Should be cited as: Psychiatria Polska
2013, tom XLVII, numer 3
strony 499–508

Psychoactive plant species – actual list of plants prohibited in Poland

Katarzyna Simonienko, Napoleon Waszkiewicz, Agata Szulc

Department of Psychiatry, Medical University of Białystok, Poland
Head of the Department: dr hab. Agata Szulc

Summary

According to the *Act* on *Counteracting Drug Addiction (20-th of March, 2009,* Dz. U. Nr 63 poz. 520.) the list of plants prohibited in Poland was expanded to include 16 new species. Until that time the only illegal plant materials were cannabis, papaver, coca and most of their products. The actual list of herbal narcotics includes species which significantly influence on the central nervous system but which are rarely described in the national literature. The plants usually come from distant places, where- among primeval cultures- are used for ritual purposes. In our civilization the plants are usually used experimentally, recreationally or to gain particular narcotic effects. The results of the consumption vary: they can be specific or less typical, imitate other substances intake, mental disorders or different pathological states. The plant active substances can interact with other medicaments, be toxic to internal organs, cause serious threat to health or even death. This article describes the sixteen plant species, which are now prohibited in Poland, their biochemical ingredients and their influence on the human organism.

Key words: plant, drug, ethnobotany

Introduction

According to Polish law, 'drugs' are natural or synthetic substances which influence on central nervous system and which are listed on the drug index nr 1, attached to the Act on Counteracting Drug Addiction (29-th July 2005, Dz. U. z 2005 r. Nr 179, poz. 1485). Until March 2009 there were only three plant species on the list: papaver, cannabis and coca. According to the change (20.03.2009) in the Act on Counteracting Drug Addiction (Dz. U. Nr 63 poz. 520.), this list was expanded to include 16 new species. Before that happened these plants were named 'designer drugs' – non delegalized psychoactive substances which work analogical to the well-known drugs, but are sold as 'collection products'. Today they are still relatively obscure and rarely described in Polish medical literature. The results of the consumption can imitate other substances intake, mental disorders or different pathological states. The plant active substances can interact with other medicaments, be toxic to internal organs, cause serious threat

to health or even death. This article describes the sixteen plant species, which are now prohibited in Poland.

The tables at the end of the article contains information about expected psychoactive effects, psychic and somatic side effects which can occur after intake of the plants products.

Plant species description

Argyreia nervosa- Hawaiian Baby Woodrose is native to the Eastern India and Bangladesh and also commonly cultivated in Hawaii. Seeds contain significant amount of ergine- LSA (d-lysergic acid amide), biochemically similar to LSD [1], which binds to the 5-HT2A receptors and other alkaloids from the ergine group. The effects last about 6–12 h and mainly cause hallucinations. Seeds can be easily overdosen. The risky behavior leading to death was described in the literature [2].

Banisteropsis caapi-ayahuasca or yage. It is an Amazonian jungle vine used as one of the ingredients of hallucinogenic potion named 'ayahuasca'. It contains β-carboline alkaloids [3]: harmine, harmaline and tetrahydroharmine acting as monoamine oxidase inhibitors (iMAO): in smaller doses sedative and euphoric, in bigger- hallucynogenic. Plants containing dimethyltryptamine (DMT) are necessary to make the ritual potion because monoamine oxidase inhibitors are used to activate psychoactive properties of DMT. Shamans of the Amazon performs healing ayahuasca rituals for their communities. They look after their patients during these events for proper execution of the process. Diarrhea and vomiting often occurs among different side effects, even after small doses of the plant. According to the local tradition, it is also a part of the ritual because ayahuasca cleanse body and mind. The plant consumption can cause serotonin syndrome (not abiding non-tyramine diet, combining with other medicaments, especially antidepressants) or hypertension syndrome which can lead to such complications as internal haemorrages, heart stroke or haematencephalon.

Calea zacatechichi (C. ternifolia) is a plant native to Middle America. Its main active substances are sesquiterpenes: caleicines and caleochromenes [4]. It elongates shallow sleep in REM stage, increases number of awakenings and helps to remember dreams- because of that it is called 'dream herb'.

Catha edulis – 'khat' is commonly cultivated in African countries. Its main active substance is phenethylamine alkaloid- cathinone, gained from the leaves. It is a stimulant which is said to cause loss of hunger, fatigue, escalates concentration (in African countries it is commonly used by students and car drivers) and euphorises just after a few minutes after the intake. Mood disorders with prevalence of depressive symptoms were described [5] and also hypomanic states. The drug addiction occurs, user can stay in abstinence to 4–5 days. During the abstinence syndrome lower mood, lethargy, trembling and nightmares occurs. Long-term side effects are insomnia, erectile dysfunction, oral cavity cancer, ulceration tendency, permanent teeth discoloration and oral cavity inflammations. Overdose causes trepidation, because of increasing pulse and blood pressure it can cause relevant circulatory complications and even death [6].

Echinopsis pachanoi-the San Pedro cactus – is a fast-growing columnar cactus native to the Peru and Ecuador. It contains phenylamine alkaolids such as mescaline- partial agonist of 5-HT2A receptor. The effects of the intake can last for many hours.

Leonotis leonurus- wild dagga ('dagga' means also 'marihuana') or Lion's Tail. It is a long-lasting, even two meter high plant with orange flowers, native to Africa. It contains many tannins, alkaloids (leonithine, leonurine) [4], saponins and lactones (marrubine, premarrubine). The psychoactive effects are similar to those after tetrahydrocannabinoid (THC) although weaker. It potentiates actions of hypotensive medications and it can cause addiction.

Mimosa tenuiflora or M. hostilis grows in North and East parts of South America and Mexico. It contains DMT-dimethyltryptamine [7] and yuremamine. Used separately causes short hallucynogenic states but usually it is one of the ayahuasca ingredients causing long-term psychedelic effect. It is worth to mention that one of the side effects of DMT is rapid elevation of blood pressure and pulse causing *risk* for the *life*-threatening severe *intoxication* [8]

Mitragyna speciosa-Kratom – is a tree native to Thailand, Malesia, Indonesia and New Guinea. The material are leaves containing alkaloid mitragynine (MG) partial opioid agonist [9] producing similar effects to morphine, and 7-hydroxymitragynine which has been reported to be even more potent [10]. Those substances can be detected in urine with full-scan gas chromatography-mass spectrometry procedure [11]. It is stimulating in lower doses, sedative in higher, the effects occur a few minutes after the intake and last couple of hours. In middle and high doses Kratom is sedative, euphorising and hallucinogenic. In long-term usage addiction (fast adaptation to the doses) and the abstinence syndrome [12] can occur.

Nymphaea caerulea – Blue Egyptian Water Lily grows in shallow inshore fresh waters of East Africa and Asia. Main active substances are probably alkaloid nufarine which influences on brain cortex and nymphaline- glycoside which influences on heart functions and blood flow through the coronary system, alkaloid aporphine- apomorphine analog used in erectile dysfunction, miorelaxant, dopamine agonist and nuciferine dissolving in alcohol [13]. In Egypt dried flower petals were used as tea, spice or merged with wine for better assimilation. The effect are noticeable even with small doses.

Peganum harmala – Harmal, Wild Rue or Syrian Rue is a plant of the family Nitrariaceae. It is a perennial plant which can grow to about 0.5 m tall, with light leaves and white flowers. It is native to North Africa, the Near East, India and Mediterranean area. Main active substances are β- carbolines which are iMAO [14]: harmaline, harmine, harmalol and harman [15]. The effects last- depending on the dose- from a few hours to over ten hours. Using this plant can intensify many other drugs side effects. Intoxication can be acute and then should be treated quickly on intensive care department.

Piper methysticum- called kava kava is a vine plant native to Western Pacific Islands. Despite of its sedative influence on central nervous system compared sometimes to alcohol or benzodiazepines, this plant can be strongly hepatotoxic [16] causing liver damages – from benign and chronic to acute, with very serious proceeding [17]. Merging with alcohol in case of liver diseases can lead to liver damage.

Psychotria viridis- chacruna is a bush native to Amazonia. Its main active substances are DMT and β-carbolines. Usually it is one of the ingredients of ayahuasca, rarely used separately as extract for incenses. It causes hallucynogenic states which last about 15 minutes and affect all the senses. It is used together with other plants because DMT taken orally is not very active, fast metabolised and does not cause expected, spectacular psychoactive effects. It need to be activated by other iMAO substance which can be found in other species.

Rivea corymbosa (Turbina corymbosa) is a vine native to Mexico and South America countries. Its seeds contains ergine alkaloid (LSA) like A. nervosa. The amount of the active substance is different, according to the area where the plants grow.

Salvia divinorum – Seer's Sage – its native habitat is within isolated places of forest in the Sierra Mazateca of Mexico but it is also often cultivated because of its growing popularity among hallucinogens users form western countries [18–21]. Mazatec shamans used it to bring visions or to heal. According to research done among American students nowdays it is usually used by young males and merged with other psychoactive substances and alcohol [20]. According to the National Institute of Drug Abuse USA report, 2009, (http://www.drugsabuse.gov) 5,7% of students from classes 8-12 used this plant in the last year. Its main active substance is unique salvinorin A- nitrogen free κ-opioid agonist [22] which is the strongest known natural hallucinogen [23] . It is called the entheogen- something that can cause states near to 'mistic experiences'. The effects usually last about 8 minutes [24] and begins just after a few seconds from the intake. Users often describes their feelings as 'the ego dissolving', 'loss of identity', 'becoming things' (i.e. wall bed etc.), flying, floating, rushing through a tunnel. Salvinorin A can be detected in human body fluids by fluid or gas chromatography- mass spectrometry [23] .

Tabernanthe iboga- bush of tropical areas of Middle and West Africa. Its main active substance is alkaloid ibogaine. Despite of trials in using this plant in treatment of drug addiction, it has psychoactive features itself [25]. In low doses it is a stimulant, in bigger cause sleep-like states and visual disturbances called OEV and CEV (open-eye visuals and closed-eye visuals), euphoria and sometimes fear. In Gabon people use it in rituals to cause states similar to death experience. Ibogaine influences on cerebellar nucleus fastigii in a way similar to ischaemia, protecting brain against stimulating amino acids neurotoxicity for some time. Simultaneously it influences on the autonomic nervous system and circulatory system, which helps to survive the time of ischaemia [26]. Ibogaine strongly interacts with many medicaments, especially psychiatric, because it is the NMDA antagonist.

Trichocereus peruvianus- is a fast-growing Peruvian cactus native to the high parts of Andes. From hundreds of years it was used by local shamans to ritual intoxications. It contains meskaline like San Pedro, the effects are similar to those described in E. pachanoi.

All of these species, despite of their exotic origin, are available all over the world by the Internet sales. Among the plants described here the most common product ingredients are ephedra alkaloids (27%), Salvia divinorum (17%) and kava kava (10%). 64% of researched websites mentioned adverse effects, and 54% mentioned

drug interactions [36]. The findings show the lack of objective information about the products offered [37]. Moreover Internet offers thousands of pages of information how to obtain potions, extracts, identify, and ingest hallucinogens [38].

Conclusions

Plants which influence on central nervous system are still used and considered as holly in some places. *Changes in one's mental state* are parts of rituals, strongly connected to local cultures and used by specially educated shamans. Because of Western civilization's curiosity about everything exotic these plants became recreation**,** escape from everyday life problems. Sacrum changed into profanum, dangerous habit or material to make drugs like coca leaves. Valuation of toxicity of those species is not easy because they are often merged with other psychoactive substances and alcohol. Case reports do not show full image of how the substances influence on human organism, however they can show potential risk and side effects. It is worth to check researches with such data as detection active substances in human body fluids, impairing on driving ability and legal regulations [39] or negative consequences of using [40], [41].

In the time of international trade, for example via the Internet, accessibility of plants formerly considered as rare, exotic or obscure becomes wider. At the beginning of October 2010, according to the decision of Health Minister and Main Sanitary Inspector most of Polish 'smart shops' were closed. Today these shops are beyond the country borders and they sell their articles by mail-order. Despite of changes in the Act on Counteracting Drug Addiction (29.07.2005) it is still possible to buy the plants described in this article or other species which are not delegalized and cause similar effects. In patients with rich history of different drugs abuse we should ask not only about the well known drugs but also remember about other plants and substances. The plant species described above can strongly influence on the central nervous system, cause intoxications and interact with prescribed medications. Perhaps more frequent question about the 'narcotic plants' would widespread medical knowledge about enigmatic plant species and help us to evaluate good diagnostic methods and treatment standards.

References

1. Borsutzky M, Passie T, Paetzold W, Emrich HM, Schneider U. *Hawaiian baby woodrose: (Psycho-) pharmacological effects of the seeds of Argyreia nervosa. A case-orientated demonstration*. Nervenarzt. 2002; 73(9): 892–6.
2. Klinke HB, Müller IB, Steffenrud S, Dahl-Sørensen R. *Two cases of lysergamide intoxication by ingestion of seeds from Hawaiian Baby Woodrose*. Forensic Sci Int. 2010; 197: 1–3
3. Callaway JC, Brito GS & Neves ES. *Phytochemical analyses of Banisteriopsis caapi and Psychotria viridis*. Journal of Psychoactive Drugs 2005; 37(2): 145–150.
4. O'Mahony Carey S. *Psychoactive Substances Manual (Edition 1.1)*. South Tipparary, UK: Health Service Executive; 2010.
5. Hassan NA, Gunaid AA, El-Khally FM, Murray-Lyon IM. *The effect of chewing Khat leaves on human mood*. Neurosciences 2002; 7(3): 184–187.

6. Corkery JM, Schifano F, Oyefeso A, Ghodse AH, Tonia T, Naidoo V, Button J. *Overview of literature and information on „khat-related" mortality: a call for recognition of the issue and further research*; Ann Ist Super Sanita. 2011;47(4): 445–64.
7. Nicasio Mdel P, Villarreal ML, Gillet F, Bensaddek L, Fliniaux MA. *Variation in the accumulation levels of N,N-dimethyltryptamine in micropropagated trees and in in vitro cultures of Mimosa tenuiflora*. Nat Prod Res. 2005; 19(1): 61–7.
8. Strassman RJ. *DMT*: The Spirit Molecule: *A Doctor's Revolutionary Research into the Biology of Near-Death and Mystical Experiences*. Rochester, USA: Park Street Press; 2001
9. Adkins JE, Boyer EW, McCurdy CR. *Mitragyna speciosa, a psychoactive tree from Southeast Asia with opioid activity*. Curr Top Med Chem. 2011; 11(9): 1165–75.
10. Babu KM, McCurdy CR, Boyer EW. *Opioid receptors and legal highs: Salvia divinorum and Kratom.* Clin Toxicol 2008; 46: 146–152.
11. Philipp AA, Meyer MR, Wissenbach DK, Weber AA, Zoerntlein SW, Zweipfenning PG, Maurer HH. *Monitoring of kratom or Krypton intake in urine using GC-MS in clinical and forensic toxicology*; Anal Bioanal Chem. 2011 Apr;400(1): 127–135. Epub 2010 Dec 12.
12. McWhirter L, Morris S. A case report of inpatient detoxification after kratom (Mitragyna speciosa) dependence. Eur Addict Res. 2010; 16(4): 229–31.
13. Ma W, Lu Y, Hu R, Chen J, Zhang Z, Pan Y. *Application of ionic liquids based microwave-assisted extraction of three alkaloids N-nornuciferine, O-nornuciferine, and nuciferine from lotus leaf*. Talanta. 2010; 80(3): 1292–7.
14. Herraiz T, González D, Ancín-Azpilicueta C, Arán VJ, Guillén H. *Beta-Carboline alkaloids in Peganum harmala and inhibition of human monoamine oxidase (MAO)*. Food Chem Toxicol. 2010; 48(3): 839–43.
15. Hemmateenejad B, Abbaspour A, Maghami H, Miri R, Panjehshahin MR. *Partial least squares-based multivariate spectral calibration method for simultaneous determination of beta-carboline derivatives in Peganum harmala seed extracts*. Anal Chim Acta. 2006; 575 (2): 290–9.
16. Nerurkar PV et al. *In vitro toxicity of kava alkaloid, pipermethystine, in HepG2 cells compared to kavalactones*. Toxicological Sciences 2004; 79(1): 106–111.
17. Rowe A, Zhang LY, Ramzan I. *Toxicokinetics of kava*. Adv Pharmacol Sci. 2011; 2011: 326724.
18. Pavarin RM. *Substance use and related problem: a study on the abuse of recreational and not recreational drugs in Northern Italy*. Ann Ist Super Sanita 2006; 42: 477–484.
19. González D, Riba J, Bouso JC, Gómez-Jarabo G, Barbanoj MJ. *Pattern of use and subjective effects of Salvia divinorum among recreational users*. Drug Alcohol Depend 2006; 85: 157–162.
20. Lange JE, Reed MB, Croff JM, Clapp JD. *College student use of Salvia divinorum*. Drug Alcohol Depend 2008; 94: 263–266.
21. Schmidt MM, Sharma A., Schifano F, Feinmann C. *"Legal highs" on the net – Evaluation of UK-based Websites, products and product information.* Forensic Sci Int 2010, doi: 1016/j. forsciint. 2010.06.030.
22. Cunningham CW, Rothman RB, Prisinzano TE. *Neuropharmacology of the naturally occurring (kappa) – opioid hallucinogen salvinorin* A. Pharmacol Rev. 2011; 63(2): 316–47.
23. Zawilska JB, Wojcieszak J, Kuna P. *Salwinoryna A*: *działania farmakologiczne, konsekwencje kliniczne. Farmakoterapia w psychiatrii i neurologii.* 2010; 2: 91–100.
24. Lange JE, Daniel J, Homer K, Reed MB, Clapp JD. *Salvia divinorum: effects and use among YouTube users*. Drug Alcohol Depend. 2010; 108(1–2): 138–40.
25. Maciulaitis R, Kontrimaviciute V, Bressolle FM, Briedis V. *Ibogaine, an anti-addictive drug: pharmacology and time to go further in development. A narrative review*. Hum Exp Toxicol. 2008; 27(3): 1 81–94.

26. Strubelt S, Maas U. *The near-death experience: a cerebellar method to protect body and soul -lessons from the Iboga healing ceremony in Gabon*. Altern Ther Health Med. 2008; 14(1): 30–4.
27. Carstairs SD, Cantrell FL. *Peyote and mescaline exposures: a 12-year review of a statewide poison center database.* Clin Toxicol (Phila). 2010; 48(4): 350–353.
28. Nelsen JL, Lapoint J, Hodgman MJ, Aldous KM. *Seizure and coma following Kratom (Mitragynina speciosa Korth) exposure*. J Med Toxicol. 2010; 6(4): 424–426.
29. Nasehi M, Piri M, Nouri M, Farzin D, Nayer-Nouri T, Zarrindast MR. I*nvolvement of dopamine D1/D2 receptors on harmane-induced amnesia in the step-down passive avoidance test*. Eur J Pharmacol. 2010; 634(1–3): 77–83.
30. Frison G, Favretto D, Zancanaro F, Fazzin G, Ferrara SD. A case of beta-carboline alkaloid intoxication following ingestion of Peganum harmala seed extract. Forensic Sci Int. 2008; 179(2-3): 37–43.
31. Yuruktumen A, Karaduman S, Bengi F, Fowler J. *Syrian rue tea: a recipe for disaster*. Clin Toxicol (Phila). 2008; 46(8): 749–52.
32. Fu PP, Xia Q, Guo L, Yu H, Chan PC. *Toxicity of kava kava*. J Environ Sci Health C Environ Carcinog Ecotoxicol Rev. 2008; 26(1): 89–112.
33. Baggott MJ, Erowid E, Erowid F, Galloway GP, Mendelson J. *Use patterns and self-reported effects of Salvia divinorum: An internet-based survey*. Drug Alcohol Depend. 2010; 111(3): 250–256.
34. Maas U, Strubelt S. *Fatalities after taking ibogaine in addiction treatment could be related to sudden cardiac death caused by autonomic dysfunction*. Med. Hypotheses. 2006; 67 (4): 960–964.
35. Piekoszewski W, Florek E. *Dopalacze*. Przegl. Lek. 2009;66 (10): 861–865.
36. Dennehy CE, Tsourounis C, Miller AE. *Evaluation of herbal dietary supplements marked on the internet for recreational use*. Ann Pharmacother 2005; 39: 1634–1639.
37. Hillebrand J, Olszewski D, Sedefov R. *Legal highs on the Internet*. Subst Use Misuse 2010 Feb; 45(3): 330–40.
38. Halpern JH, Pope HG Jr. *Hallucinogens on the Internet: a vast new source of underground drug information*. Am J Psychiatry 2001; 158: 481–483.
39. Kała M; *Drugs scene in Poland from a forensic toxicologist's view*; Przegl Lek. 2010; 67(8): 594–597.
40. Zawilska JB. ."Legal highs" – new players in the old drama. Curr Drug Abuse Rev. 2011 Jun 1; 4(2): 122–130
41. Carod Artal FJ; *Neurological syndromes associated with the ingestion of plants and fungi with a toxic component (II). Hallucinogenic fungi and plants, mycotoxins and medicinal herbs*. Rev Neurol. 2003 May 16-31; 36(10): 951–960.

Correspondence address:
Katarzyna Simonienko
Department of Psychiatry, Medical University of Białystok,
Plac Brodowicza 1, 16-070 Choroszcz, Poland;
e-mail: k_simonienko@wp.pl

TABLES

Table 1. **The expected psychoactive effects and complications which can occur after intake of the drug plants**

Plant's latin name	Expected psychoactive effects	Psychic side effects	Somatic side effects
Argyreia nervosa	euphoria, stimulation, verbosity	anxiety, abstractive perception of the reality, visual and auditory hallucinations, lack of contact with body and surrounding	nausea, vomiting
Banisteropsis caapi	sedation, euphoria	hallucinations	nausea, vomiting, diarrhea, circulatory system disturbances, malignant hypertension, serotonin syndrome
Calea zacatechichi	remembering dreams	hallucinations	nausea, vomiting
Catha edulis	stimulation, euphoria, loss of hunger, fatigue, escalates concentration	unpredicted behaviours, hallucinations, mood disturbances, insomnia	tachycardia, hypertension, high body temperature, pupils dilatation, constipation, liver damage, death
Echinopsis pachanoi	visual and auditory hallucinations, changes of perception	hallucinations, stimulation	tachycardia, pupils dilatation [27], sweating, stomach aches, vomiting, diarrhea
Leonotis leonurus	sedation, euphoria	excessive sedation	visual disturbances, dizziness, nausea, sweating, hypotension
Mimosa tenuiflora	hallucinations, usually merged with iMAO	hallucinations	hypertension, tachycardia, hyperthermia, elevated level of β-endorphines, corticotropiny, cortisol, prolactin, grow hormone [8]
Mitragyna speciosa	stimulation or sedation according to doses, euphoria, hallucinations	psychoses, fast adaptation to doses, insomnia, anxiety, tenseness, anorexia	hypotension, vomiting, breathing and movement disturbances after higher doses, intestinal atony, skin darkening (especially cheeks), tremour, sweating, jaundice, itching, convulsions, coma [28]
Nymphaea caerulea	sedation, euphoria, closed eyes visuals (CEV)	significantly slower reactions	excessive miorelaxation, inarticulate speech

table continued on next page

Peganum harmala	stimulation, euphoria	hallucinations, memory disturbances [29], stimulation [30]	lack of consciousness, hypertension, tachycardia, tachypnoe [31], vomiting, convulsions, kidneys and liver disfunction
Piper methysticum	sedation, hypnotic, anxiolytic and slightly euphorising effects	sedation	liver and kidneys disfunction, body mass reduction, rash, pulmonary hypertension, erytrocytes macrosytosis and lowering of blood platelets volume [32]
Psychotria viridis	all senses hallucinations, usually merged with iMAO	hallucinations	like Mimosa tenuiflora
Rivea corymbosa	euphoria, stimulation, verbosity	like A. nervosa	like A. nervosa
Salvia divinorum	perception changes, consciousness disturbances, visual and tactile hallucinations	hallucinations, anxiety, [33], panic, lack of control over body and behaviour, intensification of negative emotions	sweating, headaches, dizziness, palpitation [23].
Tabernanthe iboga	stimulation or sedation according to doses closed and opened eses Visual (CEV and OEV)	anxiety, feeling of dying	ataxia, dry mouth feeling, nausea, vomiting, QT interval elongation [34] , ventrical tachycardia
Trichocereus peruvianus	vsual and tactile hallucinations, perceptron changes	like E. pachanoi	like E. pachanoi

Table 2. **Psychoactive substances contained in plant products and their pharmacological activity**

Plant's latin name	Main psychoactive substances	Main pharmacological actions
Argyreia nervosa	Ergine (LSA)	5-HT2A agonist
Banisteropsis caapi	harmine, harmaline, tetrahydroharmine	iMAO
Calea zacatechichi	caleicines, akacetin, caleochromenes A and B [35]	more research needed
Catha edulis	cathinone	induces the release of dopamine
Echinopsis pachanoi	mescaline	5-HT2A partial agonist
Leonotis leonurus	leonithine, leonurine, marrubine, premarrubine	More research needed
Mimosa tenuiflora	dimethyltryptamine (DMT), yuremamine	5-HT, D_1, α_1, α_2-adrenergic agonist

table continued on next page

Mitragyna speciosa	mitragynine (MG), paynantheine (PAY), speciogynine (SG), speciociliatine (SC), 7-hydroxymitragynine	opioid agonist
Nymphaea caerulea	nufarine,nymphaline, aporphine, nuciferine	dopamine agonist
Peganum harmala	harmaline, harmine, harmalol, harman	iMAO
Piper methysticum	kavalaktones: desmethoxyyangonine	potentiate GABA A activity, reversible iMAO-B
Psychotria viridis	DMT, alkaloidy β-karbolinowe	agonista receptorów 5-HT, D_1, α_1, α_2-adrenergicznych
Rivea corymbosa	ergine (LSA)	5-HT2A agonist
Salvia divinorum	salwinorin A	K-opioid agonist
Tabernanthe iboga	ibogaine	NMDA antagonist
Trichocereus peruvianus	mescaline	5-HT2A partial agonist