctanthesarbor-tristis also known as miracle tree in the ancient literature is the source of enormous chemical constituents available in the various parts of the plant, i.e., leaves, stem, flowers, bark and seeds. However, the literature reported that the extract of the leaves and flowers possess potent antidepressant and antioxidant activity A detailed list of the chemical constitutes found in the leaves and the flowers of *Nyctanthesarbor-tristis* are given in the table 2.

Table 2: Chemical constituents found in leaves and flowers of *Nyctanthesarbor-tristis*

Name of the plant	Part of the plant	Chemical constituents	Reference
Night-flowering jasmine (*Nyctanthesarbor-tristis*; Oleaceae)	Leaves	D-mannitol, β-sitosterol, flavanol glycosides, astragalin, nicotiflorin, oleanolic acid, nyctanthic acid, tannic acid, ascorbic acid, methyl salicylate, an amorphous glycoside, an amorphous resin, trace of volatile oil, carotene, friedeline, lupeol, mannitol, glucose, fructose, iridoid glycosides, and benzoic acid	[20-22]
	Flowers	Essential oils, nyctanthin, D-mannitol, tannins, glucose, carotenoids, glycosides including β-monogentiobioside ester of α-crocetin (or crocin-3), β-monogentiobioside-β-D monoglucoside ester of α-crocetin, and β-digentiobioside ester of α-crocetin (or crocin-1)	[22-24]

A number of the phytoconstituents have been reported to be isolated fromleaves and flowers of *Nyctanthesarbor-tristis*. The chemical structures of the phytoconstituents extracted from leaves and flowers are as follows [25].



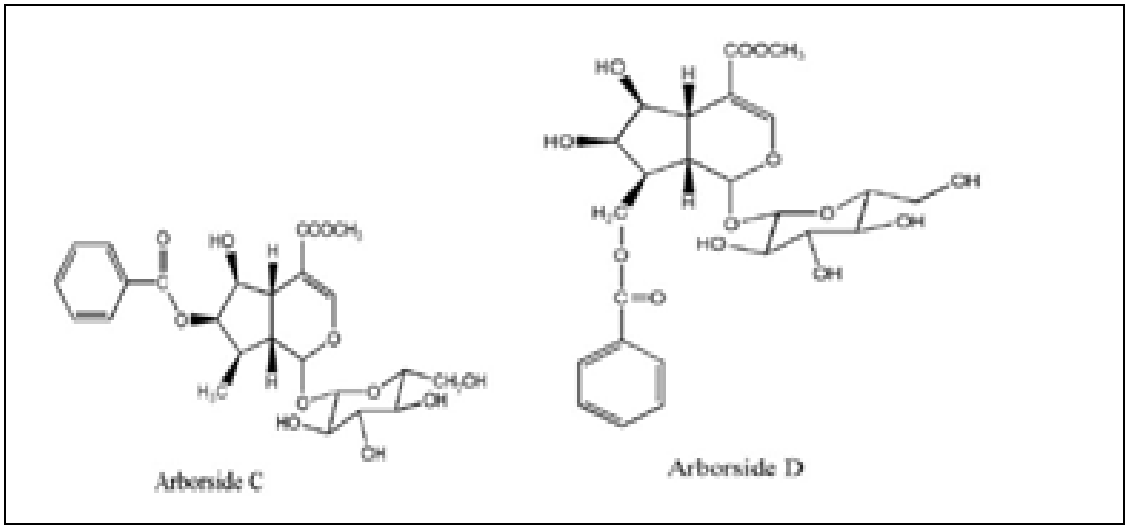


Fig 3: Reported compounds isolated from leaves of *Nyctanthesarbor-tristis* Linn.

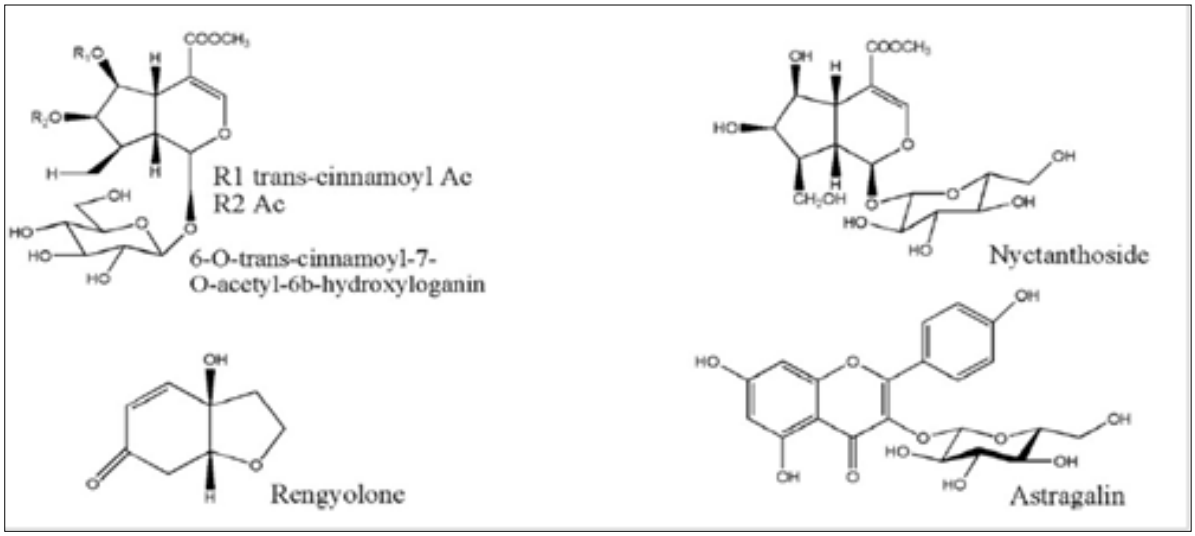


Fig 4: Reported compounds isolated from flowers of *Nyctanthesarbor-tristis* Linn.

Apart from the antidepressant and antioxidant activity of the extract of leaves and flowers of the *Nyctanthesarbor-tristis*, a long list of pharmacological activities for the treatment of various medical conditions. A list of the reported pharmacological activities are given in table 3.

Table 3: Reported pharmacological activities of *Nyctanthesarbor-tristis*

Part of the plant	Pharmacological activities	References
Leaves	Antibacterial, Anti-inflammatory, Antifungal, Anti-pyretic, Antioxidant, Anthelmintic, Antifungal, Hepatoprotective, and Immuno potential	[20-23,26-28]
Flowers	Anti-filarial, Antioxidant, Anti-bilious, Anti-inflammatory, Diuretic and Sedative	[23-24,29-30]

Extraction of chemical constituents

The chemical constituents having the antidepressant activity could be extracted from the leaves and flowers of the plants with the aid of decoction by utilising the aqueous and non-aqueous solvents. An overview of the process of the extraction process of the chemical constitutes from the leaves and flowers of *Nyctanthesarbor-tristis*is presented below.

Decoction of leaves (*aqueous and alcoholic*)

Extraction of potential chemical constituents from the fresh and dried leaves of the plant for antidepressant activity can be done by using decoction in the aqueous and non-aqueous medium. The fresh dried leaves collected from the plant are required to be air dried and crushed into the powder. The crushed powder is to be submerged in the selected solvent and kept overnight for the maceration. The macerate is to be filtered through Whatman filter paper. The collected filtrate can be purified and used in the liquid medium and or it can be dried to the powder form by using a suitable method [31].

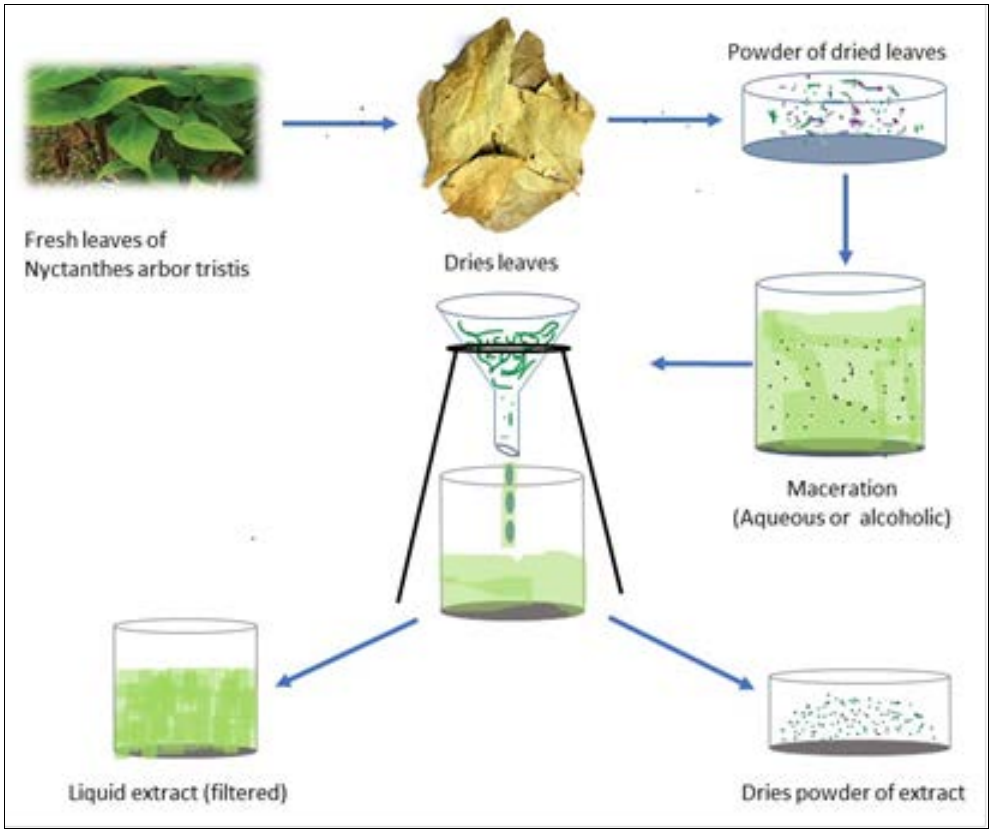


Fig 5: Extraction of chemical constitutes of *Nyctanthesarbor-tristis* leaves by decoction

Decoction of flowers (*aqueous and alcoholic*)

The freshly collected flowers from the plant are required to be air dried in the dark shade at 25℃ till the moisture evaporated. The dried flowers are required to be grinded to powder with the help of mixture grinder. The powder of the flower was submerged into the required solvent for few hours. The mixture of the flowers is to be sonicated for 90 minutes. The process of sonication is to be repeated at least three times. The macerate is required to be filtered through the Whatman filter paper. The filtrate is required to be dried with the help of freeze drying and the dried powder is to be stored in the cool temperature [31].

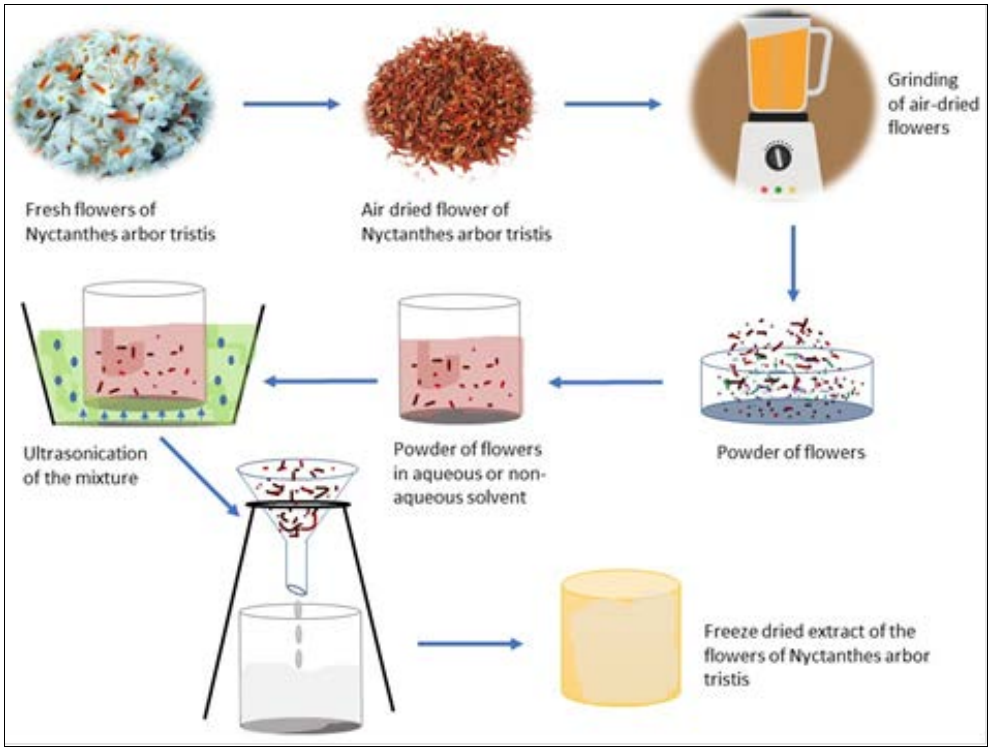


Fig 6: Extraction of chemical constitutes of *Nyctanthesarbor-tristis* flowers by decoction

Pharmacological activities of the extracts

The alcoholic and non-alcoholic extracts of leaves as well as flowers of nigh flowering jasmine were evaluated for their antidepressant activity in the various animal models by different researchers. The pharmacological activity of the extracts was evaluated by the researchers with the aid of various tools. The behavioural changes in the animals after feeding the extract were recorded in comparison to those of which were kept abstained from the extract and were feed on the saline. The research work conducted by the various researchers and their reported results are summarised in table 4.

Table 4: Antidepressant activities of *Nyctanthesarbor-tristis*

Part of the plant	Extract used	Type of experiment conducted	Animals used	Conclusion	Reference
Leaves	90% ethanolic extract	In-vivo study	Male Albino Wistar rats	Acetylcholinesterase inhibitory activity was observed in the animals, further studies are required to be performed to establish the mechanism of action for the activity	[32]
Fruit	50% ethanolic extract, water soluble portion	In-vivo study	Adult Albino rats	The biochemical changes produced due to the induced stress were reversed in the experimental animals	[33]
Leaves	50% ethanolic extract	In-vivo study	Adult Albino rats	A significant dose related response was observed in the experimental animals	[34]
Leaves and flowers	Aqueous extract	In-vivo study	Swiss albino mice	The biochemical changes induced by malathion and its activity on Acetylcholinesterase enzyme in the animals could be antagonized	[35]
Leaves	Aqueous and alcoholic extract	In-vivo study	Adult Albino rats and Wister mice	Significant dose dependant response was observed in the animals induced with anxiety	[36]
Leaves	Hydroethanolic extract	In-vivo study	Mice	A synergistic effect on the stress induced animals (significant improvement in the mobility) was shown on coadministration with fluoxetine	[37]
Leaves and flowers	Hydroalcoholic extract	In-vivo study	Wistar albino rats	The leaf and flower extract in combination had shown remarkable improvement in the antidepressant activity in the experimental animals	[38]
Leaves and fruits	70% ethanolic extract	In-vivo study	Wistar ratsalbino	Dose dependant antidepressant activity was observed on the experimental animals on the long-term exposure of the ethanolic extracts	[39]
Leaves and flowers	Ethanolic and Aqueous extract	In-vivo study	Adult Albino rats and Wister mice	Dose dependant antidepressant activity of ethanolic and aqueous extract was observed, showing better results with ethanolic extract	[40]

Conclusions

Depression being one of the most challenging illness to deal with in the current era has drawn the attention of medical fraternity and the researchers to develop effective management therapies. Several non-medical therapies recommended by the World Health Organisation (WHO) are available to help the population to deal with depression, however, lack of proper attention and care to the patient suffering from the depression by their near and dear ones makes it impossible to mitigate the illness of depression. To tackle with these issues, although there is medical treatment available still the medicines utilised for the same coming from the synthetic origin suffer from the limitation of the severe Adverse Drug Reaction (ADRs) which many time worsens the situation to an extent the treatment requires to be stopped in the middle. After the treatment is stopped, there are number of medicines reported to show the withdrawal symptoms in the patient on the later stages. The frequently reported withdrawal symptoms such as worsening the depression, frequent mood swings, irritation, migraine, and sometimes suicidal tendency makes the life of the patient further difficult.

The shifted paradigm for search of treatment and management of depression with the help of the medications from the herbal origin have shown remarkable improvement in the recent times. Out of many of the reported

herbs, *Nyctanthesarbor-tristis* also known as the wonder tree and the aqueous and non-aqueous extract of the leaves and flower have shown to be extremely effective in the laboratory animals. The extraction of the chemical constituents from the leaves and the flowers was reported to be carried out in both alcoholic and non-alcoholic solvents. Decoction as room temperature was followed to be carried to retain the stability of the chimerical constituents of the extract. In most of the reported studies, the liquid extract was feed to the animals and better behavioural changes were observed in comparison to those feed with the saline. Also, the unintentional effects were not observed in the animal feed on the extract, proving the extract from the leaves and flowers safe and effective in the laboratory animals. Moreover, the activity was also found to be dose dependant, which gives higher margin of safety during the dose selection for the individual patients. Based on the reported results by various authors it can be concluded that nigh flowering jasmine can be a potential candidate for the treatment of patient suffering from the depression. However, it will not be judicial to comment on the safety and efficacy of the extract without the proper human study. As a conclusive statement *Nyctanthesarbor-tristis* can be a potential candidate for the development of safe and effective medication for the management and treatment of depression after a thorough systematic investigation.

Conflict of interest

The authors have no conflicts of interest regarding this investigation.

Acknowledgment

None

References

1. Depression. World Health Organisation. Retrieved, 2021 from https://www.who.int/news-room/fact-sheets/detail/depression
2. The Global Crisis of Depression Summary Report. A global community of mental health innovators (MHN). Retrieved Nov 17, 2021 from https://www.mhinnovation.net/resources/global-crisis-depression-summary-report, 2015.
3. Santomauro DF, Herrera AM, Shadid J, Zheng P, Ashbaugh C, Pigott DM, *et al*. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. Lancet,2021:398(10312):1700-12.
4. Liu Q, He H, Yang J, Feng X, Zhao F, Lyu J. Changes in the global burden of depression from 1990 to 2017: Findings from the Global Burden of Disease study. J Psychiatr Res,2020:126:134-40.
5. Kessler RC. The costs of depression. Psychiatr Clin North Am,2012:35(1):1-4.
6. Group interpersonal therapy (IPT) for depression. WHO generic field-trial version 1.0, 2016. Series on Low-Intensity Psychological Interventions – 3. World Health Organization, 2016.
7. Thinking Healthy. A manual for psychosocial management of perinatal depression. WHO generic field-trial version 1.0, 2015. Series on Low-Intensity Psychological Interventions – 1. World Health Organization, 2015.
8. Problem Management Plus (PM+). Individual psychological help for adults impaired by distress in communities exposed to adversity. WHO generic field-trial version 1.1, 2018. Series on Low-Intensity Psychological Interventions – 2. World Health Organization, 2018.
9. MhGAP Intervention Guide for mental, neurological and substance use disordersin non-specialized health settings. Version-2.0. Mental Health Gap Action Programme. World Health Organization, 2016.
10. Cherney K, Litner J. How Much Does Depression Cost?. Mental Health. Healthline, 2020. Retrieved Dec 18, 2021 fromhttps://www.healthline.com/health/depression/psychotic-depression#diagnosis
11. Summary of Product Characteristics (SMPC) of Buspirone 10mg tablets. European SMPC, updated on: May 2021. Retrieved from: https://www.medicines.org.uk/emc/product/5735/smpc#gref
12. Summary of Product Characteristics (SMPC) of Atomoxetine 60mg hard capsules. European SMPC, updated on, 2021. Retrieved from: https://www.medicines.org.uk/emc/product/10338/smpc#gref
13. Summary of Product Characteristics (SMPC) of Duloxetine 20mg gastro-resistant capsules hard. European SMPC, updated on: April 21. Retrieved from: https://www.medicines.org.uk/emc/product/1777/smpc#gref
14. MiShra S, Swain TR, Mohanty M. Adverse drug reaction monitoring of antidepressants in the psychiatry outpatients department of a tertiary care teaching hospital. J Clin Diagn Res,2013:7(6):1131.
15. Parekh S, Soni A. Nyctanthesarbor-tristis: Comprehensive review on its pharmacological, antioxidant, and anticancer activities. J Appl Biol Biotechnol,2020:8(01):95-104.
16. Gulshan B, Suri KA, Parul G. A comprehensive review on Nyctanthesarbortristis. IntJ Drug Del Res,2015:7(1):183-93.
17. Srivastava R, Trivedi D, Shukla G, Srivastava P. Nyctanthesarbor-tristis: A wonder Indian herbal drug needs healthcare attention. BiomedJSci Tech Res,2018:5(3):1-4.
18. Har Singar. Nyctanthesarbor-tristis. Flowers of India. Retrieved, 2021. from http://www.flowersofindia.net/catalog/slides/Har%20Singar.html
19. Nyctanthesarbor-tristis. Indian Medicinal Plants. Retrieved, 2021. from https://www.indiaplants. com/plant-details.php?x=KXkJo52TwCo=

20. Mahida Y, Mohan JSS. Screening of plants for their potential antibacterial activity against Staphyllococcus and Salmonella. Nat Prod Rad,2007:6(4):301-305.
21. Hukkeri VI, Akki KS, Sureban RR, Gopalakrishna B, Byahatti VV, Rajendra SV, Hepatoprotective activity of the leaves of Nyctanthes arbor-tristis Linn. Ind J Pharm Sci,2006:68(4):542-543.
22. Singh J, Singh AP, Singh AP. Nyctanthes arbor-tristis: a comprehensive review. World JCurr Med Pharma Res, 2021, 74-8.
23. Rathee JS, Hassarajani SA, Chattopadhyay S. Antioxidant activity of Nyctanthes arbor-tristis leaf extract. Food Chem,2007:103:1350-57.
24. Thangavelu NR, Thomas S. In-vitro anti-oxidant studies on ethanolic extracts of leaves and stems of Nyctanthes arbor-tristis (Night flowering Jasmine). Int J Biol Med Res,2010:1(4):188-192.
25. Das S, Sasmal D, Basu SP. Phytoconstituents and therapeutic potential of *Nyctanthesarbor-tristis* Linn. *Pharmacognosy Reviews*,2007:1(2):344-34.
26. Saxena RS, Gupta B, Saxena KK, Prasad DN. Study on anti-inflammatory activity in leaves of Nyctanthesarbortristis. J Ethnopharmacol,1984:11:319-330.
27. Surekha B Barwal, Mohammed Shakir Ghouse, Amruta S Wattamwar, Ajit M Murkute. A Comprehensive Review on Night-flowering Jasmine Nyctanthes arbor-tristis. J Med Pharm Innov,2017:4(19):1-6.
28. Vishwanathan M, Juvekar AR. Hepatoregenerative effect of Nyctanthes arbor-tristis Linn. on acetaminophen induced oxidative damage in rats. Int J Pharm Tech Res,2010:2(2):1291-7.
29. Narendhirakannan RT, Smeera T. In-vitro antioxidant studies on ethanolic extracts of leaves and stems of Nyctanthesarbortristis (Night-flowering jasmine) International JBiol Med Res,2010:1:188-92.
30. Khatu NA, Haue ME, Mosaddik MA. Laboratory evaluation of Nyctanthesarbo-rtristislinn. Flower extract and its isolated compound against common filarial vector, culex quinquefasciatus say (diptera: fulicidea) larvae. Pak J bio Sci,2001:4(5):585-87.
31. Mourya NM, Bhopte DB, Sagar RS. A review on Jasminum sambac: A potential medicinal plant. Int JIndig HerbDrugs, 2017, 13-6.
32. Phanindhra B, Raju BA, Vikas G, Anusha R, Deepika D. Effect of Nyctanthesarbor-tristis leaf extract against scopolamine-inducedcognitive impairment in rats. Herva Pol,2015:60(4):34-49.
33. Tripathi S, Tripathi PK. Antistress activity of Nyctanthesarbor-tristisfruits in rats. Mol Clin Pharmacol,2013:4(1):53-8.
34. Tripathi S, Tripathi PK, Vijayakumar M, Rao CV, Singh PN. Anxiolytic activity of leaf extract of nyctanthesarbor-tristis in experimental rats. Pharmacologyonline,2010:457-63.
35. Verma N, Kaur J, Bhatia A. Stimulation of acetylcholinesterase activitywith Nyctanthesarbor-tristis leaves extract in the malathion-treated immuno suppressed mice. Int J Environ Stud,2001:58(5):645-54.
36. Abraham A. Anti anxiety evaluation of Nyctanthesarbortristis Lin. Ind J Phytoconst,2010:6:77-79.
37. Gupta S, Kashyap P, Asad M, Chattopadhyaya I, Dahiya R. Antidepressant activity of Nyctanthesarbor-tristis in mice. Bangladesh J Pharmacol,2016:11(3):634-45.
38. Guglani A, Joshi T, Singh BK. Comparative evaluation of antidepressant activity of various extracts of nyctanthesarbor-tristis. Int J Pharm Sci Res,2019:10(6):2806-11.
39. Kumari R, Agrawal A, Ilango K, Singh GP, Dubey GP. *In vivo* evaluation of the antidepressant activity of a novel polyherbal formulation. Autism-Open Access,2016:6(194):2.
40. Parekh S, Soni A. Nyctanthesarbor-tristis: Comprehensive review on its pharmacological, antioxidant, and anticancer activities. JApplBiolBiotechnol,2020:8(01):95-104.