

Review Article

Plants and Plant Products with Potential Anticonvulsant Activity – A Review

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ABSTRACT: Epilepsy is a chronic and often progressive disorder characterized by the occurrence of epileptic seizures, affecting about 50 million people worldwide. The prescribed synthetic drugs for the treatment of epilepsy are associated with severe side effects and addiction liabilities upon long term uses. Thus, researchers around the globe are searching for newer, effective and safer drugs from natural resources. The present review emphasizes pharmacological reports on anticonvulsant plants, plant products and formulations. Various chemical constituents (with structures) isolated from different plants responsible for anticonvulsant activity and their possible mechanism of actions have been incorporated in this review. The review has been compiled using references from major databases like Chemical Abstracts, Medicinal and Aromatic Plants Abstracts, PubMed, Scirus, Google scholar, Open J Gate, Scopus, Science Direct and Online Journals, and includes 599 references. Preliminary anticonvulsant activity studies have been carried out on crude extracts of traditionally used and medicinally promising plants. Such plants need to be explored properly with a view to isolate anticonvulsant constituents, and to evaluate their possible mode of actions.

KEYWORDS: Anticonvulsant activity, chemical constituents, mechanism of action, pharmacology

INTRODUCTION

Epilepsy: An Overview

Epilepsy is the second most common neurological disorder after stroke, affecting at least 50 million persons worldwide.^[1] Epilepsy shows a prevalence rate in 1-2% of the world population.^[2] It affects an estimated 7 million people in India and 50 million worldwide, approximately 40% of them are women. The prevalence of epilepsy is 0.7% in India and higher in tropical/subtropical countries, particularly in South Africa. In developed countries where drugs are easily available, epilepsy responds to treatment in up to 70% of the patients. However, in developing countries 75% of people with epilepsy do not receive effective treatment. It is estimated that up to 5% of people suffer at least one seizure in their lifetime.

Epilepsy is a chronic and often progressive disorder characterized by the periodic and unpredictable occurrence of epileptic seizures, i.e., involuntary contraction of striated muscle repeatedly. Convulsion arises due to sudden excessive and rapid discharge of cerebral neurons in the grey matter of the brain.

Classification of seizures

1. Partial seizures (Focal or local seizures)

a. **Simple partial seizures:** These have various manifestations, without impairment of consciousness.^[3,4] They may include convulsion confined to a single limb or muscle group (Jacksonian motor epilepsy), specific and localized sensory disturbances (Jacksonian sensory epilepsy) and other limited signs and symptoms depending upon the particular cortical area producing the abnormal discharge.

b. **Complex partial seizures:** These attacks result in confused behavior, with impairment of consciousness.^[3,4] They have a wide variety of clinical manifestations associated with bizarre generalized EEG activity during

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the seizure but with evidence of anterior temporal lobe focal abnormalities even in the interseizure period in many cases.

2. Generalized seizures (Convulsive or non convulsive)

a. Absence seizures

i. **Atypical absence seizures:** Such attacks have a slower onset and cessation than is usual for absence seizures and are associated with a more heterogeneous EEG.^[3,4]

ii. **Typical absence seizures:** These seizures are brief and abrupt.^[3,4] The resultant loss of consciousness is associated with high-voltage, bilaterally synchronous, 3-per-second spike-and-wave pattern in the EEG, usually with some symmetrical clonic motor activity varying from eyelid blinking to jerking of the entire body, sometimes with no motor activity.

b. **Myoclonic seizures:** These are isolated clonic jerks associated with brief bursts of multiple spikes in the EEG.^[3,4]

c. **Clonic seizures:** These are rhythmic clonic contractions of all muscles.^[3,4] They result in loss of consciousness and marked autonomic manifestations.

d. **Tonic seizures:** Tonic seizures are opisthotonus and result in a loss of consciousness and marked autonomic manifestations.^[3,4]

e. **Tonic-clonic (grand mal) seizures:** These are major convulsions, usually a sequence of maximal tonic spasms of all body musculature, followed by synchronous clonic jerking and a depression of all central functions.^[3,4]

f. **Atonic seizures:** These are characterized by loss of postural tone, sagging of the head and/or falling.^[3,4]

Neurochemistry and targets to treat epilepsy

The neurochemistry of the seizure disorder is complex and not yet understood. However, it is believed that at least two neurotransmitters play a major role in epileptic seizures:^[5]

Acetylcholine serves as an excitatory, while dopamine (DA) acts as an inhibitor. DA is an inhibitor of epileptic attacks is based upon the following findings:^[5]

1. Pretreatment with d-amphetamine diminished the incidence of epileptic attacks among audiogenic mice.

2. Amphetamine enhance audiogenic seizure while (–) dopa blocks the effect of d-amphetamine.
3. Dopaminergic agonists cause a delay in the audiogenic seizure of mice and a suitable delay in the photogenic seizures of *Papio papio*.

Epilepsy may result from long lasting plastic changes in the brain affecting neurotransmitters release and transport, the properties of receptors and channels, regulation of gene expression, synaptic reorganization and astrocyte activity.^[6] Initially, it was considered that ion channel alterations may cause the onset of the paroxysmal depolarization shifts that initiate epileptic activity. Recent studies on synaptic and nonsynaptic transmission, ion channels interactome, intracellular signalling pathways and glia-neuron signalling suggest that many neurochemical pathways play an important role in seizure initiation, maintenance and arrest.

Antiepileptic drugs may act by:^[6]

1. modifying excitatory and inhibitory neurotransmission through effects on voltage gated ion channels, GABA(A) receptors and glutamate mediated excitatory neurotransmission,
2. normalizing biochemical and morphological changes involved in the normal function of neuronal networks such as increased excitatory activity in the presynaptic neuron, calcium influx, phosphatases or protein kinase activation, phosphorylation and dephosphorylation of receptors, ion channels and other proteins, cytoskeletal changes, and mobilisation of receptors and ion channels,
3. potentiating GABA neurotransmission through inhibiting calcineurin (protein phosphatase 2B),
4. diminishing activation of NMDA extrasynaptic receptors and
5. inhibiting activation of extracellular regulated kinase and p38 α mitogen activated protein kinase pathways.

Experimental models used for convulsion studies

Innumerable *in vitro* and *in vivo* models of seizures have been described over the years.^[7] The *in vitro* models include brain slices, monosynaptic system and neuronal culture. The *in vivo* models employ diverse animal species like mice, rats, guinea pigs, cats, dogs, monkeys etc. and use different physical and chemical/pharmacological stimuli to induce seizures. Various experimental models used to assess anticonvulsant potential of drugs have been shown in figure 1.

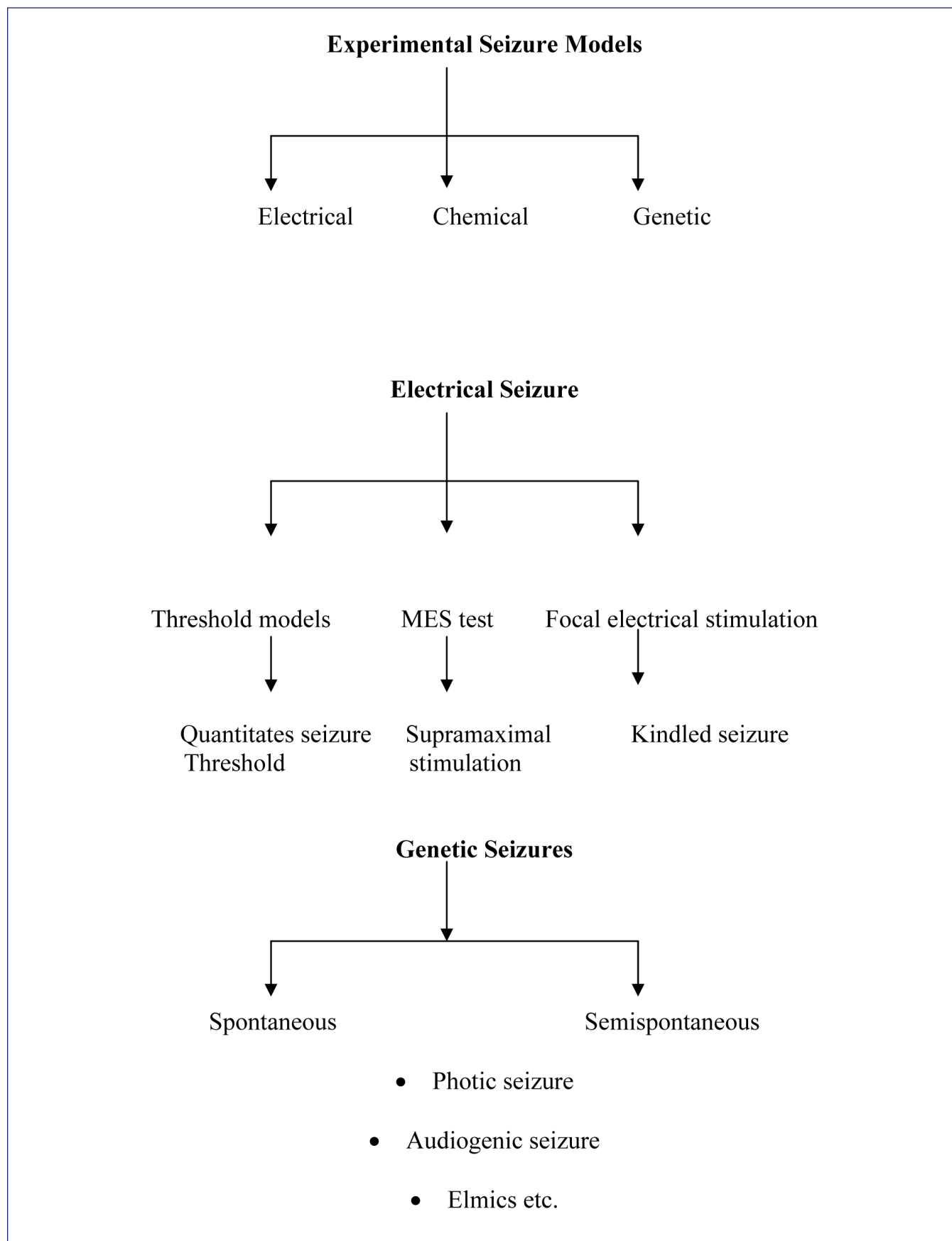
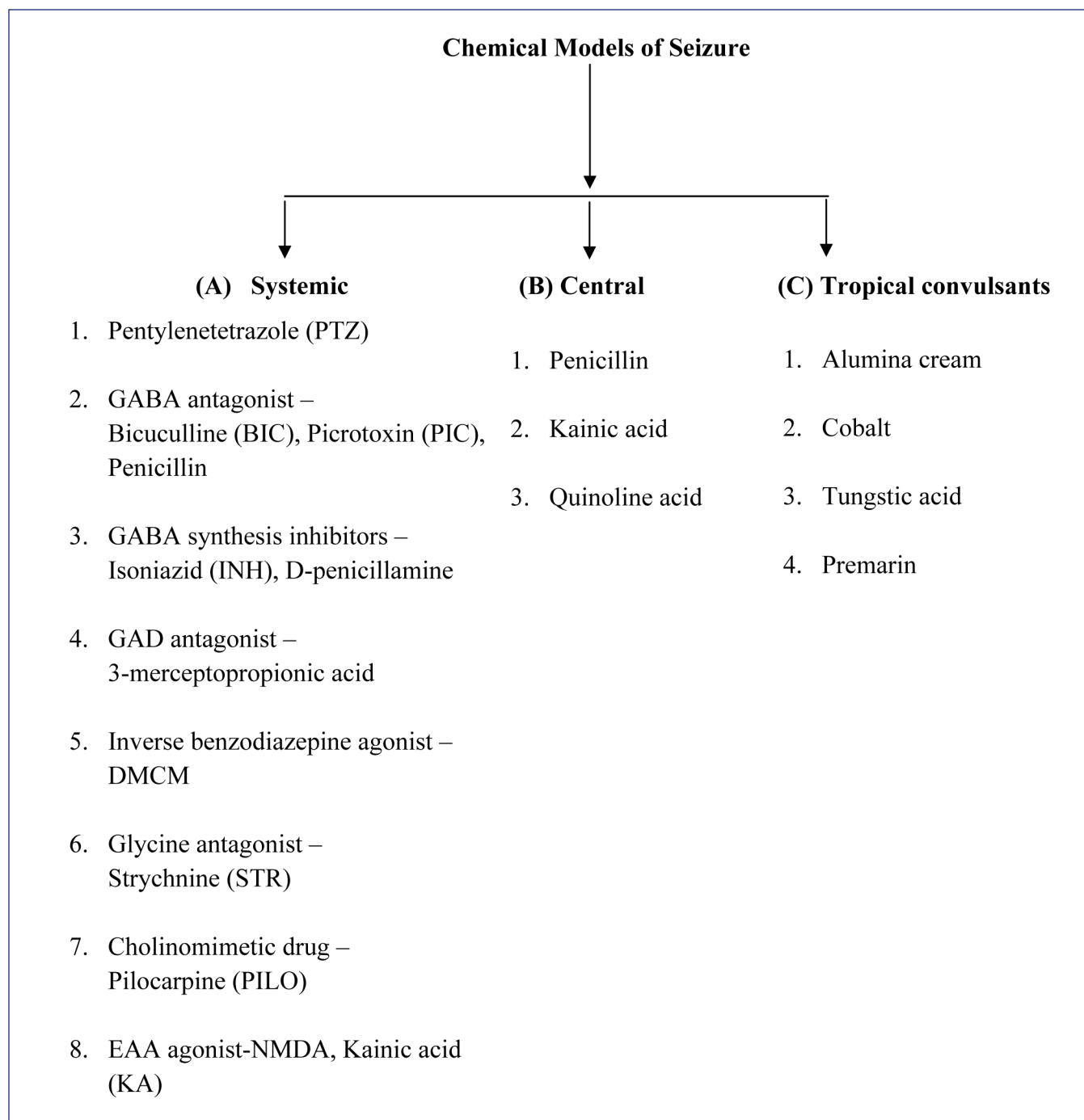


Figure 1: Schematic representation of various experimental models used for assessing anticonvulsant potential of drugs.

**Figure 1:** (Continued)

PLANTS HAVING ANTICONVULSANT ACTIVITY

A thorough survey of literature reveals that a number of plants such as *Acorus calamus*, *Crocus sativus*, *Emblica officinalis*, *Ginkgo biloba*, *Hypericum perforatum*, *Matricaria recutita*, *Panax ginseng*, *Passiflora incarnata*, etc. have been reported to exhibit anticonvulsant activity. Table 1 shows anticonvulsant activity reports on such plants, and information covered include biological source (botanical

name, family and common names) of plant, extract/fraction/isolate of plant part used, bioactive dose, route of administration, animals/human beings, experimental model/clinical parameters assessed and mode of actions (if reported). Various classes of phytoconstituents such as alkaloids, lipids, terpenes, triterpenoids, flavonoids and coumarins have been reported to possess anticonvulsant activity. Anticonvulsant activity reports on such classes of phytoconstituents have been depicted in table 2. The

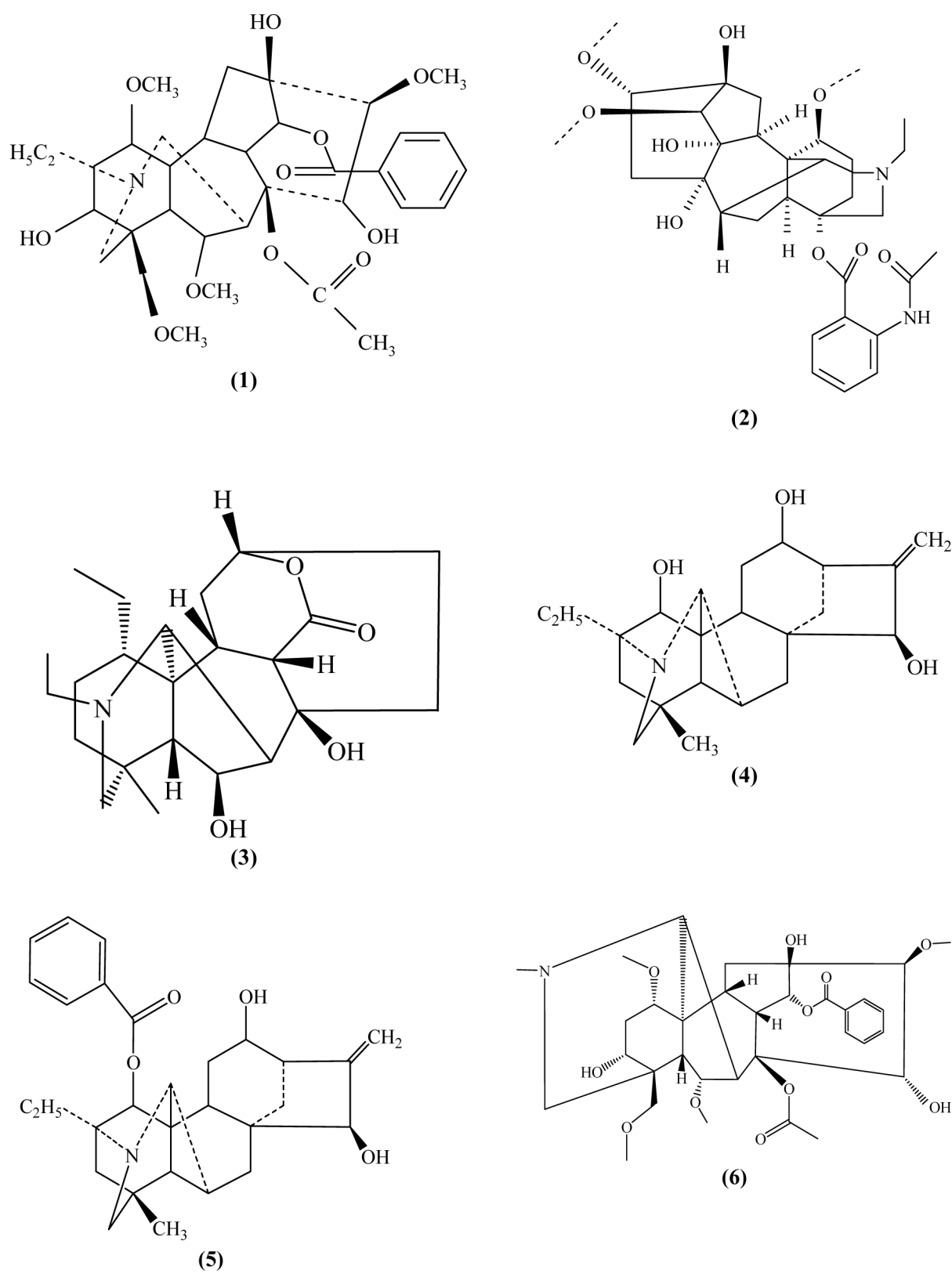


Figure 2: Structures of phytoconstituents reported to possess anticonvulsant activity.

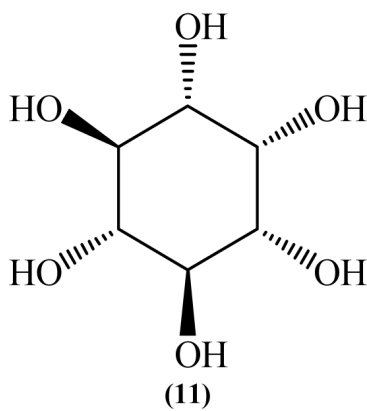
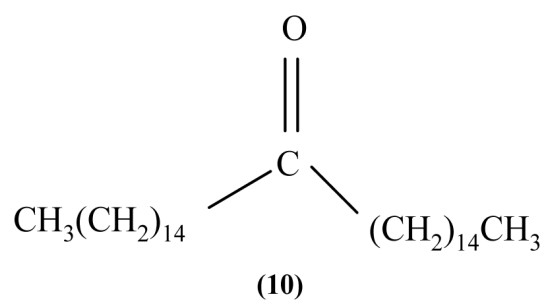
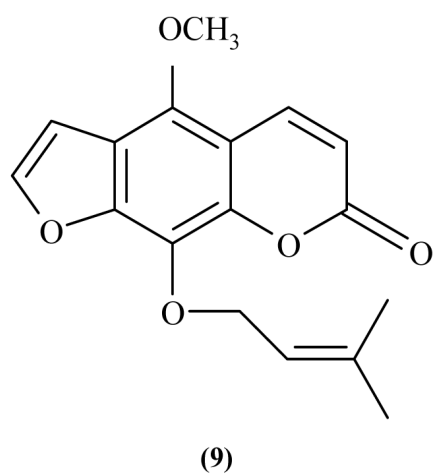
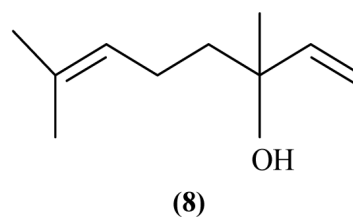
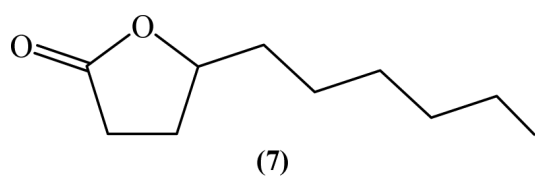


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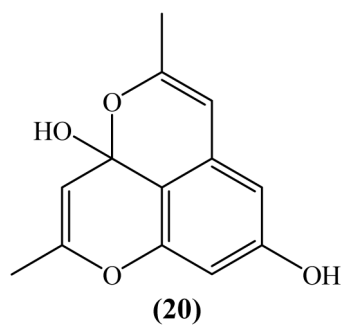
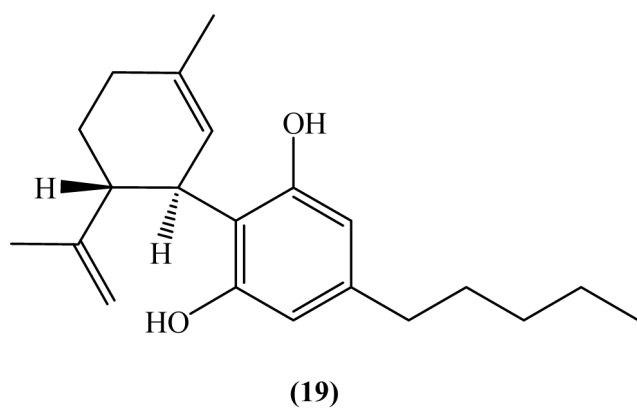
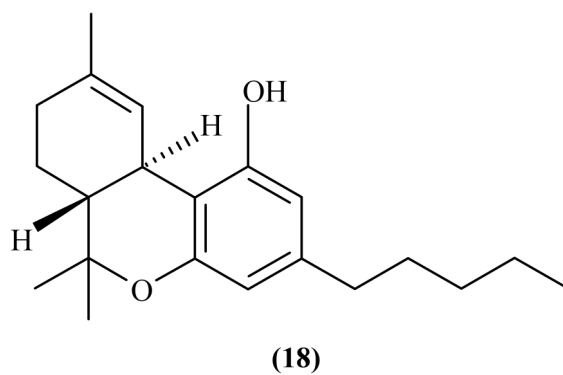
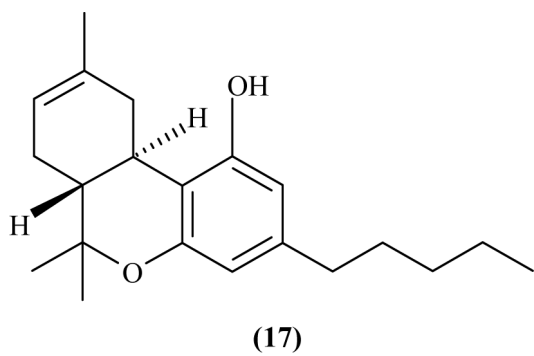
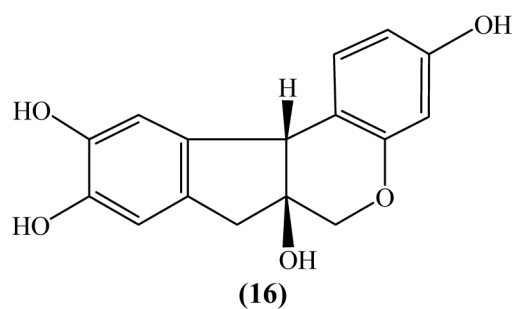
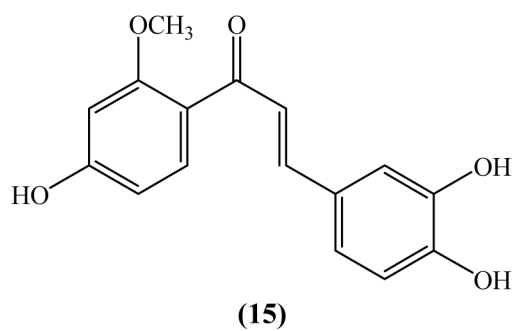
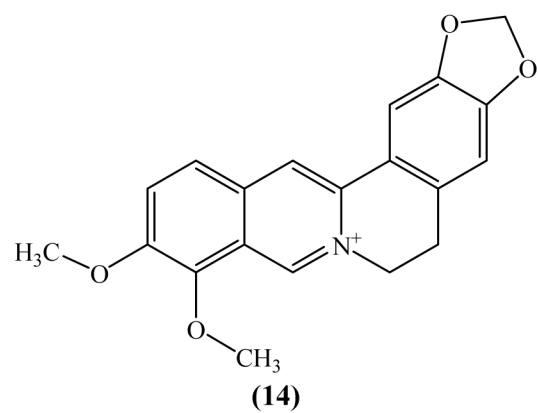
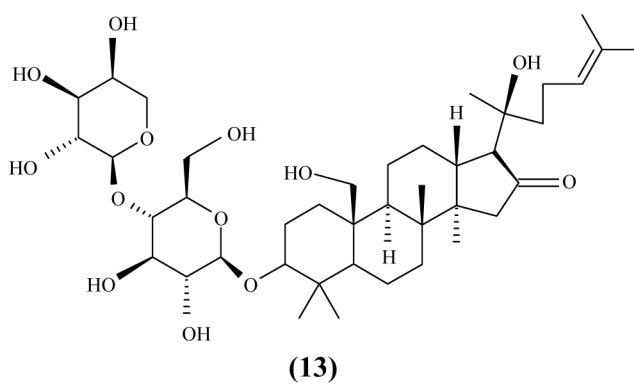


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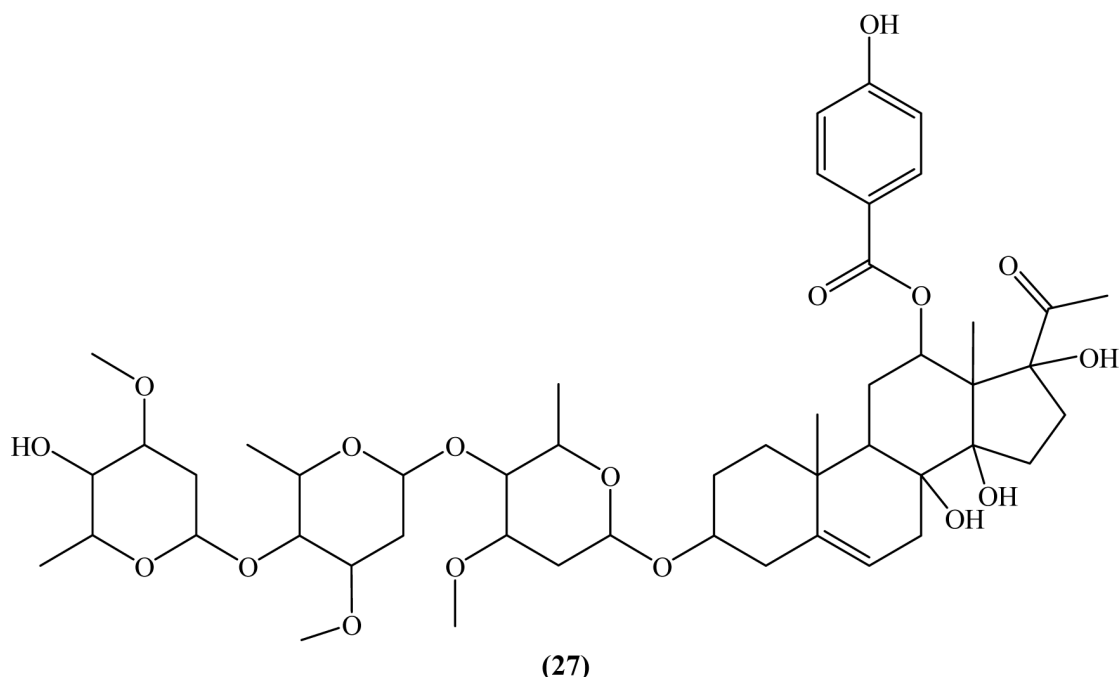
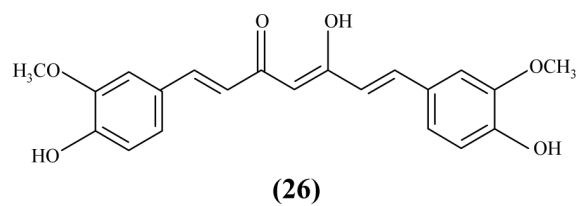
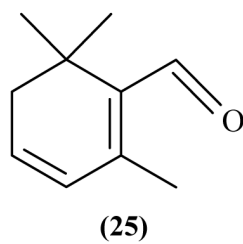
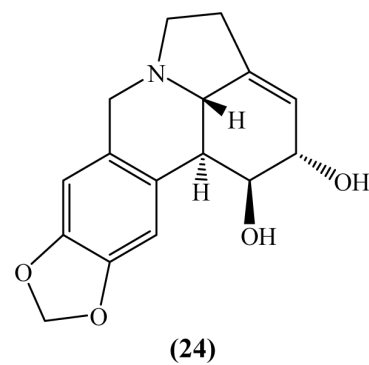
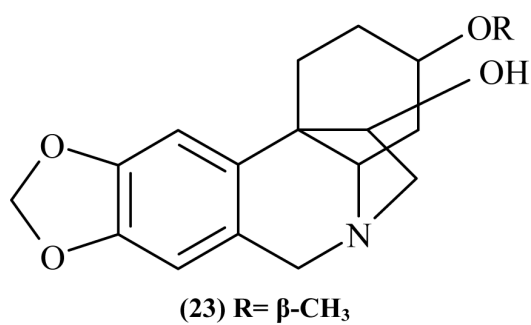
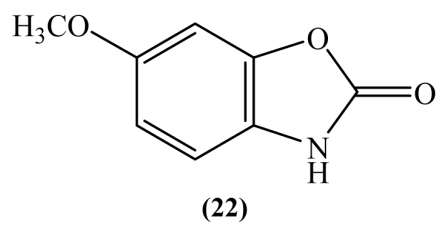
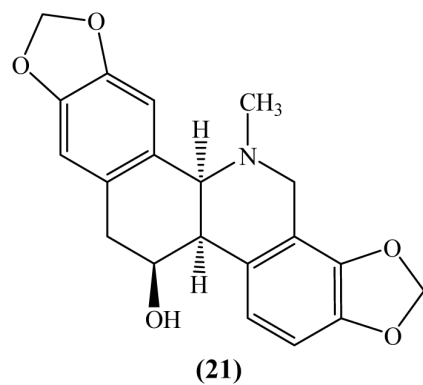
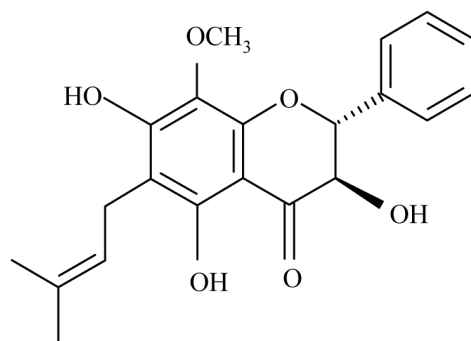
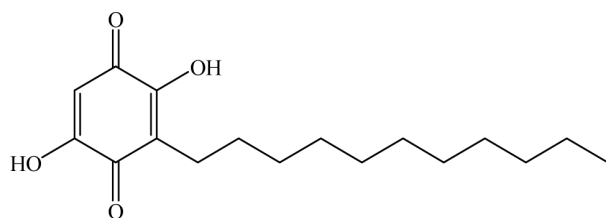


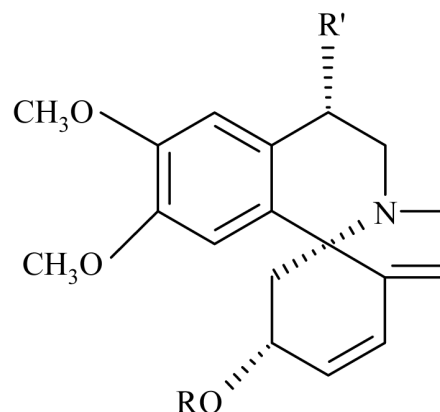
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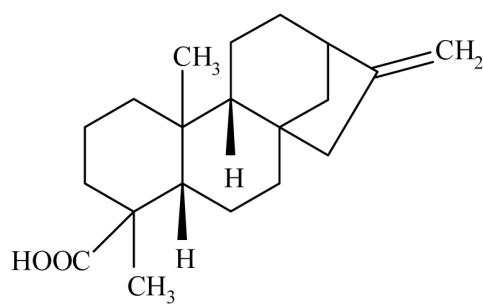
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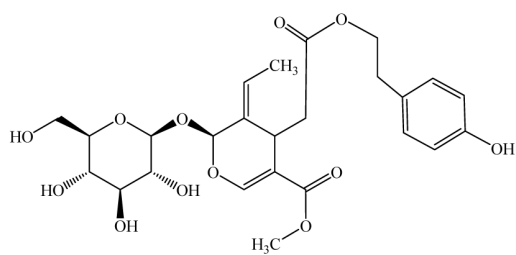
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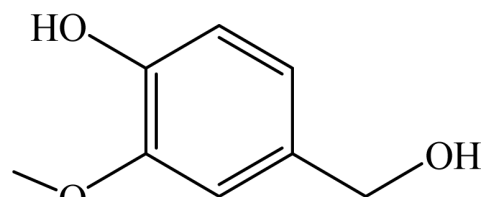
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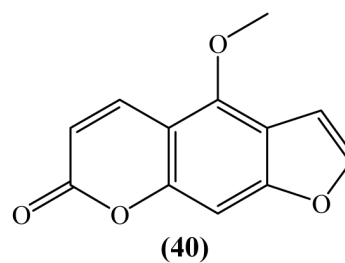
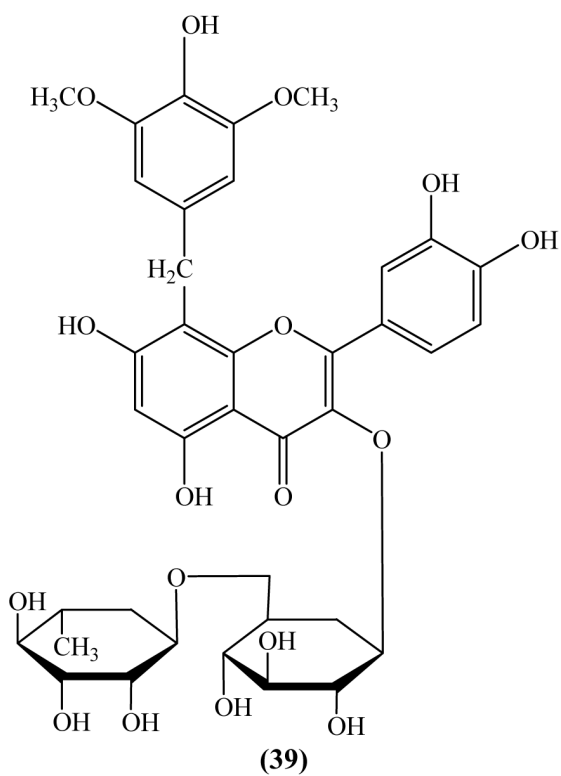
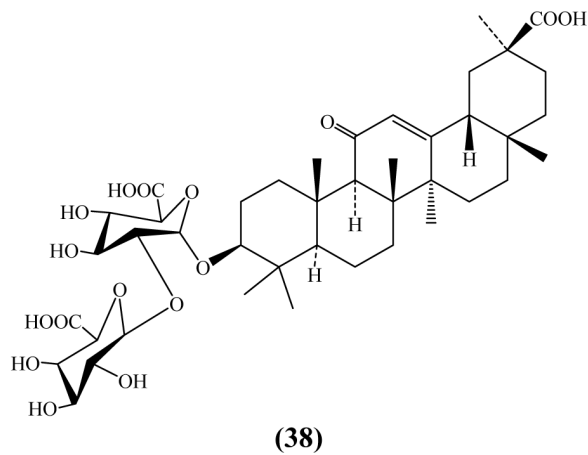
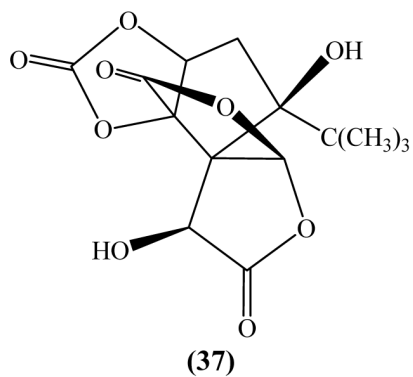
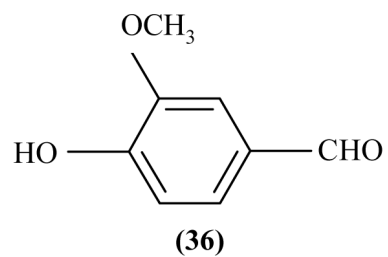
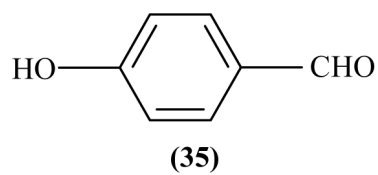


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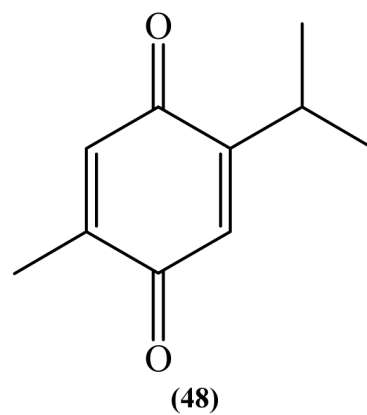
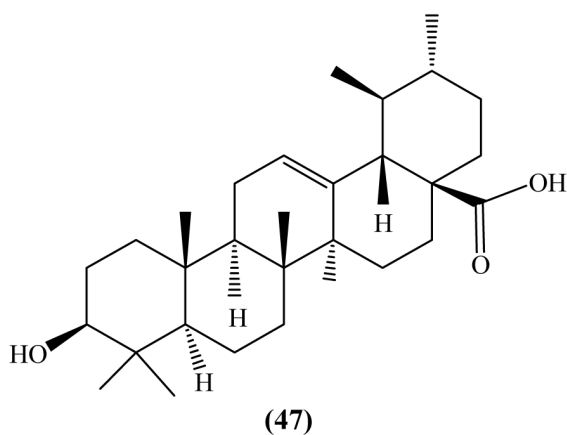
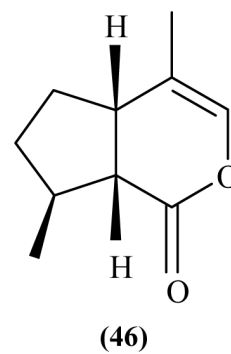
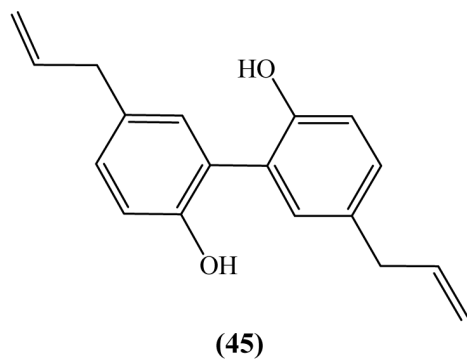
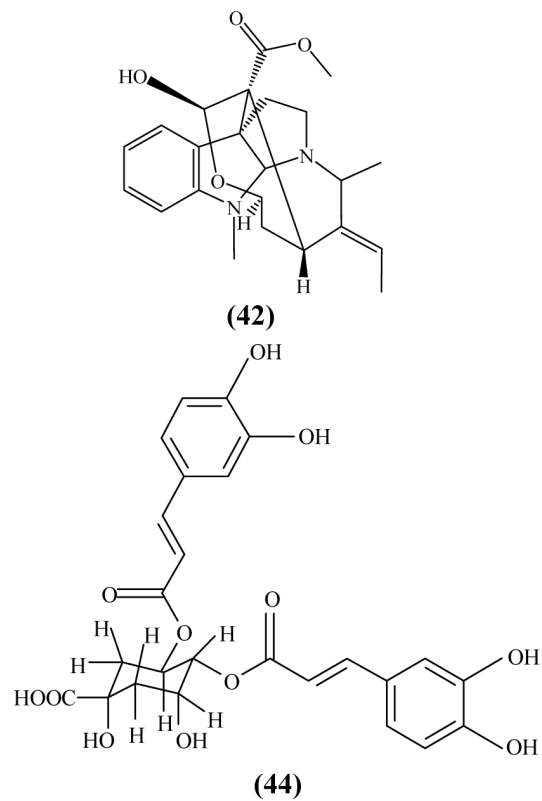
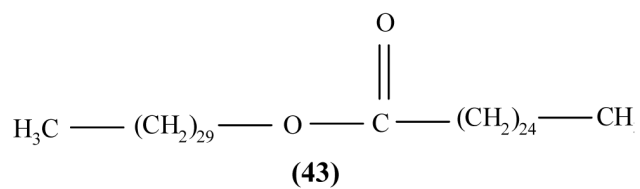
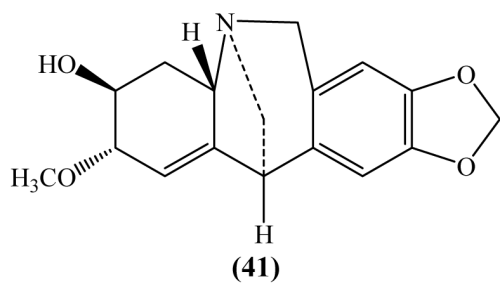
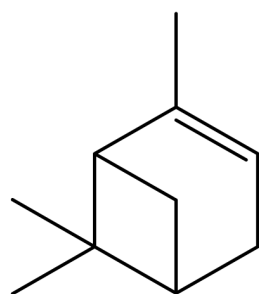
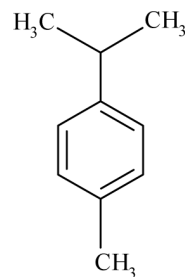


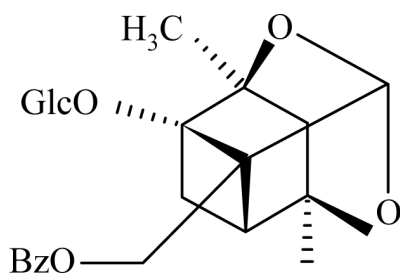
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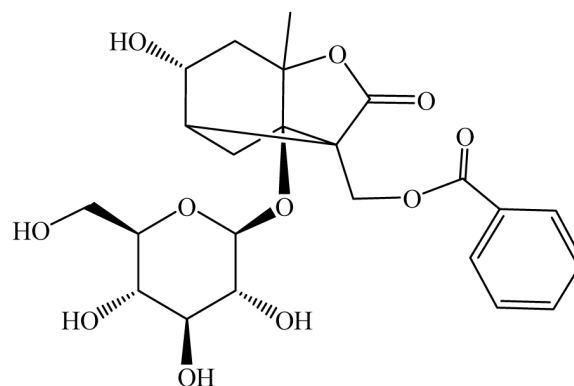
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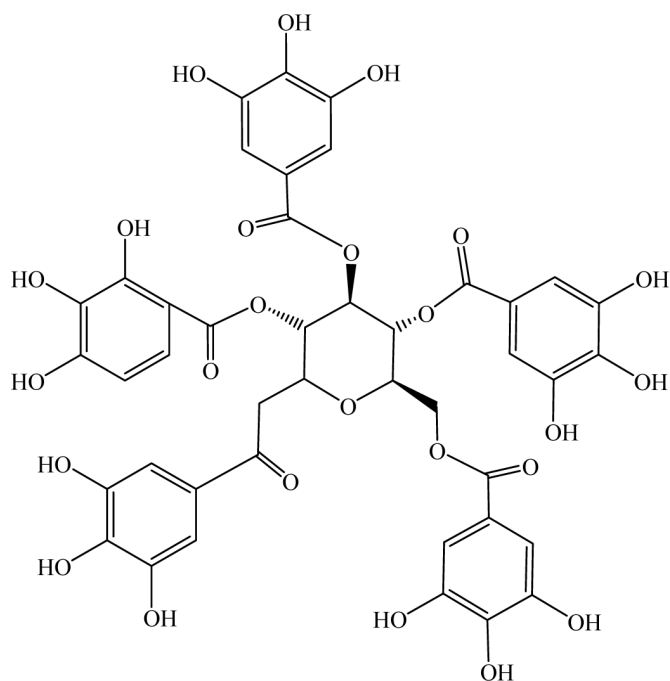
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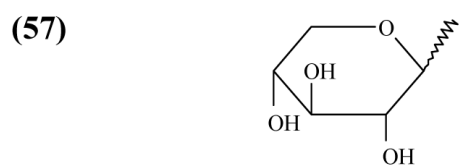
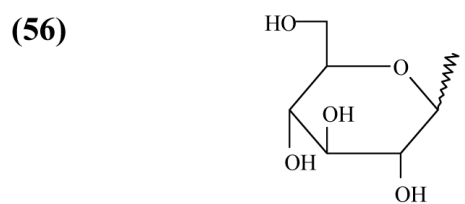
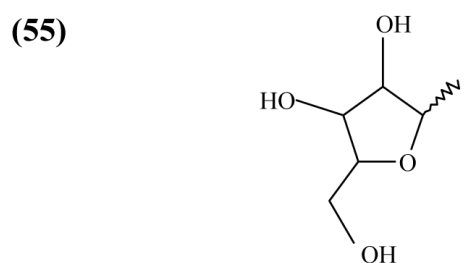
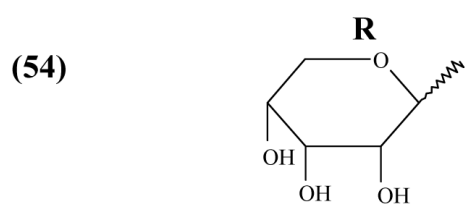
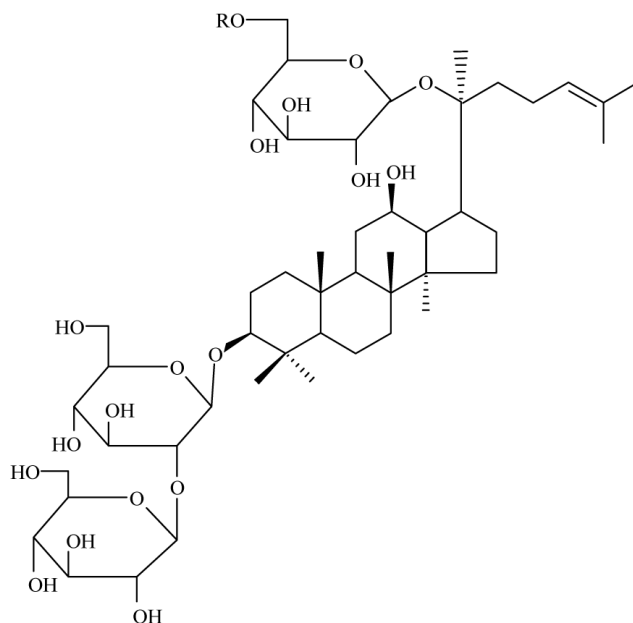
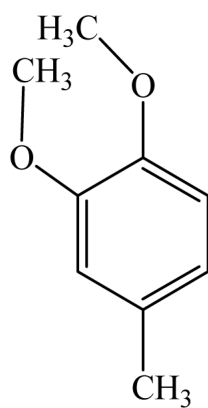
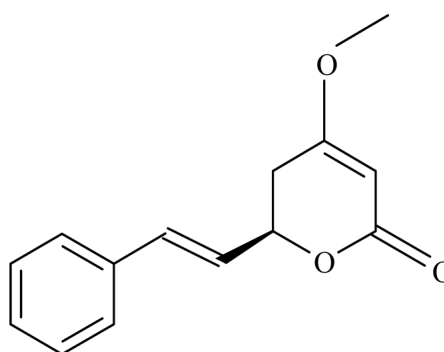


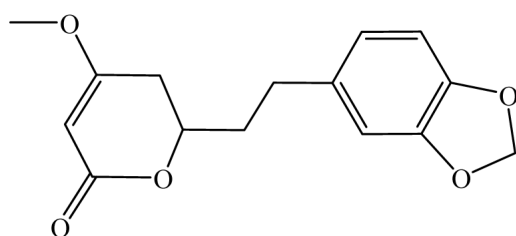
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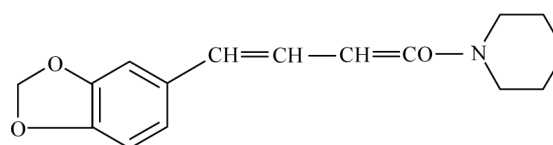
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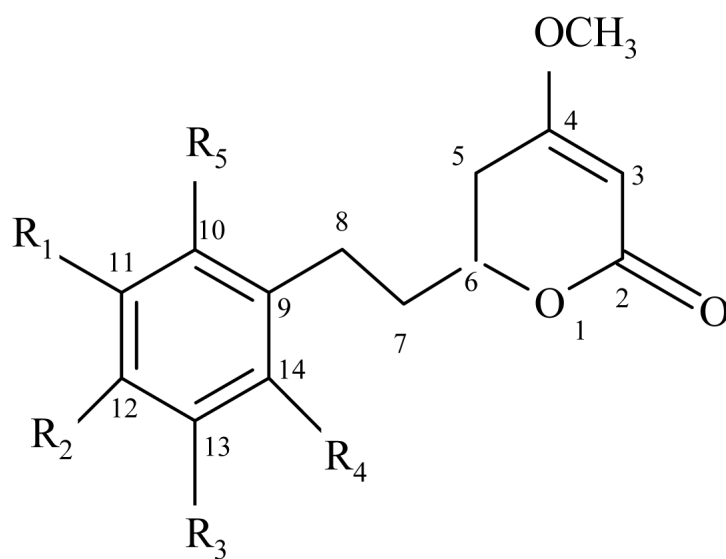
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(62)



	R₁	R₂	R₃	R₄	R₅	C₅-C₆	C₇-C₈
(63)	OCH ₂ O		H	H	H	=	
(64)	OCH ₂ O		H	OCH ₃	H	=	
(65)	OCH ₂ O		H	H	OCH ₃	=	
(66)	OCH ₂ O		H	H	H	=	=
(67)	OCH ₂ O		H	OCH ₃	H	=	=
(68)	OCH ₂ O		H	H	H	=	=
(69)	OCH ₃	OCH ₃	H	H	H	=	OCH ₃

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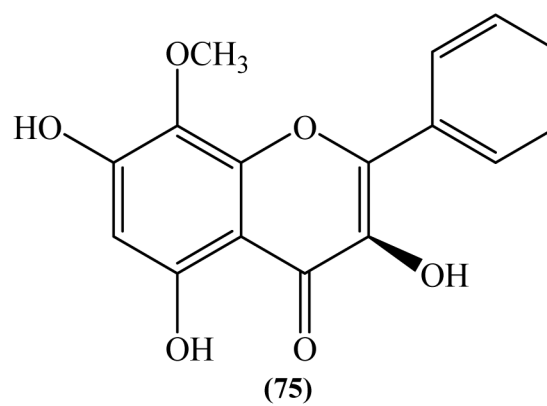
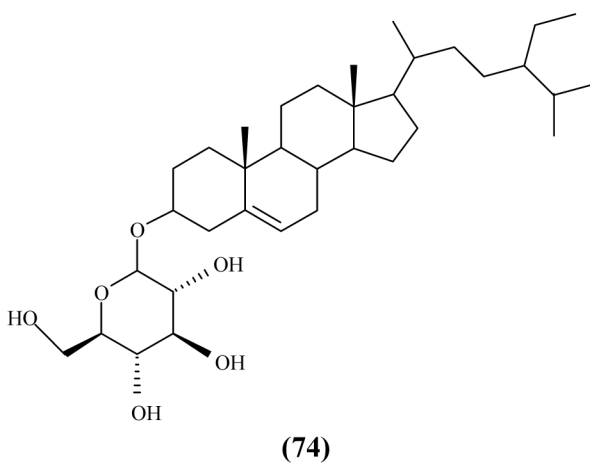
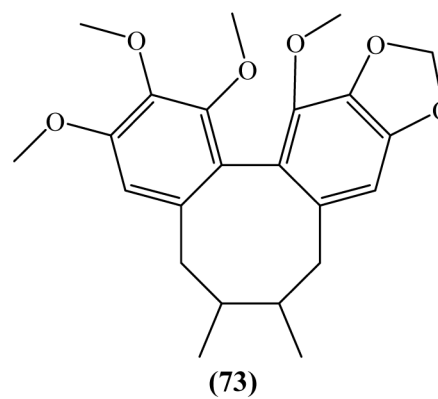
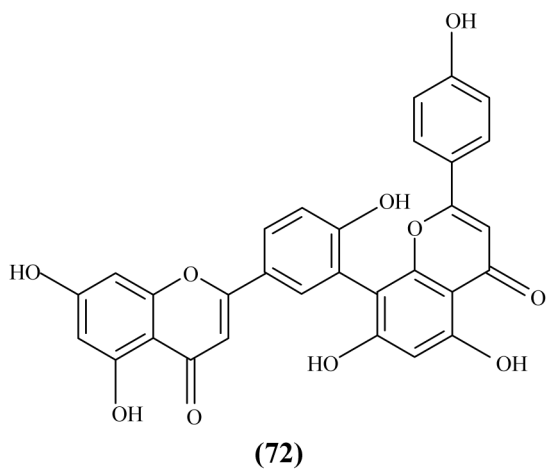
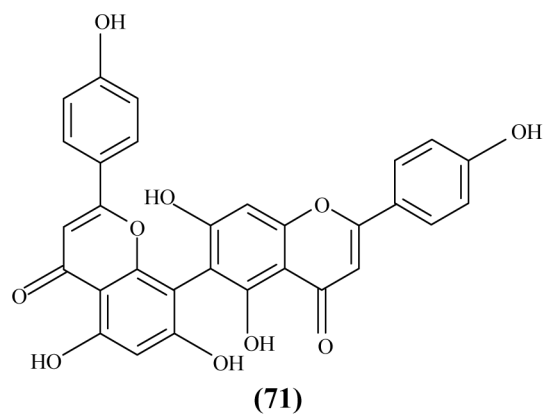
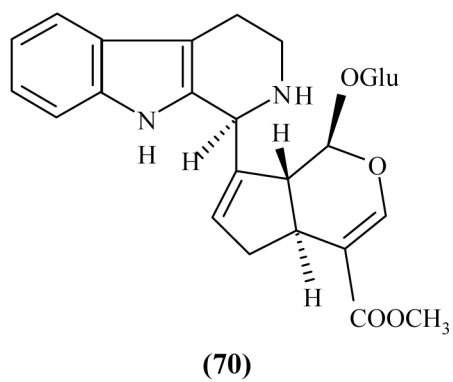


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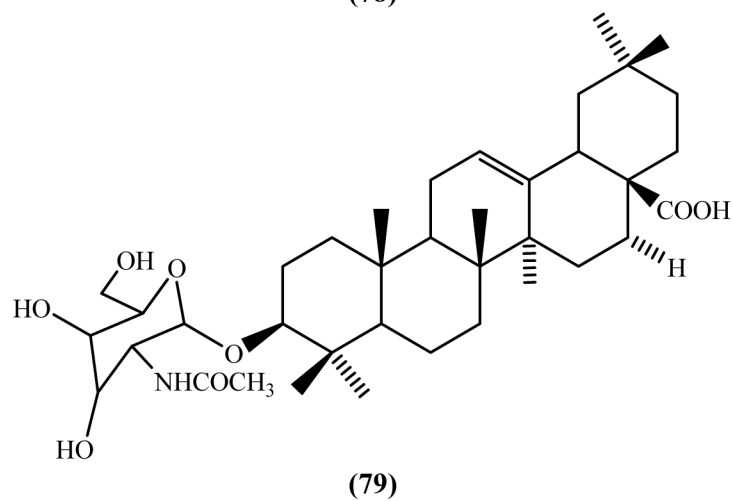
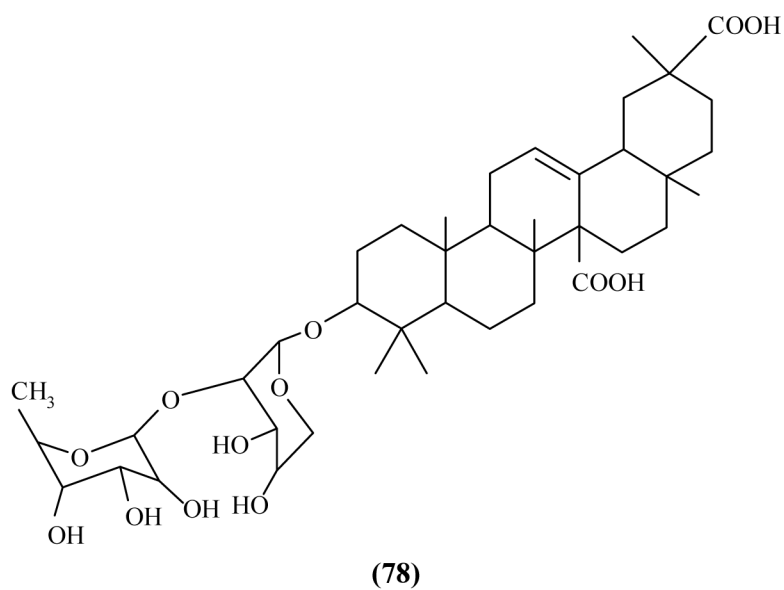
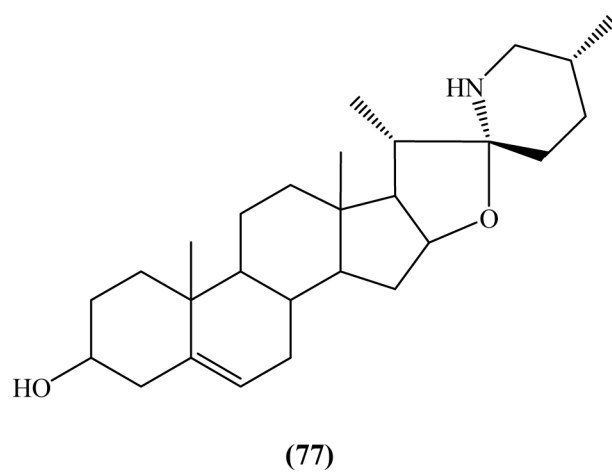
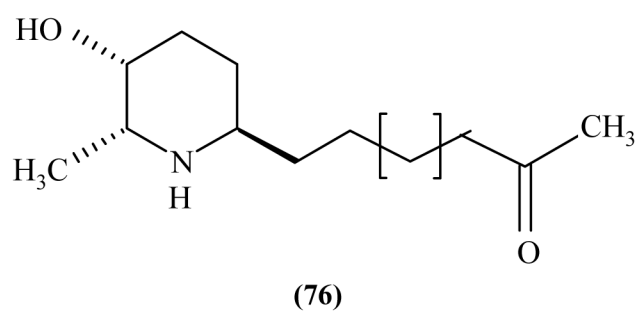


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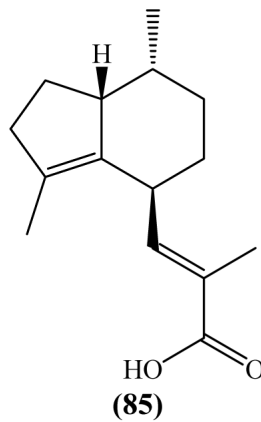
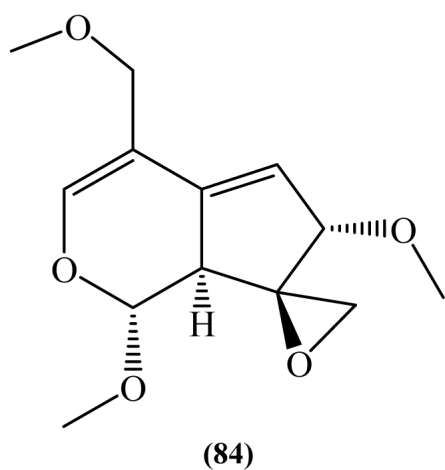
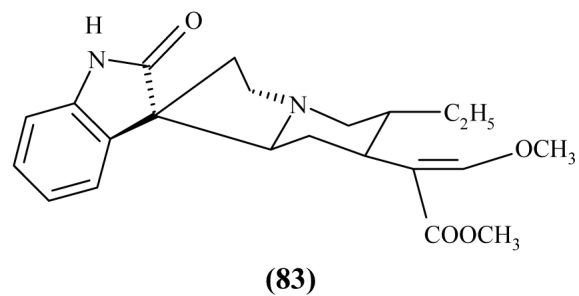
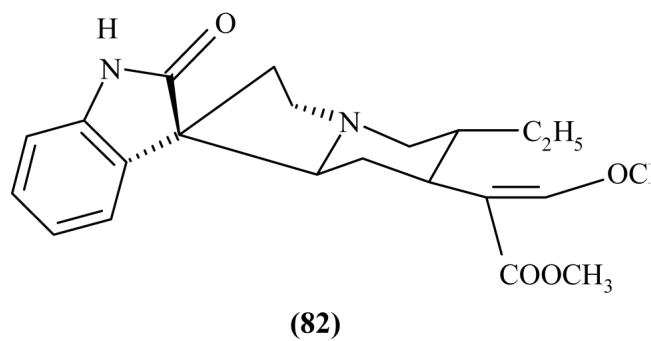
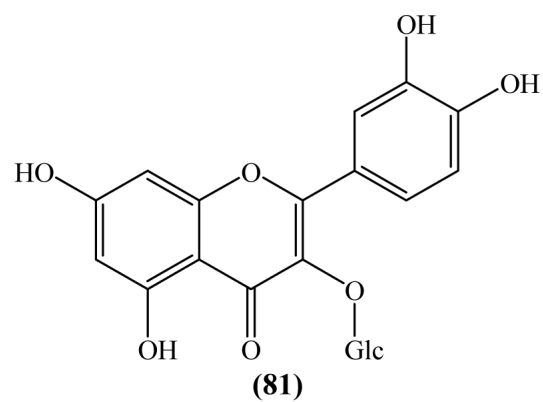
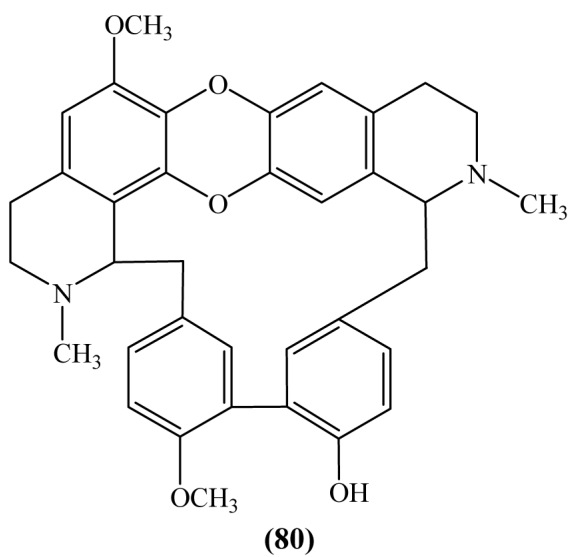


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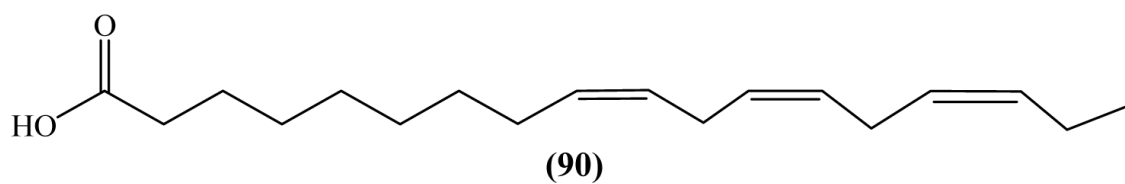
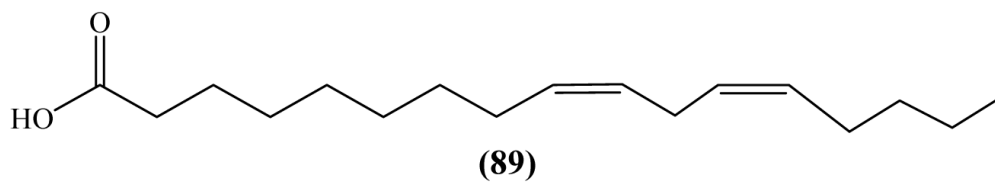
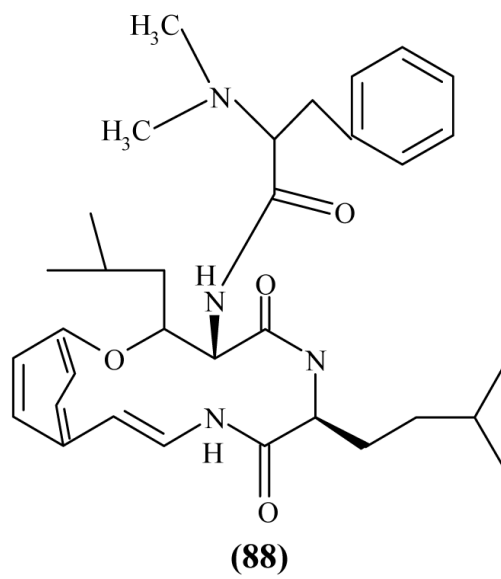
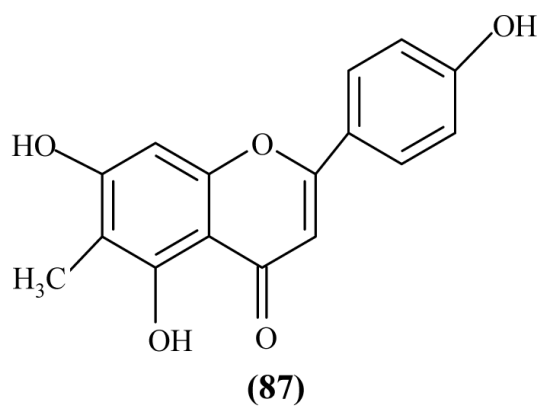
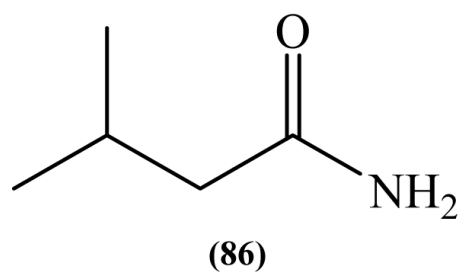


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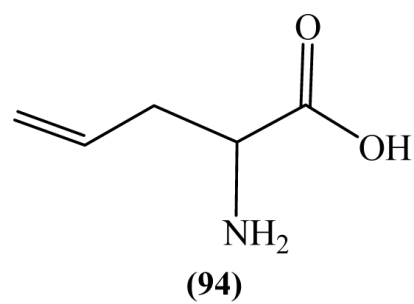
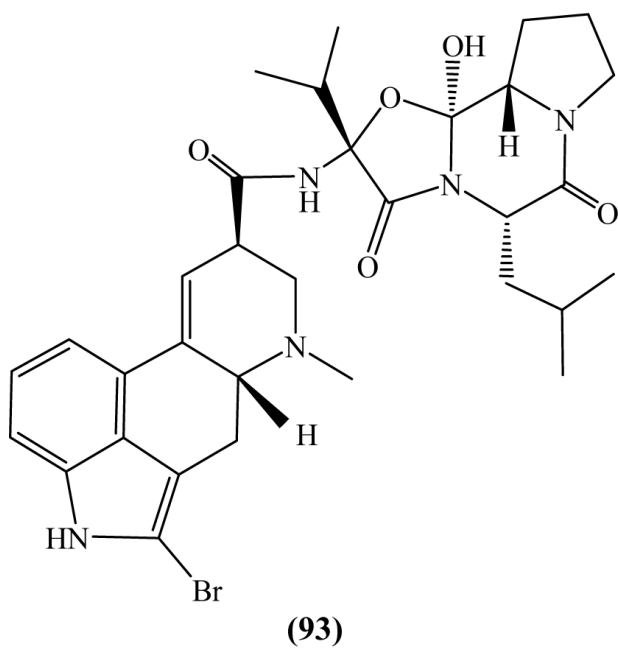
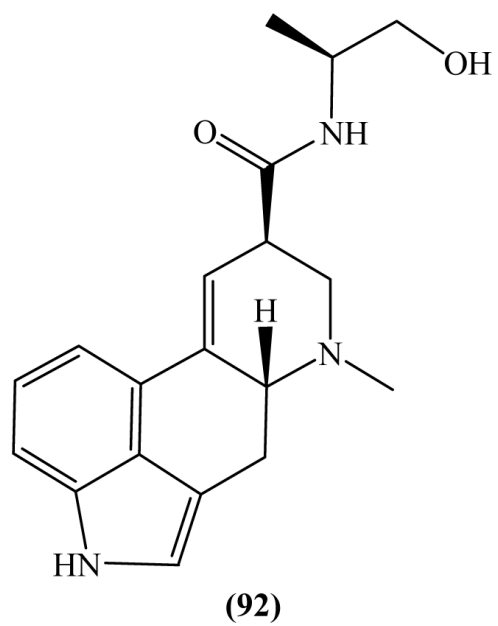
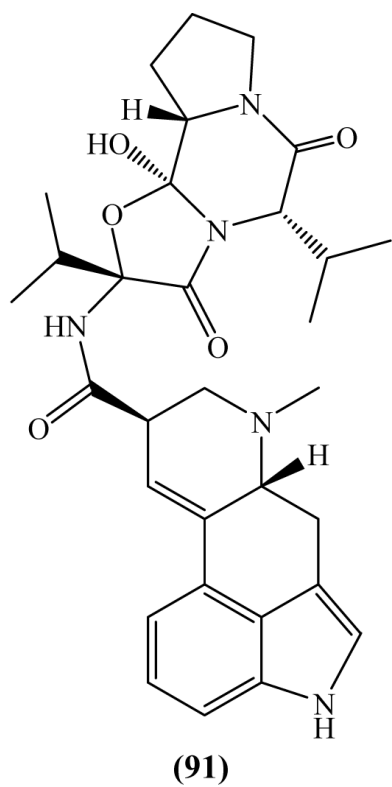


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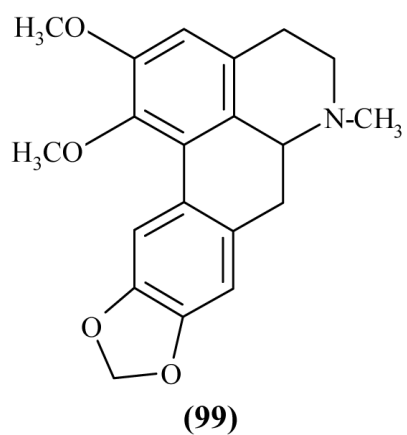
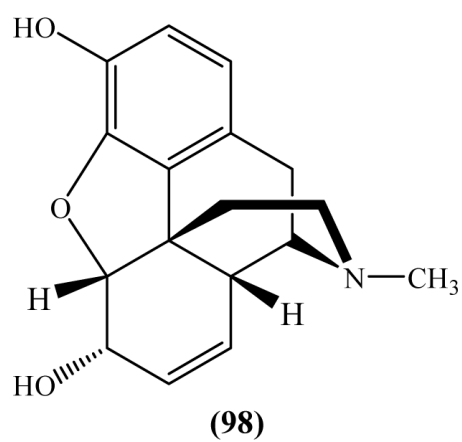
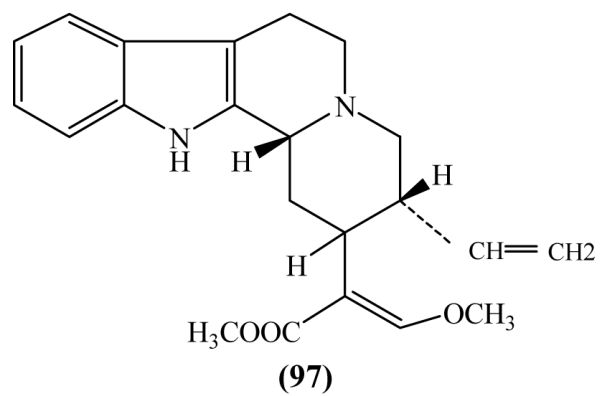
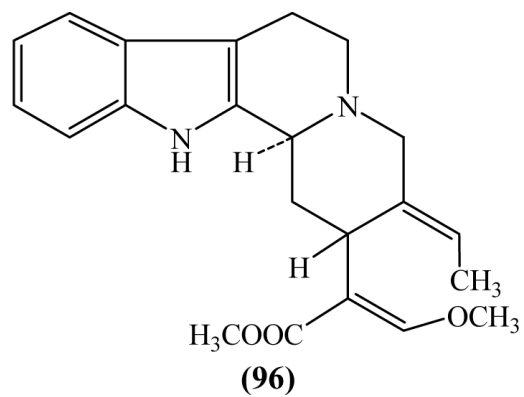
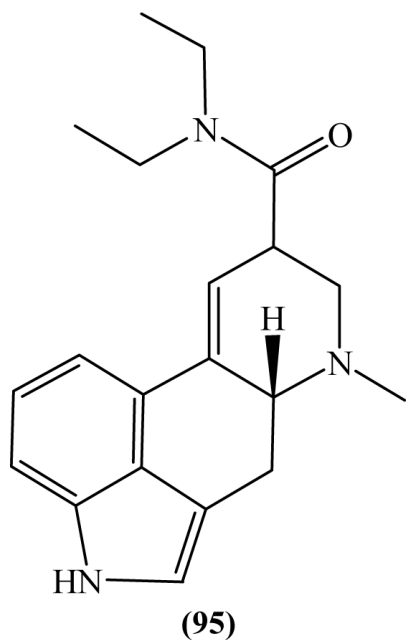


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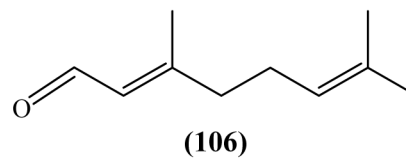
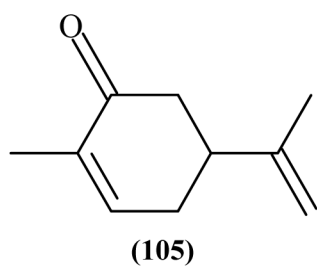
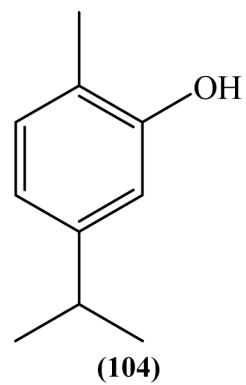
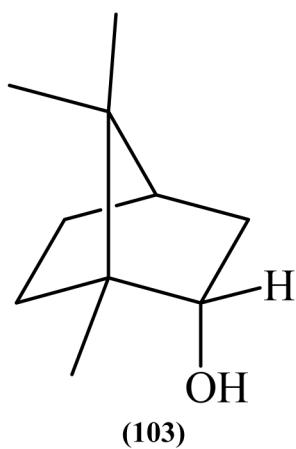
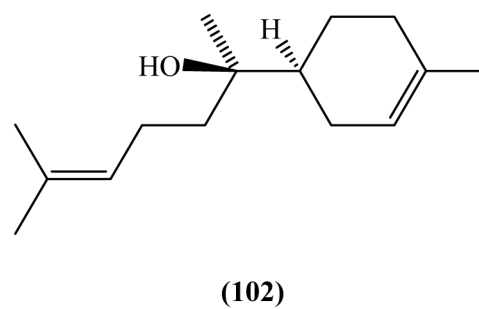
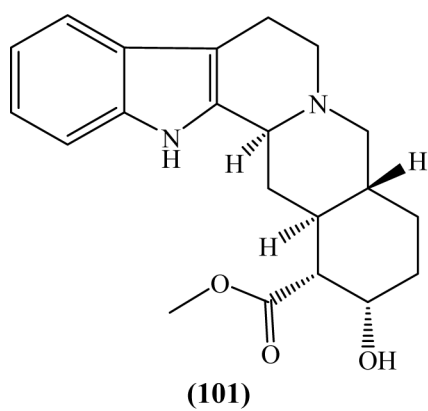
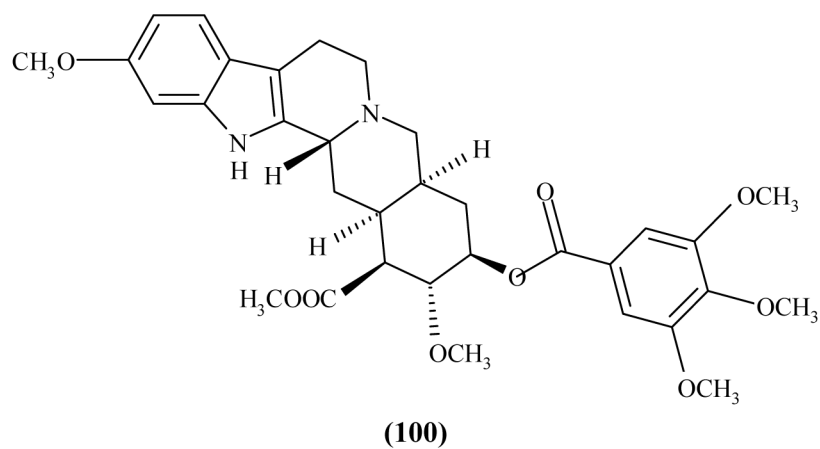


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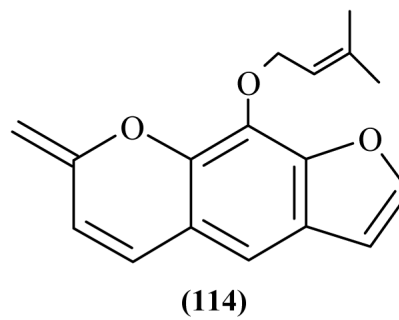
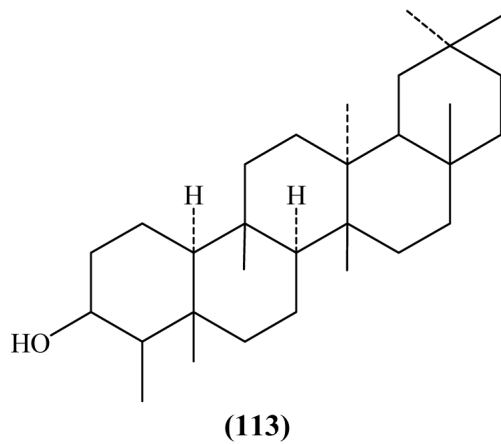
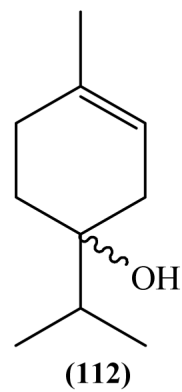
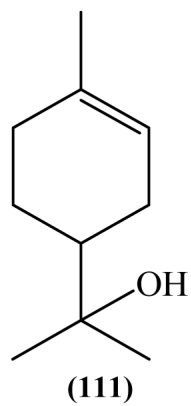
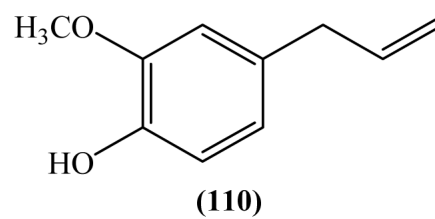
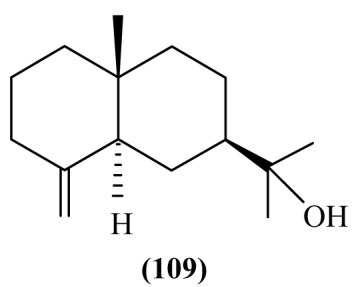
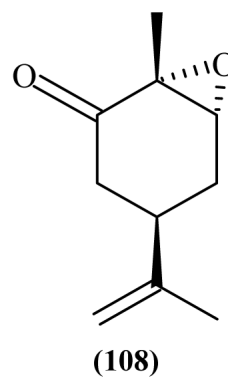
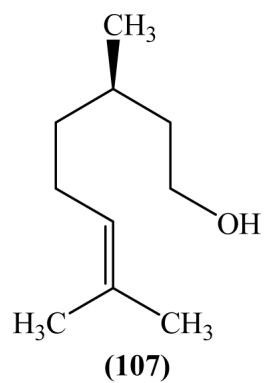


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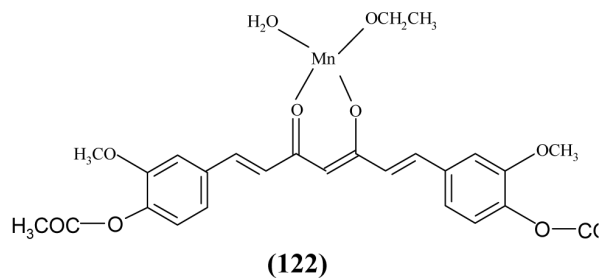
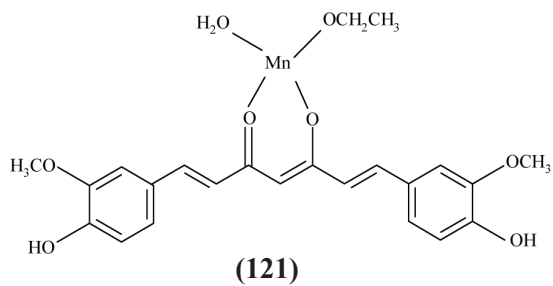
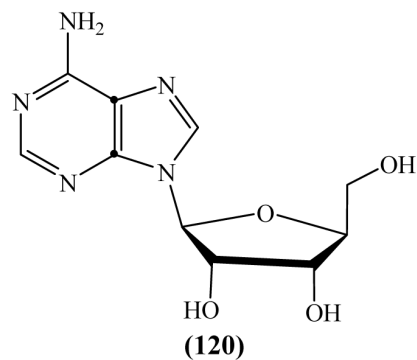
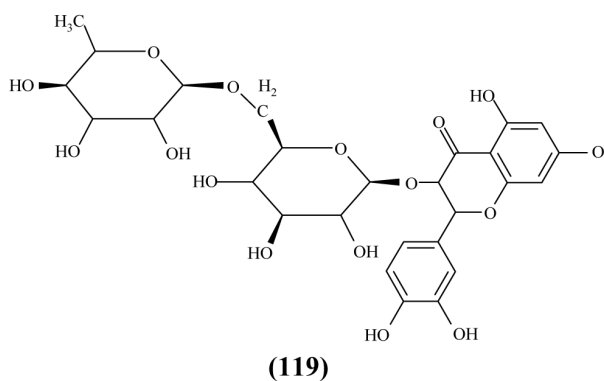
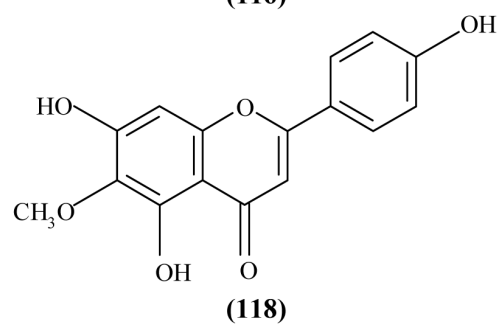
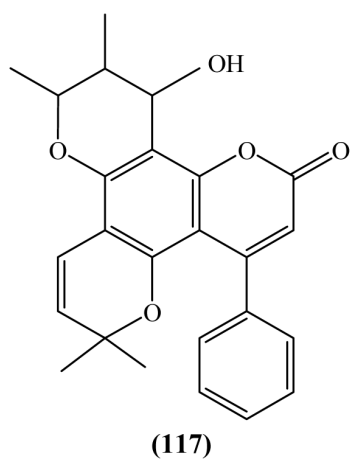
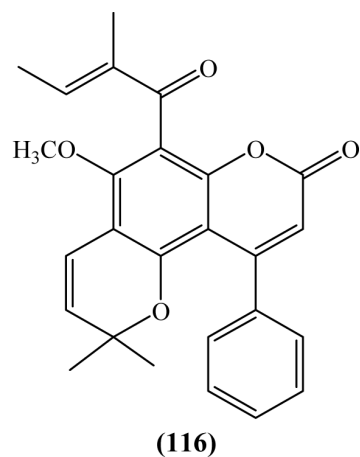
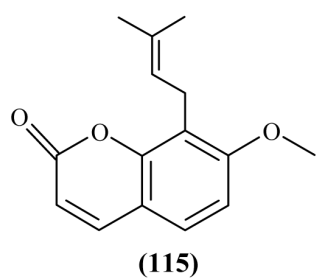


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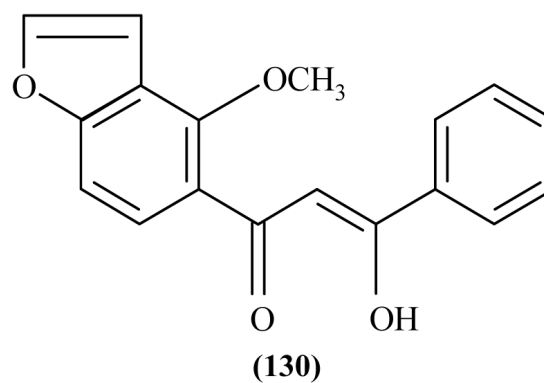
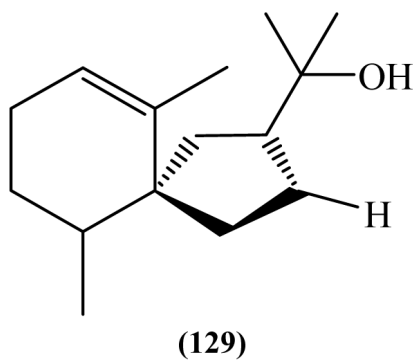
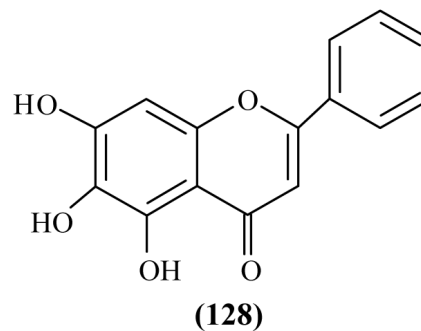
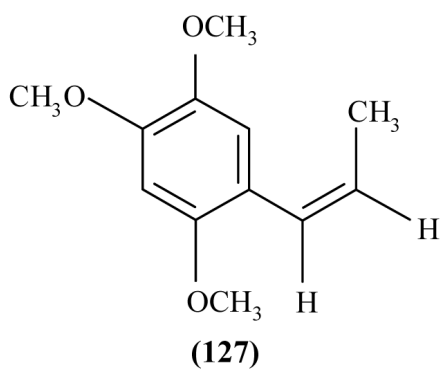
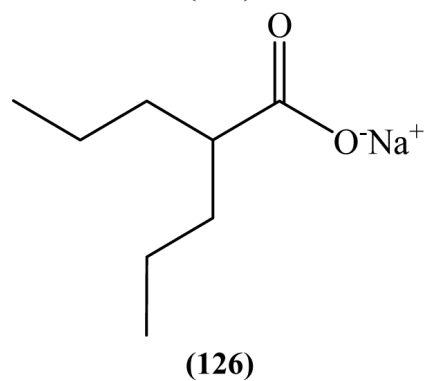
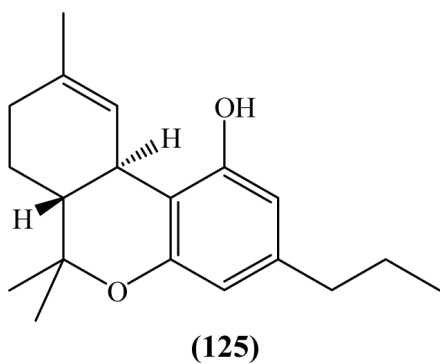
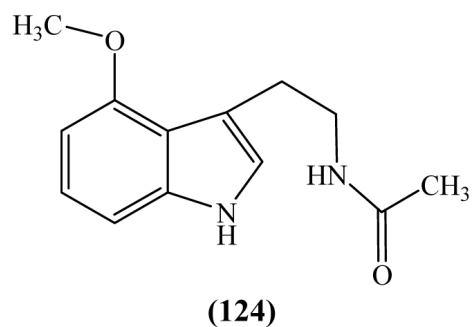
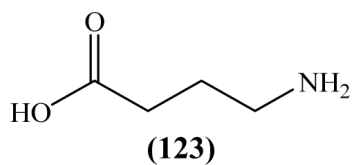
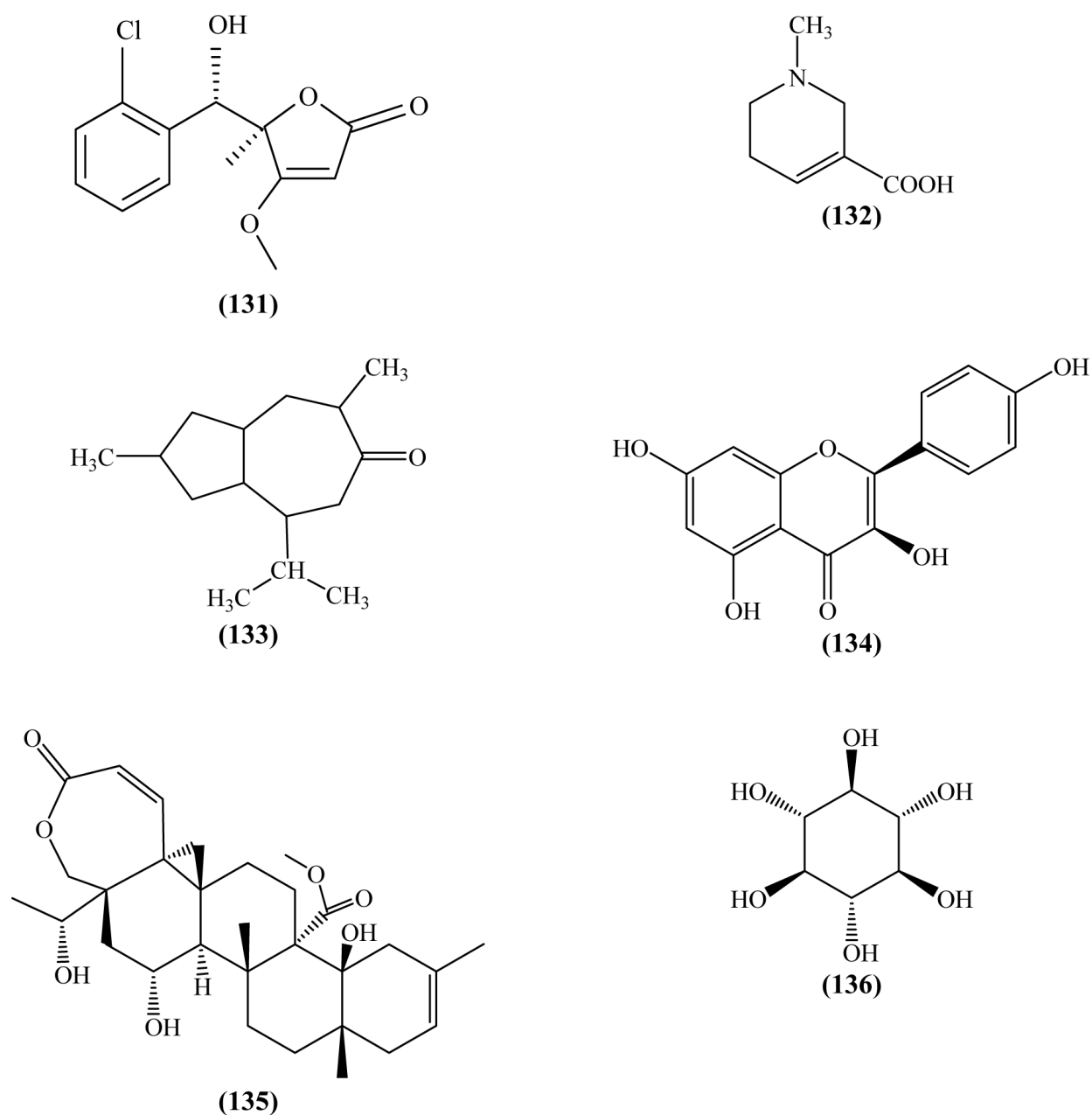


Figure 2: (Continued)

**Figure 2:** (Continued)

information covered in table 2 include name and structure of pure constituent, bioactive dose, route of administration, animals/human beings, experimental model/clinical parameters assessed, and mode of actions (if reported). Figure 2 shows structures of various phytoconstituents reported to possess anticonvulsant activity. Appropriate numbers have been assigned to all structures as well as to their corresponding phytoconstituents. A number

of plant based formulations from various systems of medicines like Brahmi Rasayana (Ayurvedic medicine), Chaihu-longu-muli tang (Chinese medicine), Habb-e-Shifa (Unani medicine), TJ-960 (Japanese kampo medicine) and Nigerian herbal recipe have shown anticonvulsant potential in battery of animal models. The list of such formulations with their composition, and anticonvulsant activity reports covering information on bioactive

Table 1: List of various plants reported to possess anticonvulsant activity.

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
01	<i>Abelmoschus manihot</i> Linn. (Malvaceae)	75% ethanol extract of flowers	100 or 200 mg/kg, p.o.	Male ICR mice and SD rats	PTZ	-----	++	[8]
02	Medicus flower, Aibika <i>Acanthus montanus</i> (Nees) T. Anderson (Acanthaceae) Bear's breech, Mountain thistle <i>Aconite</i> (Ranunculaceae)	Decoction of leaves	(a) 100 mg/kg, p.o. (b) 1000 mg/kg, p.o.	Swiss male mice	(a) PIC, STR (b) PTZ, MES	-----	++	[9]
03	<i>Aconite</i> (Ranunculaceae)	Aconitum alkaloids, (a) aconitine (1) (b) Lappaconitine (2), and heteratisine (3)	(a) 1µm (b) 10µm	<i>In vitro</i> , Male Wistar rats hippocampal slices	Neuronal activity in rat hippocampal slices	Diminishes epileptiform activity induced by a nominal Mg++ free bathing medium to activate NMDA receptor mediated responses	++	[10]
		Napelline (4) and 1-benzoyl napelline (5)	1-100µm	<i>In vitro</i> , Male Wistar rats hippocampal slices	Neuronal activity in rat hippocampal slices	Diminishes epileptiform activity induced by a nominal Mg++ free bathing medium to activate NMDA receptor mediated responses	++	[11]
04	<i>Acorus calamus</i> Linn. (Acoraceae) Sweet Flag, Calamus, Vasa Bach	Aconitum alkaloid mesaconitine (6) 95.4% ethanol extract of roots 90% methanol extract of roots	30nm-1µm 0.5-1.0 ml/kg, i.p. of 500 mg/ml concentration 100 or 200 mg/kg, p.o.	<i>In vitro</i> , Male Wistar rats hippocampal slices Wistar rats and swiss mice Wistar albino mice	Neuronal activity in rat hippocampal slices (a) PTZ (b) STR, MES PTZ	----- Involvement of α-adrenoreceptor Involvement of GABAergic and noradrenergic pathway	++ (a) + (b) - ++	[12] [13] [14]
05	<i>Acorus gramineus</i> Alton (Acoraceae) Dwarf sedge, Japanese rush, Japanese sweet flag	Ethanol extract of roots Water extract of rhizomes	3 g/kg, p.o. 5 g/kg, i.p.	Albino mice Male ICR mice	STR, MTZ, MES PTZ	----- Involvement of central dopamine and GABA(A) receptors	++ +	[15] [16]
06	<i>Acorus tatarinowii</i> Schott (Acoraceae) Calamus of the Orient	Volatile oil Decoction and volatile oil extracted from rhizomes	35 mg/kg, i.p. Decoction (10-20 g/kg, i.p.), volatile oil (1.25 g/kg, i.p.)	Albino rats Chinese Kun-Ming mice and Male SD rats	KA PTZ, MES	Increases GABA content in brain Prevention of GABAergic neuron damage in brain	++ ++	[17] [18]
07	<i>Acosmium subelegans</i> (Mohlenbr) Yakovi (Leguminosae) Perobinha-do-Campo	Ethanol extract of stem bark	1 g/kg, p.o.	Female Swiss mice	PTZ, MES	-----	++	[19]

08	<i>Adenanthera pruvonia</i> Linn. (Fabaceae) Barbados pride, Red Coral-wood, Red sandalwood tree	Methanol extract of seeds	50-200 mg/kg, p.o.	Albino mice	PTZ, PIC, STR	Enhances GABAergic neurotransmission or facilitates GABAergic action and/or prevention of cell membrane destabilization in the brain	++	[20]
09	<i>Aegle marmelos</i> (L.) Corr Serr. (Rutaceae) Bael	Ethanol extract from leaves	100 or 200 mg/kg, p.o.	Albino male mice	PTZ, MES	GABAergic mechanism in brain	++	[21]
10	<i>Aeolanthus suaveolens</i> Mart. (Labiatae) Macassa	γ -decanolactone (7) from essential oil	400 or 500 mg/kg, i.p.; 2000 mg/kg, p.o.	CS1 albino mice	PTZ, MES	-----	++	[22]
		Linalool (8) and γ -decanolactone (7) present in essential oil	400 or 500 mg/kg, i.p.; 2000 mg/kg, p.o.	Albino mice	PTZ, MES	-----	++	[23]
11	<i>Aframomium laxiflora</i> (Benth.) Harms (Leguminosae-Papilionoidaceae) Satin wood, False Dalbergia	Root decoction	150-300 mg/kg, i.p.	Swiss albino mice	PTZ, MES	-----	++	[24]
12	<i>Alangium salvifolium</i> (L.F.) Wang [Cornaceae (Alangiaceae)] Akarkanta, Ankora, Sage-leafed alangium	Aqueous and ethanolic extract of leaves	250 or 500 mg/kg, p.o.	Wistar albino mice	PTZ, MES	-----	++	[25]
13	<i>Albizia lebbek</i> Benth. (Fabaceae) Siris tree, Albizia	Chloroform fraction of methanolic extract of leaves	40 or 80 mg/kg, i.p.	Albino mice	PTZ, PIC, MES	Enhances GABA level	++	[26]
		Methanol fraction of chloroform part of ethanolic extract of leaves	40 mg/kg, i.p.	Male SD rats	MES, Electrical kindling, PTZ, Lithium-PiLO	-----	++	[27]
14	<i>Alchornea laxiflora</i> (Benth.) Pax & K. Hoffmann (Euphorbiaceae) Lowveld bead string, Muruka	Decoction of leaves	(a) 60 mg/kg, p.o. (b) 120 mg/kg, p.o.	Swiss male mice	(a) NMDA (b) STR	-----	(a) ++ (b) ++ PTZ (-)	[9]
15	<i>Ambrosia paniculata</i> Michx. var. peruviana (Willd.) O. E. Schulz (Asteraceae) Annual ragweed	Decoction of dry leaves	0.01 ml/g, i.p. of 5% decoction	OF-1 mice and Wistar male rats	PIC, INH	Enhances GABAergic neurotransmission	++	[28]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
16	<i>Angelica dahurica</i> (Fisch. ex Hoffm.) Benth. (Apiaceae) Dahurian angelica	Furanocoumarin – Phellopterin (9) isolated from methanol extract of roots	IC50 = 0.36 µM	<i>In vitro</i> , Male Wistar rats brain tissues	Binding assay	BZD receptors agonist	++	[29]
17	<i>Anisomeles malabarica</i> (L.) R.Br. ex Sims (Lamiaceae) Chodhava, Vaikanth, Karithumba, Malabar Catmint, Gopoli	Chloroform and ethyl acetate extracts of leaves	200 or 400 mg/kg, p.o	Male Wistar rats	PTZ, MES	-----	++	[30]
18	<i>Annona diversifolia</i> Saff. (Annonaceae) Llama, Anona blanca	Palmitone (10) from hexane fraction of ethanolic extract of leaves Palmitone (10)	5-20 mg/kg, i.p. ED50 – 1.85 mg/kg, i.p. 10 mg/kg, i.p.	Male Taconic mice Male Wistar rats	PTZ, BIC, STR, KA Penicillin induced convulsions	GABAergic inhibitory system GABAergic neurotransmission	++ ++	[31] [32]
19	<i>Annona squamosa</i> Linn. (Annonaceae) Custard-apple, Sugar-apple, Sitafal	(a) Hexane extract (b) Ethanolic extract of leaves (c) palmitone (10) Ethanol extract of leaves	(a) 100 mg/kg, i.p. or p.o. (b) 100 mg/kg, p.o. (c) 10 mg/kg, i.p. 250 mg/kg, p.o.	Male Wistar rats Albino rats	Kindling convulsions MES	-----	++ ++	[33] [34]
20	<i>Aquilegia vulgaris</i> Linn. (Ranunculaceae) European columbine, Granny's nightcap	(a) Myoinositol (11) (b) Oleamide (12)	-----	-----	<i>In vitro</i>	(a) GABA(A) receptor (b) Inhibits 3H muscimol binding (specific ligand of the GABA binding site at GABA(A) receptor) and stimulates 3H-MK 801 (specific ligand of activated NMDA type glutamate receptor)	++	[35]
21	<i>Araucaria angustifolia</i> (Bertol.) Kuntze (Araucariaceae) Pin de parana	Gymnosperm lectin from seeds	10 mg/kg, i.p.	Male swiss mice	(a) PTZ, STR (b) PILO	GABAergic mechanism	(a) ++ (b) –	[36]
22	<i>Argyrea speciosa</i> Linn. (Convolvulaceae) Elephant creeper, Woolly morning glory, Bidhara, Dhavapatta	Hydroalcoholic (50% ethanol) extract of roots	200 or 400 mg/kg, p.o. for 10 days	Male Swiss mice	PTZ, MES	-----	++	[37]

23	<i>Armilleria mellea</i> Vahl. ex Fr. Quel. (Tricholomataceae)	Aqueous extract of mycelia	25 or 50 g/kg, s.c.	Male ICR mice	MES, PTZ, STR	-----	++	[38]
24	Mi Huan Jun <i>Artemisia annua</i> Linn. (Asteraceae) Sweet wormwood, Sweet Annie, Sweet sagewort or Annual wormwood	Essential oil and ethanolic extract of aerial parts	Essential oil (470 mg/kg, i.p.), ethanolic extract (450 mg/kg, i.p.)	Male Swiss albino mice	PTZ, PIC, PILO, STR	-----	++	[39]
25	<i>Artemisia copa</i> Phil. (Asteraceae) Copa tola	Aqueous extract from aerial parts	1.5 g/kg, p.o	Female Swiss albino mice	PTZ	-----	++	[40]
26	<i>Artemisia dracuncul</i> Linn. (Asteraceae)	Essential oil from aerial parts	0.26 or 0.84 ml/kg, p.o.	Male NMRI mice	MES (0.84 ml/kg, p.o.), PTZ (0.26 ml/kg, p.o.)	-----	++	[41]
27	Tarragon <i>Artemisia verlotorum</i> Lamotte (Asteraceae) Chinese wormwood, Verlot's mugwort	Hydro-alcoholic (95% ethanol) extract of whole plant	2 or 4 g/kg, i.p./p.o.	Male Swiss albino mice	PTZ, MES	-----	++	[42]
28	<i>Artemisia vulgar</i> Linn. (Asteraceae) Mugwort, Common wormweed	Aqueous extract of leaves and stems (10 g/100 ml)	0.2 ml	White female mice	PIC	-----	++	[43]
29	<i>Astragalus mongholicus</i> Bge. (Fabaceae) Bei qi, Huang qi, Milk vetch	Ethanol extract of roots Ethanolic extract of aerial parts and roots	150 or 300 mg/kg, i.p. 150 or 300 mg/kg, p.o.	Albino mice (a) Male Balb/c mice (b) SD rats	PTZ, MES (a) PTZ (b) MES	----- Protection against oxidative damage and amelioration of mitochondrial dysfunction	++ ++	[44] [45]
30	<i>Baccharis serratifolia</i> DC. (Asteraceae) Coyote Bush	Saponin fraction from ethanol extract of roots Methanolic extract of leaves	50, 100 or 200 mg/kg, p.o. 50, 100, 200 or 250 mg/kg, i.p.	Male Wistar rats Male Balb/c albino mice	PTZ STR, PTZ	----- Interference with calcium influx, Ca++ release from an intracellular store	++ ++	[46] [47]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
31	<i>Bacopa monnieri</i> Linn. (Scrophulariaceae) Brahmi	60% ethanolic extract of leaves Aqueous extract of whole plant	(a) 50 mg/kg, p.o. (b) 55 mg/kg, p.o. 300 mg/kg/day, p.o. for 15 days	(a) Wistar mice (b) Wistar rats Wistar rats	PTZ, STR, MES PILO	GABA agonist Upregulation of 5-HT(2C) receptors, increase in 5-HT(2C) gene expression and inositol triphosphate content in hippocampus Upregulation of 5-HT(2C) receptors Amplification of GABA(A) receptor subunits, such as GABA(A α 1), GABA(A α 5) and GABA(A δ) which were downregulated in epileptic conditions Reduces impairment in peripheral nervous system	++ ++	[48] [49]
		Aqueous extract of whole plant Bacoside –A (13) from 90% ethanolic extract of whole plant	300 mg/kg/day, p.o. for 15 days 300 mg/kg/day, p.o. for 15 days	Wistar rats Male Wistar rats	PILO PILO-atropine	Upregulation of 5-HT(2C) receptors Upregulation of GABA(A) receptor subunits, such as GABA(A α 1), GABA(A α 5) and GABA(A δ) which were downregulated in epileptic conditions	++ ++	[50] [51]
		Bacoside –A (13) from 90% ethanolic extract of whole plant	150 mg/kg/day, p.o. for 15 days	Male Wistar rats	PILO-atropine	Reduces impairment in peripheral nervous system	++	[52]
		Bacoside –A (13) from 90% ethanolic extract of whole plant	150 mg/kg/day, p.o. for 15 days	Male Wistar rats	PILO-atropine	Upregulation of GABA(A γ) subunit in brain	++	[53]
32	<i>Basilicum polystachyon</i> (L.) Moench (Lamiaceae) Musk basil	Aqueous extract of leaves	300 or 600 mg/kg, p.o.	Albino mice	PTZ, MES	-----	++	[54]
33	<i>Benkara malabarica</i> (Lam.) Tirveng. (Rubiaceae) Pudan, Sirukarai, Pidathi	Methanolic extract of roots	25 or 50 mg/kg, p.o.	Male Wistar rats	(a) STR (b) INH	Inhibits GABA-T activity	(a) – (b) ++	[55]
34	<i>Berberis vulgaris</i> Linn. (Berberidaceae) Common barberry	Berberine (14), an isoquinoline alkaloid	10 or 20 mg/kg, i.p.	Male Swiss albino mice	PTZ, KA, MES	Modulates neurotransmitter systems like NMDA, nitric oxide and serotonin	++	[56]
35	<i>Bixa orellana</i> Linn. (Bixaceae) Aploppas, Lipsticktree	Methanolic extract of leaves	250 or 500 mg/kg, p.o.	Swiss albino mice	STR	-----	++	[57]
36	<i>Bryonia laciniosa</i> Linn. (Cucurbitaceae) Gargumaru, Shivalingi, Vaduballi	Hydro-alcoholic extract (70% ethanol) of whole plant	500 mg/kg, p.o.	Swiss albino mice	MES	-----	++	[58]

37	<i>Bryophyllum pinnatum</i> (Lam.) Kurz. (Crassulaceae) Air plant, Mother of millions	Aqueous extract of leaves	100 or 200 mg/kg, p.o.	Swiss albino mice	STR, PIC	-----	++	[59]
38	<i>Bupleurum falcatum</i> Linn. (Apiaceae) Radix bupleuri, Chai Hu	Volatile oil, saikosaponin and water soluble component	100 mg/kg, i.p.	Albino mice	PTZ, MES	-----	++	[60]
39	<i>Butea monspemsa</i> (Lam.) Taub. (Fabaceae) Palash, Dhak, Palah, Flame of the forest, Bastard teak	Acetone soluble part of petroleum ether extract of aerial parts Triterpene present in the n-hexane: ethyl acetate (1:1) fraction of the petroleum ether extract of leaves	50 mg/kg, i.p. 10-100 mg/kg, i.p.	Male SD rats Male SD rats and male mice	MES, Electrical kindling, PTZ, Lithium-PiLO (a) PTZ, Lithium sulphate, PiLO, MES (b) STR, PIC	-----	++ (a) ++ (b) –	[27] [61]
40	<i>Cadia rubra</i> R. Vig. (Papilionatae) Bord de la Mandrava	Lyophilized water extract of leaves	100 or 300 mg/kg, p.o.	Swiss Webster mice	PTZ induced epileptiform seizures	-----	++	[62]
41	<i>Caesalpinia pulcherrima</i> (L.) Sw. (Fabaceae) Poinciana, Peacock flower, Red bird of paradise	Ethanol extract of leaves	200 or 400 mg/kg, i.p.	Albino rats and mice	PTZ, MES	-----	++	[63]
42	<i>Caesalpinia sappan</i> Linn. (Fabaceae) Sappanwood	Sappanhalcone (15) and brazilin (16) isolated from ethyl acetate fraction of 80% methanolic extract of wood	50-250 µM	<i>In vitro</i>	-----	Inhibition of activities of two GABA degradative enzymes succinic semialdehyde dehydrogenase (SSADH) and succinic semialdehyde reductase (SSAR)	++	[64]
43	<i>Calliandra portoricensis</i> (Jacq.) Benth. (Fabaceae) Snowflake acacia, Powder-puff	80% methanol extract of whole roots Aqueous extract of (a) roots (b) stems	100 mg/kg, i.p. (a) 299.6 or 312 mg/kg, i.p. (b) 338 or 402 mg/kg, i.p.	Albino mice Albino mice	PTZ, STR PTZ, MES	-----	++ ++	[65] [66]
44	<i>Calotropis gigantea</i> (L.) Dryand. (Apocynaceae) Giant milkweed, Crown flower, Aak	Alcoholic extract of peeled roots Methanolic extract of stem bark	250 or 500 mg/kg, p.o. 180 mg/kg body weight, p.o.	Albino rats Albino wistar rats	PTZ PTZ, MES	-----	++ ++	[67] [68]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
45	<i>Cannabis indica</i> Lam. (Cannabaceae) Hemp	Resin Tetrahydrocannabinols: Δ^8 -THC (17), Δ^9 -THC (18) and cannabidiol (19) (-) and (+) isomers of cannabidiol (19) and (+)- isomer of dimethylheptyl cannabidiol	200 mg/kg, i.p. 10 or 60 mg/kg, i.p. twice daily for two days 10 mg/kg, i.p.	Albino rats Male SD rats Albino mice	MES Bilateral cerebral cobalt implantation MES	Limits the spread of epileptogenic activity originating from cofocus -----	++ ++ ++	[69] [70] [71]
46	<i>Cannabis sativa</i> Linn. (Cannabaceae) Hemp, Marijuana	Cannabidiol (19) Marihuana smoking + phenobarbital + diphenylhydantoin Crude plant	100 mg/kg, i.p. 2 to 5 joints per night + 30 mg four times a day + 100 mg four times a day -----	Male Wistar Kyoto rats 24 year old epileptic patient A case report on 45 year old man with cerebral palsy and epilepsy <i>In vitro</i>	PILO model of temporal lobe seizures, Penicillin model of partial seizures Physical and emotional studies Seizure frequency	----- No disability -----	++ ++ ++	[72] [73] [74]
47	<i>Canscora decussata</i> Roem. & Sch. (Gentianaceae) Shankhpushpi	(a) Absolute alcohol extract of whole plant (b) Crude powder	0.3 µg/ml (a) 2, 5, 10, 15 or 20 mg/100 g, p.o. (b) 25, 50, 75, 100 or 125 mg/100g, p.o.	Albino rats	Immature rat piriform cortical brain slices – application of oxotremorine M, a muscarinic agonist	Inhibits sustained epileptiform seizures induced by the muscarinic receptor agonist oxotremorine M in immature rat piriform cortical brain slices -----	++ ++	[75] [76]
48	<i>Capparis decidua</i> (Forssk.) Edgew. (Capparaceae) Kerda, Kair, Karir	Ethanol extract of aerial parts including flowers and fruits	100, 200 or 300 mg/kg, i.p.	Swiss male mice	PTZ, MES	-----	++	[77]
49	<i>Carica papaya</i> Gaertn. (Apocynaceae) Papita	Alcoholic extract of leaves	100 or 200 mg/kg, i.p.	Male albino Wistar rats	PTZ, MES	-----	++	[78]

50	<i>Carissa carandas</i> Linn. (Apocynaceae)	95% ethanol extract of roots	100, 200 or 400 mg/kg, i.p.	Swiss mice	PTZ, BIC, PIC, NMIDA, MES	-----	++	[79]
51	Karonda, Karaunda <i>Carissa edulis</i> (Forssk) Vahl. (Apocynaceae)	60% ethanol extract of root bark	5 or 20 mg/kg, i.p.	(a) Swiss albino mice (b) White ranger Cockerels	(a) PTZ (b) MES	-----	++	[80]
52	<i>Casimiroa edulis</i> Llave & Lex. (Rutaceae)	Dried aqueous extract of leaves	100 mg/kg, p.o.	Adult male Wistar rats	MTZ, MES	-----	++	[81]
	White sapote, Zapote blanco	Aqueous and absolute ethanol extract of seeds	Aqueous extract (5, 10 or 100 mg/kg, p.o.) and ethanol extract (10, 100 or 1000 mg/kg, p.o.)	Male Wistar rats	MES	-----	++	[82]
53	<i>Cassia siamila</i> Lamk. (Caesalpinaceae)	Barakol (20)	100 mg/kg, i.p.	Male ICR mice	PTZ, BIC, PIC, STR	-----	++	[83]
54	Chakundi <i>Cassia sophora</i> Linn. (Caesalpinaceae)	70% ethanol extract of seeds	440 mg/kg, p.o.	Wistar albino rats	PTZ, MES	-----	++	[84]
55	Kasondi <i>Catha edulis</i> (Vahl) Forssk. ex Endl. (Celastraceae)	Aqueous extract of fresh young leaves	3 g/kg, body weight, p.o.	Male Sprague dawley rats	PTZ	-----	++	[85]
56	Khat <i>Cedrus deodara</i> (Roxb.) G.Don (Pinaceae)	70% ethanol extract of heart wood	50, 100 or 200 mg/kg, p.o.	Swiss albino mice	PTZ, MES	Modulation of GABA levels in brain	++	[86]
57	Deodar cedar, Himalayan cedar, Deodar <i>Cedrela coromandeliana</i> Vahl. (Scrophulariaceae)	Petroleum ether extract of aerial parts	300 or 400 mg/kg, i.p.	Swiss albino mice	STR, Leptazol	-----	++	[87]
58	Kokhima, Kutki, Chinese mullein <i>Centella asiatica</i> (L.) Urb. (Umbelliferae)	Hydro-alcoholic (70% ethanol) extract of fresh and dried leaves	40, 50 or 60 mg/kg, p.o.	Male Swiss mice	PTZ	-----	++	[88]
	Gotu Kola	(a) Phenytoin (b) Valproate (c) Gabapentin (d) Ethyl acetate fraction (EACA) + phenytoin (e) EACA + valproate (f) EACA + gabapentin (g) EACA alone n-hexane, chloroform, ethyl acetate, n-butanol, and water extracts of leaves	(a) 13 mg/kg, i.p. (b) 104 mg/kg, i.p. (c) 301 mg/kg, i.p. (d) 5 mg/kg, i.p. (e) 29 mg/kg, i.p. (f) 79 mg/kg, i.p. (g) 300-1000 mg/kg, p.o. (673 mg/kg, p.o.) 200 mg/kg body weight, p.o. for one week	Male ICR mice	PTZ	-----	++	[89]
				Male Wistar rats	PTZ	-----	++	[90]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
59	<i>Centella asiatica</i> and <i>Bacopa monnieri</i> (Scrophulariaceae)	Aqueous extract of herb	500 mg/kg, p.o. at 3 hr	Male Wistar rats	MES	-----	++	[91]
60	<i>Centranthus longiflorus</i> Steven (Valerianaceae) Red valerian	Aqueous extract of roots	100 mg/kg, p.o.	Albino mice	Caffeine induced convulsions	-----	++	[92]
61	<i>Cerbera odollan</i> Gaertn. (Apocynaceae) Suicide tree, Pong-pong, Othallanga	95% ethanol extract of leaves	5.8 or 10.15 mg/kg, i.p.	Swiss albino mice	PTZ	-----	++	[93]
62	<i>Cestrum nocturnum</i> Linn. (Solanaceae) Lady of the night, Queen of the night, Night-blooming Jasmine	Decoctions obtained from dried leaves	30%	OF-1 male mice	(a) INH, Penicillin (b) PIC, MES	-----	(a) ++ (b) –	[94]
63	<i>Chelidonium majus</i> Linn. (Papaveraceae) Greater celandine, Blood root	Chelidonine (21)	10 mg/kg, i.p.	Albino mice	MES	-----	++	[95]
64	<i>Cimicifuga simplex</i> Wornsk. (Ranunculaceae) Shoma	Water soluble part of methanol extract of rhizomes	0.5-2.0 mg/kg, p.o.	Albino mice	(a) MTZ (b) STR	-----	(a) – (b) ++	[96]
65	<i>Cissampelos mucronata</i> A. Rich (Menispermaceae) Velvet leaf, False pareira brava	Ethanol extract of leaves	100 mg/kg, p.o.	Albino mice and rats	PTZ	-----	++	[97]
66	<i>Cissus quadrangularis</i> Linn. (Vitaceae) Veldt grape, Devil's backbone	Aqueous extract of stems	100, 200, 500, 1000 or 2000 mg/kg, p.o.	Male Swiss mice	PTZ, Isonicotinic hydrazid acid, STR, NMDA, MES	-----	++	[98]
67	<i>Cissus sicyoides</i> Linn. (Vitaceae) Princess vine, Millionaire vine, Curtain Ivy	Hydro-alcoholic (70% ethanol) extract of aerial parts	300, 600 or 1000 mg/kg, i.p.	Swiss albino mice	PTZ	-----	++	[99]
68	<i>Citrus bergamia</i> Risso (Rutaceae) Bergamol	Non volatile residue from the essential oil obtained from fresh pericarp of fruits	40 mg/kg, i.p.	Male Swiss mice	PTZ	-----	++	[100]
69	<i>Clausena anisata</i> (Willd.) J.Hk. ex Benth. (Rutaceae) Kattu-veppilai, Kattukarveppilai	Aqueous extract of root bark	200-500 mg/kg, i.p.	Albino mice	Leptazol, STR	-----	++	[101]

70	<i>Cleome rutidosperma</i> DC. (Capparaceae) Fringed spiderflower	Petroleum ether, ethyl acetate, n-butanol extract of aerial parts	100 mg/kg, p.o.	Swiss albino mice	STR	-----	++	[102]
71	<i>Cleome viscosa</i> Linn. (Capparidaceae) Dog mustard	Ethanol and aqueous extracts of seeds	400 or 600 mg/kg, p.o.	Swiss albino mice	PTZ, MES	-----	++	[103]
72	<i>Clerodendron colebrookianum</i> Walp. (Lamiaceae) East Indian glory bower	Aqueous extract of leaves	20, 40 or 80 mg/kg, i.p.	Albino Swiss mice	PTZ (leptazol), STR	Enhancement of GABA activity and blockade of multineural pathways in the spinal cord	++	[104]
73	<i>Clerodendron infortunatum</i> Linn. (Lamiaceae) Hill glory bower	Saponins isolated from aqueous extract of leaves	30, 50, 75 or 100 mg/kg, i.p. ED50 – 45 mg/kg, i.p. (30.2-65)	Swiss albino mice	Leptazol	-----	++	[105]
74	<i>Clinopodium mexicanum</i> Benth. Govaerts (Lamiaceae) Toronjil de Monte	Methanolic extract of leaves	250 or 500 mg/kg, i.p.	Swiss albino mice	PTZ, STR	-----	++	[106]
75	<i>Clitoria ternatea</i> Linn. (Papilionaceae) Butterfly pea	Aqueous extract of leaves	10, 100 or 200 mg/kg, i.p.	Male Swiss Webster mice	PTZ, PIC	-----	++	[107]
76	<i>Cnestis ferruginea</i> DC (Connaraceae) Okro-Aja, Gboyin-Gboyin	Methanolic extract of aerial parts	100 mg/kg, p.o.	Male Swiss albino mice	PTZ, MES	Serotonin and acetylcholine systems	++	[108]
77	<i>Coccoloba hirsuta</i> Linn. (Menispermaceae) Jaljamni, Jamti ke-bel	Water and ethanolic extracts of roots	100 mg/kg, p.o.	Albino mice	STR, Coramine, MES	-----	++	[109]
78	<i>Cocos nucifera</i> Linn. (Cocaceae) Coconut palm	Aqueous soluble fraction of the amonical ethanol extract of stem and roots	100 mg/kg, p.o.	Albino rats	MTZ, MES	-----	++	[110]
79	<i>Coix lachryma</i> Linn. (Poaceae) Job's tears, Coixseed, Tear grass	Ethanolic extract of roots	25-80 mg/kg, i.p.	Swiss albino mice	PTZ	-----	++	[111]
80	<i>Commiphora africana</i> (A. Rich.) Engl. (Bursaceae) African myrrh, Angka	Coixol (6- methoxy-benzoxazolone) (22)	50-100 mg/kg, i.p.	Albino mice	PTZ, MES	-----	++	[112]
81	<i>Convolvulus pluricaulis</i> Choisy Sankhpushpi	Hydro-ethanolic (70% ethanol) extract of stem bark	50, 100 or 200 mg/kg, i.p.	Swiss albino mice	PTZ	-----	++	[113]
		80% ethanol extract of whole plant (50 g powder / 500 ml ethanol)	0.5 ml, i.p.	Albino rats	MES	-----	++	[114]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
82	<i>Corchorus olitorius</i> Linn. (Malvaceae) Tossa jute	Methanolic extract of seeds	0.05 or 0.075 g/kg, i.p.	Male Swiss albino mice	STR, Biochemical estimations of catecholamines	Enhances GABA content in brain	++	[115]
83	<i>Corydalis yanhua</i> W. T. Wang (Papaveraceae) Corydalis tuber	Chloroform extract of tuber	100 mg/kg, p.o.	Albino mice	PTZ, PIC	-----	++	[116]
84	<i>Corydalis orbiculata</i> Linn. (Crassulaceae) Pig's ear, Round-leaved Navel-wort	Methanolic extract of leaves Aqueous and methanolic extract of leaves	100 or 200 mg/kg, i.p. Aqueous (50-100 mg/kg, i.p.) and methanolic extract (100-400 mg/kg, i.p.)	Male albino mice Male albino mice	PTZ, BIC, PIC, NMDA PTZ, BIC, PIC, NMDA	----- -----	++ ++	[117] [118]
85	<i>Crassostrea gigas</i> Thunberg (Ostreidae) Miyagi oyster, Japanese oyster	Aqueous extract of raw oysters	4.6 mg for 10 consecutive days	Magnesium deficient DBA/2 mice	Audiogenic seizures	-----	++	[119]
86	<i>Crataegus oxyacantha</i> Linn. (Rosaceae) Hawthorn	Aqueous extract of roots	100 mg/kg, p.o.	Albino rats	STR	-----	++	[120]
87	<i>Crinum jagus</i> J. Thomps. (Amaryllidaceae) Dandy	Methanol extract of bulbs	100 mg/kg, p.o.	Albino mice	MES	-----	++	[121]
88	<i>Crinum ornatum</i> (L.f. ex Aiton) Bury (Amaryllidaceae) Milk and Wine Lily	50% ethanolic extract and alkaloids haemanthamine (23) and lycorine (24) from bulbs	2 mg/ml, i.p.	Male Wistar rats	MES	Protection against both free radical generation and lipid peroxidation	++	[122]
89	<i>Crocus sativus</i> Linn. (Liliaceae) Saffron, Autumn crocus	Aqueous and 80% ethanolic extract of stigmas Safranal (25) isolated from stigmas	0.08, 0.32, 0.56 or 0.8 g/kg, i.p. 0.35 ml/kg, i.p.	Male and female albino mice Albino mice	PTZ, MES PTZ	----- -----	++ ++	[123] [124]
90	<i>Croton celtidifolius</i> Baill. (Euphorbiaceae) Sanguine-de-adave	Proanthocyanidin rich fraction (PRF) isolated from 80% ethanolic extract of bark	72.75, 145.5 or 291 mg/kg, i.p.	Male Wistar rats	PTZ	GABA(A)-BZD receptor complex	++	[125]
91	<i>Croton penduliflorus</i> Hutch (Euphorbiaceae) Rushfoil, Croton	Seeds oil	0.3-3.0 mg/kg, i.p. 6 mg/kg, i.p.	Male Wistar rats Albino mice	PTZ PTZ, STR	----- -----	++ ++	[126] [127]

92	<i>Croton zambescus</i> Müll. - Arg. (Euphorbiaceae) Dahomey, Hausa, Bergboegoe, Lavender croton	Aqueous extract of leaves 97% ethanolic extract of roots	1000-1500 mg/kg, p.o. 27-81 mg/kg, p.o.	Swiss albino mice Swiss albino mice	PTZ, MES PTZ, PIC	----- GABA neurotransmission	++ ++	[128] [129]
93	<i>Croton zehntneri</i> Pax and Hoffman (Euphorbiaceae) Canela-de-cunhu	Essential oil of leaves	10 µl/100g, p.o.	Male Wistar rats	PTZ	-----	++	[130]
94	<i>Cuminum cyminum</i> Linn. (Apiaceae) Cumin, Jeera	Aqueous, ethanolic extracts and essential oil from seeds	Aqueous extract (2.8- 4 g/kg, p.o.), ethanol extract (5 g/kg, p.o.), essential oil (0.35 g/kg, i.p.)	Albino mice	PTZ	-----	++	[131]
95	<i>Curcuma longa</i> Linn. (Zingiberaceae) Turmeric, Haldi	Curcumin (26)	Acute administration - 50, 100 or 200 mg/kg, p.o.; Chronic administration - 100 mg/kg, p.o. for 21 days	Swiss albino mice	MES	-----	++	[132]
		Cucumin (26)	50, 100 or 200 mg/kg, p.o.	Swiss albino mice	PTZ induced kindling	Decreases levels of malondialdehyde and glutathione	++	[133]
		Curcumin (26)	100, 200 or 300 mg/kg, p.o.	Male Wistar rats	PTZ	-----	++	[134]
96	<i>Cuscuta chinensis</i> Lam. (Convolvulaceae) Dodder	Aqueous extract of whole plant	1g/kg, p.o.	Albino mice	MES	-----	++	[135]
97	<i>Cuscuta reflexa</i> Roxb. (Convolvulaceae) Amar Bel, Giant Dodder	Methanolic extract of stems	0.02 or 0.025 g/kg, i.p.	Male Swiss albino mice	STR, Biochemical estimations of catecholamines	Enhances GABA content in brain	++	[115]
98	<i>Cymbopogon citratus</i> (DC.) Stapf (Poaceae) Lemongrass, Ginger grass	Essential oil from fresh leaves Essential oil from leaves	0.5 or 1.0 g/kg, p.o. 200 mg/kg, i.p.	Swiss male mice Male Swiss mice	PTZ, MES PTZ, PILO, STR	----- GABAergic neurotransmission	++ ++	[136] [137]
99	<i>Cymbopogon winterianus</i> Jowitt (Poaceae) Cymbopogon grass, Java citronella grass	Essential oil from fresh leaves Essential oil from leaves	100, 200 or 400 mg/kg, i.p. 200 mg/kg, i.p.	Male Swiss mice Male Swiss mice	PTZ PTZ, PILO, STR	----- GABAergic neurotransmission	++ ++	[138] [137]
100	<i>Cynanchum chinense</i> R. Brown (Apocynaceae) Bai Qian	Water and chloroform extract of whole plant	100 mg/kg, p.o.	Albino mice	MTZ, MES	-----	++	[139]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
101	<i>Cynanchum otophyllum</i> C.K. Schneid. (Apocynaceae) Qingyangshen	Otophyllolide (27)	10 mg/kg, i.p.	Albino rats	Andiogenic convulsions	-----	++	[140]
		Alkaloids from roots	10 mg/kg, i.p.	Albino rats and mice	MES, andiogenic induced convulsions	-----	++	[141]
		Crude drug	15 mg/kg, q.o.d. for 6 days + DPH 50 mg/kg, q.o.d. for 6 days	<i>In vitro</i>	α - and β -tubulin gene expression during KA induced chronic seizures	Inhibition of tubulin synthesis and reduction in mossy fibre sprouting and neosynaptogenesis	++	[142]
102	<i>Cynodon dactylon</i> (L.) Pers. (Poaceae) Bermuda grass, Bahama grass, Arugampul	Hydro-alcoholic (75% ethanol) extract of grass Ethanol extract of aerial parts	200, 400, 500 or 600 mg/kg, i.p.	Swiss albino mice	PTZ, MES	-----	++	[143]
			25-100 mg/kg, i.p.	Swiss albino mice	PTZ MES (-ve)	-----	++	[144]
		Ethanol extract of whole plant	200, 400 or 600 mg/kg, p.o.	Swiss albino mice	PTZ, MES	-----	++	[145]
		95% ethanol extract of leaves	800 mg/kg, p.o.	Albino mice	MES, PTZ	-----	++	[146]
103	<i>Cyperus articulatus</i> Linn. (Cyperaceae) Piri-piri	(a) Water extract of rhizomes (b) Water extract obtained after successive extraction with ethyl acetate and methanol (c) Lyophilized water extract ultrafiltered Methanolic extract of rhizomes Water extract of rhizomes	(a) 178 or 173 μ g/ml (b) 36 or 64 μ g/ml (c) 298 or 208 μ g/ml 500, 1000 or 2000 mg/kg, i.p. (a) 0.5 mg/ml (b) 3 mg/ml	Sprague dawley rats brain Male OF-1 albino mice <i>In vitro</i>	Receptor binding assay on [3H] glycine or NMDA recognition site of [3H] CGP39653 (a) MES, PTZ, NMDA, INH, STR (b) BIC and PIC -----	Inhibition of NMDA mediated neurotransmission (a) Decreased spontaneous epileptiform discharges (b) NMDA-induced depolarizations in the rat cortical wedge preparations	++ (a) ++ (b) -- ++	[147] [148] [149]
104	<i>Cyperus esculentus</i> Linn. (Cyperaceae) Chufa sedge, Yellow nutsedge, Tigernut sedge, Earth almond	Essential oil	250, 500 or 750 mg/kg, p.o.	Swiss albino rats	MES	-----	++	[150]

105	<i>Cyperus rotundus</i> Linn. (Cyperaceae) Coco-grass, Purple nut sedge, Red nut sedge	Ethanol extract of roots Ethanol extract of rhizomes Hydro-alcoholic (80% ethanol) extract of rhizomes	25, 40, 60 or 80 mg/kg, i.p. 100 mg/kg, p.o. 200 or 400 mg/ kg, i.p.	Swiss albino mice Albino rats Male albino mice	STR, Leptazol PTZ, MES PTZ induced kindling	----- ----- Increases the levels of SOD (superoxide dismutase), NO (nitric oxide) and decreases MDA (malondialdehyde) level in mice brain	++ ++ ++	[151] [152] [153]
106	<i>Cystoseira usneoides</i> (L.) Roberts (Cystoseiraceae) Algaebase	Essential oil	250, 500 and 750 mg/kg, p.o. 25 mg/kg, i.p.	Swiss albino rats Male CD1 mice	MES PTZ	----- -----	++ ++	[150] [154]
107	<i>Datura stramonium</i> Linn. (Solanaceae) Jimson weed, Thornapple	Commercially available fluid extract	24 drops/2L water for 30 days	Wistar rats	Lithium- PILO	-----	++	[155]
108	<i>Delphinium denudatum</i> Wall (Ranunculaceae) Jadwar, Nirbishi, Nirbisi	Aqueous extract (a) 95% ethanolic extract of roots (b) Aqueous fraction of above extract washed with hexane and acidic and basic chloroform Partially purified sub fraction (FS-I) fraction of above aqueous fraction devoid of alkaloids Aqueous fraction as obtained above	100 mg/kg, p.o. (a) 200, 400 or 600 mg/kg, p.o. (b) 400, 600 or 800 mg/kg, i.p. 600 mg/kg, i.p.	Albino rats Male CF-1 mice CF-1 mice	MES (a) PTZ, BIC, PIC, MES (b) STR (a) MES, PTZ, BIC (b) PIC (c) STR	----- ----- -----	++ (a) ++ (b) + (c) –	[156] [157] [158]
			0.6 mg/ml	<i>In vitro</i> ; SD rats hippocampal pyramidal neuronal culture	PTZ, BIC induced epileptiform activity using whole cell current clamp technique comprising paroxysmal depolarization shifts	Interaction with GABA(A) receptor	++	[159]
		Aqueous fraction	0.2-0.6 mg/ml	Cultured neonatal SD rat hippocampal pyramidal neurons	Whole cell current clamp technique sustained repetitive firing was elicited in neurons	Interaction with resting state of Na ⁺ channels	++	[160]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
109	<i>Delphinium nordhagenii</i> Wendelbo (Ranunculaceae) Die lie cui que hua	DNS II acetone fraction of 80% ethanolic extract of roots, devoid of alkaloids	60, 65 or 70 mg/kg, i.p.	Male NMRI mice	PTZ, PIC, MES	-----	++	[161]
110	<i>Desmodium adscendens</i> (Sw.) DC (Fabaceae) Amor seco, Amor-do-campo, Margarita	Ethanolic extract of leaves	300 mg/kg, s.c.	Male Swiss mice and Wistar rats	PTZ, KA	-----	++	[162]
111	<i>Dioclea grandiflora</i> Mart. ex Benth. (Fabaceae) Mucuna, Mucuna of stone	Aqueous extract of seeds	520 or 685 mg/kg, i.p.	Swiss albino mice	(a) PTZ (b) Transcorneal electroshock	-----	(a) ++ (b) +	[163]
		Alcoholic fraction and its major component dioclenol (28) from stem bark	Alcoholic fraction (15, 30, or 60 mg/kg, i.p.) and dioclenol (10 mg/kg, i.p.)	Swiss male albino mice	PTZ	-----	++	[164]
112	<i>Diodia scandens</i> Sw. (Rubiaceae) Ivory coast	Dark brown residue obtained while drying 95% ethanol extract of aerial parts at 40°C	1.5 mg/kg, i.p.	Albino mice	<i>Echis carinatus</i> venom induced toxic convulsions	-----	++	[165]
113	<i>Diospyros fischeri</i> Gurke (Ebenaceae) Vilosa de winter	80% ethanol extract of stem bark	200-1600 mg/kg, p.o.	Theiller's albino white mice	PIC	-----	++	[166]
114	<i>Diospyros mespiliformis</i> Hochst. ex A. DC (Ebenaceae) Jackalberry, African ebony	Aqueous extract of stem bark	100 or 200 mg/kg, p.o.	Swiss albino mice	PTZ	-----	++	[167]
115	<i>Dodonaea viscosa</i> Jacq. (Sapindaceae) Hopbush, Candlewood	Ethanolic extract of seeds	30 mg/kg, p.o.	Albino mice	PTZ, MES	-----	++	[168]
116	<i>Drosera burmannii</i> Vahl. (Droseraceae) Burmese sundew	90% ethanol and aqueous extracts of whole plant	500 mg/kg, body weight, p.o.	Swiss albino mice	PTZ	-----	++	[169]
117	<i>Dunalilia tertiolecta</i> Butcher (Bacillariophyceae)	Aqueous extract of microalgae	150 or 300 mg/kg, i.p.	Charles River CD 1 mice	PTZ	-----	++	[170]
118	<i>Echinodorus berteroi</i> (Spreng.) Fassett (Alismataceae) Cellophane Sword	Decoctions of dried roots	30% decoction, i.p. and repeated administration of 5% decoction	Male OF-1 mice and Wistar rats	(a) PIC, Penicillin induced epileptic foci (b) INH, MES	-----	(a) ++ (b) –	[171]

119	<i>Egletes viscosa</i> (L.) Less. (Asteraceae) Erect tropical daisy	Essential oil from flowers heads	50-400 mg/kg, i.p.	Male swiss mice	PTZ	Modulates the function of GABA and /or NMDA-receptor complex	++	[172]
120	<i>Elaeocarpus ganitrus</i> Roxb. (Elaeocarpaceae) Rudraksha	Aqueous solution of mixed fatty acids from petroleum ether extract obtained from seeds	1200 mg/kg, p.o.	CDRI albino mice	Leptazol, MES	-----	++	[173]
121	<i>Embelia ribes</i> Burm. f. (Myrsinaceae) False black pepper	90% ethanol extract of fruits	100 or 200 mg/kg, i.p.	Albino rats	MES, MTZ	-----	++	[174, 175]
122	<i>Embelia officinalis</i> Linn. (Phyllanthaceae) Indian gooseberry, Amla	Embelin (29) isolated from hexane extract of plant berries	2.5, 5.0, or 10 mg/kg, i.p.	(a) Swiss albino rats	(a) MES	-----	++	[176]
		Standardized hydro-alcoholic extract	500 or 700 mg/kg, i.p. for seven days	(b) Swiss mice	(b) PTZ	Decreases oxidative stress markers viz., malondialdehyde and glutathione	++	[177]
123	<i>Equisetum arvense</i> Linn. (Equisetaceae) Field horsetail, Common horsetail	Hydro-alcoholic (50% ethanol) extract of stems	200 or 400 mg/kg, i.p.	Male Wistar rats	PTZ	-----	++	[178]
124	<i>Eryngium foetidum</i> Linn. (Apiaceae) Shadow benny, Bandanya, Culantro	Aqueous extract of chopped leaves	100 mg/kg, p.o.	Albino rats	PIC	-----	++	[179]
125	<i>Erythrina americana</i> Miller (Fabaceae) Colorin	Free alkaloids in hexane, free alkaloids in methanol, liberated alkaloids of seeds	3 mg/kg, p.o. and i.p.	Male Wistar rats	Aggression behaviour and visual isolation	Decreases aggressive behaviour, Cholinergic and GABAergic system	++	[180]
126	<i>Erythrina mulungu</i> Mart. (Papilionaceae) Mulungu, Corticeira	Hydro-alcoholic (50% ethanol) extract from stem bark	200 or 400 mg/kg, i.p.	Male Swiss mice	(a) STR (b) PTZ	Glycine inhibitory mechanism	(a) ++ (b) –	[181]
		(+)- erythravine (30) and (+)-11- α -hydroxy-erythravine (31) isolated from 70% ethanol extract of flowers	0.25 to 3 μ g/ μ l, i.c.v.	Male Wistar rats	PTZ, BIC, KA, NMDA	-----	++	[182]
127	<i>Erythrina variegata</i> Linn. (Fabaceae) Tiger's claw, Indian Coral tree, Sunshine tree	Aqueous extract of stem bark	100 or 200 mg/kg, p.o.	Male Swiss albino mice	PTZ, MES	Modulation of GABA levels in brain	++	[183]
		Total alkaloids from ethanol extract of bark	5 mg/kg, i.p.	CDRI albino mice	MES, PTZ	-----	++	[184]
128	<i>Erythrina velutina</i> Willd. (Fabaceae) Bico-De-Papagaio	Hydro-alcoholic (50% ethanol) extract of stem bark	200 or 400 mg/kg, i.p.	Male Swiss mice	(a) STR (b) PTZ	Glycine inhibitory mechanism	(a) ++ (b) –	[181]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
129	<i>Espeletia semiglobulata</i> Cuatrec. (Compositae) Paramo rosette	Kaurenic acid (32) a diterpene isolated from hexane extract of aerial parts	(a) 0.625 and 1.25 mg/kg, i.p. (b) ED50 – 2.5 mg/kg, ventral lymphatic sac	(a) NMRI mice (b) South American tropical toads (<i>Bufo marinus</i>)	(a) PTZ (b) Isolated spinal cord hindlimb preparation; spinal seizures induced by sudden cooling	-----	++	[185]
130	<i>Eugenia caryophyllata</i> Thunb. (Myrtaceae) Clove	Essential oil from buds	0.050 ml/kg, i.p. ED50 – 0.048 ml/kg, i.p.	Male NMRI mice	PTZ, MES	-----	++	[186]
131	<i>Ferula gummosa</i> Boiss. (Apiaceae) Galbanum	Methanol extract of seeds and roots	250 or 500 mg/kg, i.p.	Male NMRI mice	(a) PTZ [ED50 – 55 (34.65-87.43) mg/kg, i.p.] (b) MES [ED50 – 198.34 (171.93-228.8) mg/kg, i.p.]	-----	++	[187, 188]
132	<i>Ficus exasperata</i> vahl. (moraceae) Irambarattam, Maramthinni attthi, Parakam	Essential oil from fruits	1, 1.5, 2.5 ml/kg, i.p.	Male NMRI mice	PTZ, MES	-----	++	[189]
133	<i>Ficus hispida</i> L. f. (Moraceae)	Hydro-alcoholic (70% ethanol) extract of leaves	30- 300 mg/kg, p.o.	Male ICR mice	PTZ, PIC, MES	-----	++	[190]
134	<i>Chona-atthi, Kattatthi</i> <i>Ficus platyphylla</i> Del. (Moraceae) Flake rubber tree, Gutta-percha tree	Methanolic extract of leaves Saponin rich fraction obtained from methanol extract of stem bark	200 or 400 mg/kg, p.o. 25-100 mg/kg, p.o.	Swiss albino mice (a) <i>In vivo</i> ; Albino mice (b) <i>In vitro</i> ; SD rats	PTZ, PIC, STR (a) (i) PTZ, STR (ii) MES (b) Extracellular brain slice recordings; spontaneous excitatory postsynaptic currents; sustained repetitive firing; evoked GABA currents	Suppresses excitatory and inhibitory synaptic traffic; blocks sustained repetitive firing and spontaneous action potential firing; impairs membrane excitability	(a) (i) ++ (ii) – (b) ++	[192]
135	<i>Ficus religiosa</i> Linn. (Moraceae) Sacred fig	70% methanolic extract of figs	25, 50 or 100 mg/kg, i.p.	Male Swiss albino mice	PTZ, PIC, MES	-----	++	[193]
136	<i>Ficus sycamoros</i> Linn. (Moraceae) Sycamore fig, Fig-mulberry	Aqueous extract of stem bark	400 or 600 mg/kg, i.p.	White Wistar albino rats	PTZ, STR	-----	++	[194]

137	<i>Flemingia macrophylla</i> (Willd.) Merr. (Fabaceae) Apa apa, Hahapaan, Gewawini	95% ethanolic extract of aerial parts	20, 50, 100 or 200 mg/kg, p.o.	Male Swiss albino mice	PTZ, MES	-----	++	[195]
138	<i>Fraxinus griffithii</i> C.B. Clarke (Oleaceae) Griffith's ash	Ligustrosid (33) glycoside isolated from bark	100, 200, 300, 400 or 500 mg/kg, i.p.	Balb/c mice	MTZ, MES	Increases GABA-facilitated inhibition in CNS through interaction with GABA-BZD-BARB/PICRO-CL receptor complex	++	[196]
139	<i>Fumaria indica</i> (Hausskn.) Pugsley (Fumariaceae) Pitpapa	50% ethanolic extract of whole plant containing fumaric acid and dimethyl fumarate	100, 200 or 400 mg/kg, p.o.	(a) Charles Foster albino rats (b) Wistar mice	(a) MES (b) PTZ	-----	++	[197]
140	<i>Galeopsis ladanum</i> Linn. (Lamiaceae) Broad leaf hemp nettle	Aqueous extract of overground parts	200 mg/kg, i.p.	Male Swiss albino mice and Male Wistar rats	(a) PTZ (b) MES	-----	(a) + (b) –	[198]
141	<i>Galphimia glauca</i> Galph. (Malpighiaceae) Barbados cherry, Thryallis, Slender goldshower	Methanolic extract of aerial parts	50 or 100 mg/100 g, i.p.	(a) Male Wistar rats (b) Male albino mice	(a) STR (b) Leptazole	-----	++	[199]
142	<i>Ganoderma lucidum</i> (Curtis) P. Karst. (Ganodermataceae) Lingzhi or Reishi mushroom	Aqueous extract of fruit bodies	300 mg/kg, s.c.	Male Std:ddY mice	(a) STR, Caffeine (b) PTZ	-----	(a) + (b) –	[200]
143	<i>Gastrodia elata</i> Blume (Orchidaceae) Tian ma	Aqueous extract of roots	0.2- 0.5 ml/10 g, i.p.	Albino mice	MTZ	-----	++	[201]
		Methanolic extract	500 mg/kg, p.o.	Albino rats	-----	Antioxidative effect	++	[202]
		Vanillyl alcohol (34)	200 mg/kg, i.p.	Sprague Dawley rats	Ferric chloride induced convulsions	Inhibition of wet dog shakes and lipid peroxide levels in bilateral cerebral cortex; reduces luminol chemiluminescence and lucigenin count in peripheral blood	++	[203]
		(a) 4-hydroxy benzaldehyde (35) (b) 4-hydroxy-3-methoxy benzaldehyde (36)	(a) 4.1 µg/ml (b) 5.4 µg/ml	<i>In vitro</i>	-----	Inhibits activity of GABA transaminase	++	[204]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
	<i>Gastrodia elata</i> Blume (Orchidaceae) Tian ma	Aqueous extract of roots	0.5 or 1.0 g/kg, p.o.	Sprague Dawley rats	KA	Regulation of activator protein-I expression via the C-Jun N-terminal kinases (JNKs) signaling pathway in KA induced epilepsy	++	[205]
144	<i>Gelsemium sempervirens</i> (L.) J. St.-Hil. (Gelsemiaceae) Yellow jasmine, Carolina jasmine	Commercially available fluid extract	24 drops/2L water for 30 days	Wistar rats	Lithium- PILO		++	[155]
145	<i>Ginkgo biloba</i> Linn. (Ginkgoaceae) Ginkgo, Maidenhair tree	EGb 761	100 mg/kg/day, p.o. for 14 days	<i>In vitro</i> ; Rat hippocampus and cerebral cortex	Electroconvulsive shock induced accumulation of free fatty acids and diacylglycerols		++	[206]
		Bilobalide (37), a sesquiterpene isolated from leaves	30 mg/kg, p.o once a day for 4 days	Male ddY mice	MES, INH, 4-O-methylpyridoxine	Elevation in hippocampal GABA levels through potentiation of glutamic acid decarboxylase activity; potentiation of hepatic 7-methoxy coumarin O-demethylase enzyme activity which cause disappearance of MPN in blood	++	[207-209]
		Aqueous extract of leaves	20 or 40 mg/kg body weight, i.p.	Albino rats	MTZ, MES		++	[210]
		EGb 761 extract	100 mg/kg, p.o. daily for 26 days	Male Swiss mice	PTZ	Suppression of seizure induced reactive oxygen species (ROS) in brain	++	[211]
146	<i>Glycyrrhiza glabra</i> Linn. (Leguminosae) Licorice, Mulethi	Glycyrrhizic acid ammonium salt (38) isolated from roots (a) 80% ethanol extract of leaves (b) Dichloro-methane fraction	100, 200, 300 or 400 mg/kg, i.p. 1, 1.5, 2, 3 or 4 g/kg, i.p. (a) ED50- 2.11 g/kg, i.p. (b) (a) ED50- 1.30 g/kg, i.p.	Swiss albino mice Male NMRI mice	PTZ, INH PTZ, MES		++ ++	[212] [213]

147	<i>Glyphaea brevis</i> (Spreng.) Monachino (Tiliaceae) Fula-Tukulor <i>Goodyera</i> <i>schlechtendalliana</i> H. G. Reichenbach (Orchidaceae) Ban ye lan, Hào lan schlechtendal, Miyamauzura (Rubiaceae) Beach gardenia, Zebra wood	Aqueous ethanolic extract of leaves	400 or 800 mg/kg, body weight, p.o.	Albino mice	PTZ, STR	-----	++	[214]
148	<i>Goodyera</i> <i>schlechtendalliana</i> H. G. Reichenbach (Orchidaceae) Ban ye lan, Hào lan schlechtendal, Miyamauzura (Rubiaceae) Beach gardenia, Zebra wood	Goodyerin (39) a flavonol glycoside isolated from methanol extract of whole plant	25 or 55 mg/kg, i.p.	Male SD rats	PIC	-----	++	[215]
149	<i>Guettarda speciosa</i> Linn. (Rubiaceae) Beach gardenia, Zebra wood	Ethanolic (95%) extract of inner bark	200 or 400 mg/kg, p.o.	Albino Wistar rats	PTZ, MES	Increases levels of monoamines such as NA, DA, 5-HT and GABA in brain	++	[216]
150	<i>Harpagophytum</i> <i>procumbens</i> (Burch.) DC. ex Meissner (Pedaliaceae) Grapple plant, Wood spider, Devil's Claw <i>Heracleum crenatifolium</i> Boiss. (Apiaceae) Hogweed	Ethanolic (95%) extract of inner bark	200 or 400 mg/kg, p.o.	Albino Wistar rats	PTZ, MES	GABA/ chloride channel or bezodiazepine receptor complex	++	[217]
151	<i>Heracleum persicum</i> Desf. ex Fisch. (Apiaceae) Golpar, Persian Hogweed	Aqueous extract of roots	50- 800 mg/kg, i.p.	Male Balb/c mice	PTZ, PIC, BIC	Enhances GABAergic neurotransmission and/ or facilitates GABAergic action in the brain	++	[218]
152	<i>Heracleum persicum</i> Desf. ex Fisch. (Apiaceae) Golpar, Persian Hogweed	(a) Furano-coumarins, coumarin mixture (b) essential oil, bergapten (40) isolated from petroleum ether extract of fruits	(a) 60 mg/kg, i.p. (b) 0.84 ml/kg, i.p.	Male albino mice	MES	-----	++	[219]
153	<i>Heracleum persicum</i> Desf. ex Fisch. (Apiaceae) Golpar, Persian Hogweed	Acetone extract of seeds	100-400 mg/kg, i.p. (a) ED50 – 205.9 (114.8-283) mg/ kg, i.p. (b) ED50 – 265.8 (208.2-306.8) mg/kg, i.p.	Male NMRI mice	(a) PTZ (b) MES	-----	++	[220]
154	<i>Herpestis monniera</i> (Schrophulariaceae) Brahmi	Crude drug	3, 6, 9 or 12 mg/100g, i.p. PD50 (Protective dose – 6.31 mg/100g)	Albino mice	Audiogenic seizures	-----	++	[221]
154	<i>Hibiscus rosa sinensis</i> Linn. (Malvaceae) Chinese hibiscus, Shoe flower	Acetone soluble part of ethanol extract of leaves	100 mg/kg, i.p.	Male SD rats	MES, Electrical kindling, PTZ, Lithium-PiLO	-----	++	[27]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
155	<i>Himantalia elongate</i> (Linn.) S.F. Gray (Himantaliaceae) Thongweed, Buttonweed, Sea spaghetti	Protein rich extract obtained from sodium carbonate solution of seaweed	300 or 600 mg/kg, i.p.	Male Charles River CD-1 mice	PTZ	-----	++	[222]
156	<i>Hippeastrum vittatum</i> (L'Hér.) Herbert (Liliaceae) Bella Raquel, Amaryllis	Montanine (41), an isoquinoline alkaloid isolated from ethanol extract of fresh bulbs	30 or 60 mg/kg, i.p.	Swiss albino mice	PTZ	-----	++	[223]
157	<i>Hoslundia opposita</i> Vahl. (Labiatae) Orange bird berry, Bird gooseberry	Chloroform extract from roots	50 or 100 mg/kg, p.o.	Swiss male mice	Leptazol	-----	++	[224]
158	<i>Humulus lupulus</i> Linn. (Cannabaceae) Common hop	Aqueous extract	100, 250 or 500 mg/kg, i.p.	ICR mice	PTZ	-----	++	[225, 226]
159	<i>Hunteria zeylanica</i> (Retz.) Gard. ex Thw. (Apocynaceae) Hunterier de Ceylan, Ceylon hunteria	Methanol, butanol and chloroform fraction and a pure compound corymine (42) from leaves	15, 60 or 120 mg/kg, i.p.	Male ddY mice	(a) PIC, STR (b) PTZ	-----	(a) ++ (b) –	[227]
160	<i>Hygrophila difformis</i> Blume (Acanthaceae) Water wisteria	Ethanol extract of aerial parts	200-500 mg/kg, i.p.	Swiss albino mice	STR, Leptazol	-----	++	[228]
161	<i>Hyoscyamus niger</i> Linn. (Solanaceae) Stinking nightshade, Black henbane	80% Methanolic extract of seeds	200, 300 or 400 mg/kg, i.p.	Male albino mice	PIC	-----	++	[229]
162	<i>Hypericum perforatum</i> Linn. (Guttiferae) St John's wort	Water, n-butanol and ether fractions of crude 80% ethanolic extract of aerial parts Aqueous and ethanolic extracts of aerial parts Methanolic extract of flowers	1 ml/kg, body weight, i.m. of 0.1 g/ml concentration 0.1- 1 g/kg, i.p. 25, 50, 100 or 200 mg/kg, i.p.	Chinchilla rabbits Albino mice Male Swiss mice	Kindling convulsions in rabbits (a) PTZ (b) MES PIC	Nitric oxide pathway -----	(a) ++ (b) – ++	[231] [232]

163	<i>Hypoxis hemerocallidea</i> Fisch. Mey. & Avel-Lall. (Hypoxidaceae) African star grass, African potato <i>Hyptis spicigera</i> Lam. (Labiatae) Marubio	Aqueous extract of corm	50-800 mg/kg, i.p.	Male Balb/c mice	PTZ, PIC, BIC	Enhances GABAergic neurotransmission in the brain	++	[233]
164		Decoction of leaves	120 mg/kg, p.o.	Swiss male mice	PTZ, STR	-----	++	[9]
165	<i>Icacina trichantha</i> Oliv. (Icacinaeae) Ututo ògiri	50% methanol extract of tuber	400 mg/kg, i.p.	White albino rats	(a) PTZ (b) STR	-----	(a) ++ (b) –	[234]
		Methanolic extract of leaves	200 mg/kg, i.p.	Albino mice	PTZ	-----	++	[235]
166	<i>Indigofera tinctoria</i> Linn. (Fabaceae) True indigo	Aqueous extracts of leaves and stems	100 mg/kg, p.o.	Albino mice	STR	-----	++	[236]
		Methanolic extract of leaves	200 or 400 mg/kg, p.o.	Albino Wistar rats	PTZ, MES	Chloride channel of the GABA or benzodiazepine receptor complex	++	[237]
167	<i>Ipomoea aquatica</i> Forsk. (Convolvulaceae) Water spinach, Water morning glory, Water Convolvulus	Methanolic extract of leaves	200 or 400 mg/kg, p.o.	Albino mice	PTZ, PIC, STR	-----	++	[238]
		Methanol extract of leaves	100 mg/kg, p.o.	Albino mice	MES	-----	++	[121]
168	<i>Ipomoea fistulosa</i> Mart. Ex Choisy (Convolvulaceae) The pink morning glory	Marsillin (43), an ester of 1- triacontanol and hexacosanoic acid	10 mg/kg, i.p.	Albino mice	STR	-----	++	[239]
169	<i>Ipomoea stans</i> Cav. (Convolvulaceae) Morning glory	Aqueous, ethanolic and chloroform extract of roots	100 mg/kg, p.o.	Male Wistar rats	MTZ, MES	-----	++	[240, 241]
		Ethyl acetate extract of roots	2.5, 5, 10 or 20 mg/kg, i.p.	ICR male mice	PTZ	Involves GABAergic neurotransmission system and increase the release of GABA in brain cortex	++	[242]
170	<i>Isochrysis galbana</i> Demart (Haptophyceae)	Aqueous extract of microalgae	400 mg/kg, i.p.	Male CD1 albino mice	PTZ	-----	+	[243]
171	<i>Kalanchoe crenata</i> Andr. Haw. (Crassulaceae) Neverdie	Methylene chloride/ methanolic (1:1) extract of leaves	150, 300 or 600 mg/kg, p.o.	Wistar rats	PTZ, STR, Thiosemicarbazide	-----	++	[244]
172	<i>Kigelia pinnata</i> (Jacq.) DC (Bignoniaceae) Sausage tree	Methanolic and aqueous extract extracted successively from bark	250 or 500 mg/ kg, i.p.	Male Wistar rats	PTZ, MES	-----	++	[245]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
173	<i>Lactuca sativa</i> Linn. (Asteraceae) Lettuce	Seed oil	1.25 or 2.5 mg/kg, p.o.	Swiss mice	PTZ	-----	++	[246]
174	<i>Lagenaria breviflora</i> (Benth.) Roberty (Cucurbitaceae) Wild colocynth, Calebasse tigrée	80% methanolic extract of inner part of fresh fruits	100 mg/kg, i.p.	Albino mice	PTZ, STR	-----	++	[65]
175	<i>Laminaria ochroleuca</i> Bachelot de la Pylaie (Laminariaceae) Kelp	Methanolic extract of seaweed	25 or 100 mg/kg, i.p.	Male CD-1 mice	PTZ	-----	++	[247]
176	<i>Laurus nobilis</i> Linn. (Lauraceae) Bay laurel, Sweet bay	Essential oil of leaves	0.25-1 ml/kg, i.p.	Male NMRI mice	PTZ, MES	-----	++	[248]
177	<i>Lavandula stoechas</i> Linn. (Lamiaceae) French lavender, Spanish lavender	Aqueous methanolic (70% methanol) extract of flowers	600 mg/kg, p.o.	Swiss albino mice	PTZ	Blocks calcium channels	++	[249]
178	<i>Leea guineensis</i> G. Don (Leeaceae) Red tree vine, Amamali, West Indian holly	Aqueous extract of leaves	30- 300 mg/kg, p.o.	Female ICR mice	PTZ, PIC, MES	-----	++	[250]
179	<i>Leonotis leonurus</i> Linn. (Lamiaceae) Lion's tail, Wild dagga	Water extract of leaves	200 or 400 mg/kg, i.p.	Male albino mice	PTZ, BIC, PIC, NMDA	Effects both GABAergic and glutaminergic system	++	[251]
180	<i>Leonotis nepetifolia</i> (L.) R. Br. (Lamiaceae) Klip dagga, Lion's ear	Methanol extract of capitulum	150, 300 or 600 mg/kg, i.p.	(a) Swiss albino mice (b) Ranger Cockerels	(a) (i) PTZ, STR (ii) 4- amino pyridine (b) MES	-----	(a) (i) ++ (ii) – (b) –	[252]
181	<i>Licaria puchury-majior</i> (Mart.) Kosterm. (Lauraceae) Puchuri-grosso, Puchurim	(a) Essential oil obtained from powder seeds (b) Aqueous extract of seeds	(a) 200 mg/kg, i.p. (b) 150 g/kg, p.o.	Male albino mice	MES	-----	++	[253]
182	<i>Lippia alba</i> (Mill.) N.E.Br. ex Britton & P.Wilson (Verbenaceae) Bushy matgrass, Bushy lippia	Essential oil from three chemotypes Spray-dried ethanolic (40, 60 or 80%) extracts containing non volatile fraction from leaves 80% ethanolic and methanolic extract of leaves of LP1 to LP7 chemotypes	200 or 400 mg, i.p. or p.o. 200 mg/kg, p.o.	Female Swiss mice Male Swiss mice	PTZ PTZ	----- -----	++ ++	[254] [255]
			300 mg/kg, p.o.	Male Swiss mice	PTZ LP1, III and VI showed activity	Inhibition of GABA uptake and GABA binding	++	[256]

183	<i>Lychnophora rupestris</i> Semir & Leitão Filho (Asteraceae) Falsa arnica	(a) 4, 5-di-O-[E]- caffeoyl quinic acid (44) (b) Methanolic extract (c) Polar extract of whole plant	(a) 12.5, 25 or 50 mg/kg, i.p. (b) 100 mg/kg, i.p. (c) 600 mg/kg, i.p.	Male swiss mice	PTZ	Adenosinergic, glutamatergic systems and GABAergic neurotransmission	++	[257]
184	<i>Lychnophora staavioides</i> Mart. (Asteraceae) Arnica da serra	4, 5-di-O-[E]- caffeoyl quinic acid (44) and methanolic extract of leaves, flowers, and leaves, stems, stem bark, branches and roots	600 mg/kg, i.p.	Male Swiss albino mice	PTZ	Adenosinergic, glutamatergic systems and GABAergic neurotransmission	++	[257]
185	<i>Magnolia dealbata</i> Zucc. (Magnoliaceae) Cloudforest magnolia	Absolute ethanolic extract of leaves	100 or 300 mg/ kg, i.p.	Male Swiss albino mice	PTZ	-----	++	[258]
186	<i>Magnolia grandiflora</i> Linn. (Magnoliaceae) Southern magnolia, Bull bay	Ethyl ether and hydroalcoholic extract of seeds	200 or 250 mg/kg, p.o.	Male Wistar rats	MES	-----	++	[259]
187	<i>Magnolia officinalis</i> Rehder & Wilson (Magnoliaceae) Houpu Magnolia, Magnolia-bark	Magnolol (45) isolated from an alkaline soluble fraction of ether extract of bark	100 mg/kg, i.p.	Male albino ddY mice and Wistar male rats	Penicillin induced convulsions	-----	++	[260]
188	<i>Maprounea africana</i> Mull Arg. (Euphorbiaceae) Redskin	Absolute ethanolic extract of leaves	50, 300 or 1000 mg/kg, i.p.	Male Swiss albino mice	(a) PTZ (b) MES, PIC, KA, PILO	-----	(a) ++ (b) -	[261]
189	<i>Martynia annua</i> Linn. (Martyniaceae) Cat's claw	Methanolic extract of leaves	200 or 400 mg/ kg body weight, p.o.	Albino Wistar rats	PTZ, MES	-----	++	[262]
190	<i>Matricaria chamomilla</i> Linn. Synonym - <i>Matricaria recutita</i> Linn. (Asteraceae) German chamomile	Aqueous extract of leaves and stems (10 g/100 ml) Hydro-methanolic (80% methanol) percolated extract of aerial parts	0.2 ml, i.p. 100 or 200 mg/ kg, i.p.	White female mice Male albino mice	PIC PIC	-----	++ ++	[43] [263]
191	<i>Microglossa pyrifolia</i> (Lam.) Kuntze (Asteraceae) Vi-thiet, Tieu-thiet	Decoction of leaves	260 mg/kg, p.o.	Swiss male mice	MES, PTZ, PIC, NMDA, INH, STR	-----	++	[9]
192	<i>Mimosa pudica</i> Linn. (Fabaceae) Chumui, Touch-me-not	Decoction of leaves	1000- 4000 mg/ kg, i.p.	Male Swiss mice	(a) PTZ, STR, NMDA (b) PIC	-----	(a) ++ (b) -	[264]
193	<i>Mitragyna africana</i> (Willd.) Kuntze (Rubiaceae) Kratom	50% methanol extract of stem bark	400 mg/kg, i.p.	Wistar male rats	STR	-----	++	[265]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
194	<i>Morinda tinctoria</i> Roxb. (Rubiaceae)	Petroleum ether extract of leaves	200, 400 or 600 mg/kg, i.p.	Albino Swiss mice	PTZ, MES	-----	++	[266]
195	Aal, Indian mulberry <i>Moringa oleifera</i> Lam. (Moringaceae)	Alkaloid fraction of roots	12.5 mg/kg, i.p.	Albino mice	STR	Binds at STR site in spinal cord	++	[267]
	Horseradish-tree, Ben-oil tree, Drumstick-tree	Methanolic extract of roots	0.35 to 0.70 g/kg, i.p.	Swiss mice	STR, Leptazol	-----	++	[268]
196	<i>Morus alba</i> Linn. (Moraceae)	Butanol and Water soluble fractions of methanol extract of root bark	10 g/kg, i.p.	Male ddY mice	MES	-----	++	[269]
	White mulberry tree							
197	<i>Mucuna pruriens</i> (L.) DC (Fabaceae)	95% ethanolic extract of leaves	100 mg/kg, p.o.	Albino rats	MES, PILO	-----	++	[270]
198	Velvet bean, Cowitch <i>Musa sapientum</i> Linn. (Musaceae)	Fresh juice of steams	250 or 500 mg/kg, p.o.	Swiss albino mice	INH	Prevention of inhibition of vitamin- B6 metabolism thereby increasing the GABA synthesis in the CNS or due to facilitatory effect on GABAergic neurons	++	[271]
	Banana							
199	<i>Myristica fragrans</i> Houtt. (Myristicaceae)	n- hexane fraction of acetone insoluble part of petroleum ether extract of seeds	10, 30 or 100 mg/kg, i.p.	Male albino mice and rats	MES, PIC, PTZ, Lithium sulphate and PILO nitrate induced status epilepticus	-----	++	[272]
	Nutmeg							
200	<i>Nardostachys jatamansi</i> DC (Valerianaceae)	Volatile oil from dried ripe seeds	50- 300 µl/kg, i.p.	Male NMRI mice	PTZ, STR, BIC, MES	-----	++	[273]
	Muskroot, Nard, Nardin, Spikenard	95% ethanol extract of roots	250 or 500 mg/kg, i.p.	Male albino Wistar rats	PTZ, MES	-----	++	[274]
201	<i>Nauclea latifolia</i> Smith (Rubiaceae)	Decodction from bark of roots	16, 40, 80 or 160 mg/kg, i.p.	Swiss albino mice	PTZ, STR, NMDA, MES	-----	++	[275]
	African peach, Strawberry tree							
202	<i>Nepeta cataria</i> Lam. (Apocynaceae)	-----	10% of the normal diet 2 h/day for 1 or 7 days	Albino mice	PIC	Increases susceptibility	++	[276]
	Catnip							
203	<i>Nepeta sibthorpii</i> Bentham (Lamiaceae)	95% methanolic extract of aerial parts and its active compound epinepetalactone (46)	50 mg/kg, i.p. and p.o.	Swiss male mice	PTZ	GABAergic mediation	++	[277]
	Catmint							

204	<i>Nerium indicum</i> Mill. (Apocynaceae) Indian Oleander, Kaner herb	Ursolic acid (47), a terpenoid isolated from 95% methanol extract of aerial parts Aqueous extract of flowers Petroleum ether, methanol and aqueous extract of flowers Petroleum ether, methanolic and aqueous extract of flower Ethylacetate fraction of methanol extract of leaves Methanolic extract of stem bark	2.3 mg/kg, p.o. 400 mg/kg body weight, p.o. 400 mg/kg, p.o. 400 mg/kg body weight, p.o. 50 mg/kg, i.p. 400 mg/kg, i.p.	Swiss male mice Swiss albino mice Wistar albino mice Swiss albino mice NMRI male albino mice Albino mice	PTZ PTZ, MES PTZ, MES PTZ, MES (a) PIC, BIC (b) PTZ, STR Leptazol	----- ----- ----- ----- ----- -----	++ ++ ++ ++ (a) ++ (b) – ++	[278] [279] [280] [279] [281] [282]
205	<i>Nerium oderum</i> Sol. ex Alton (Apocynaceae) Sweet scented oleander	Petroleum ether, methanolic and aqueous extract of flower	400 mg/kg body weight, p.o.	Swiss albino mice	PTZ, MES	-----	++	[279]
206	<i>Nerium oleander</i> Linn. (Apocynaceae) Oleander	Ethylacetate fraction of methanol extract of leaves	50 mg/kg, i.p.	NMRI male albino mice	(a) PIC, BIC (b) PTZ, STR	-----	(a) ++ (b) –	[281]
207	<i>Newboldia laevis</i> (P. Beauv.) Seem. ex Bureau (Bignoniaceae) African border tree, Akoko tree, Newboldia	Methanolic extract of stem bark	400 mg/kg, i.p.	Albino mice	Leptazol	-----	++	[282]
208	<i>Nigella sativa</i> Linn. (Ranunculaceae) Fennel flower, Nutmeg flower, Kaljeera, Black caraway, Roman coriander	Thymoquinone (48) isolated from seeds Thymoquinone (48) isolated from seeds	40 and 80 mg/kg, i.p. 200 or 400 µM by i.c.v. injection	Male albino Balb/c mice Male Wistar rats	PTZ, MES PTZ	Opioid receptor mediated increase in GABAergic tone Opioid receptor mediated increase in GABAergic tone	++ ++	[283] [284]
209	<i>Nilumbo nucifera</i> Gaertn. (Nelumbonaceae) Indian lotus, Sacred lotus, Bean of India	Aqueous extract of black seeds (i) Aqueous extract from seeds (ii) Fixed oil (iii) Volatile oil (iv) Thymoquinone (48) (v) α-pinene (49) (vi) p-cymene (50) Chloroform extract of leaves	40 mg/kg/8h for one month ED50 values (i) 2000 (ii) > 3244 (iii) 375.8 (iv) 93.2 (v) 440 (vi) 393.8 mg/kg, i.p. 120 mg/kg, p.o.	Add on placebo-controlled double blind crossover study on 23 children Swiss albino mice Male albino mice	Uniform measure of seizure frequency and parental satisfaction (a) PTZ (b) MES, PIC, STR PTZ, MES	----- GABA receptors Involvement of GABA	++ (a) ++ (b) – ++	[285] [286] [287]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
210	<i>Nyctanthes arborescens</i> Linn. (Oleaceae)	Ethanol and aqueous extracts of leaves	500, 1000 or 1500 mg/kg, p.o.	Wistar albino mice	PTZ, MES	-----	++	[288]
211	Night flowering jasmine <i>Nylandtia spinosa</i> L. Dumont (Polygalaceae) Tortoise berry, Mimaba, Skilpadbessie	Aqueous and methanolic extracts of leaves	200 or 400 mg/kg, i.p.	Male albino mice	(a) PTZ, BIC, PIC (b) NMDA	-----	(a) ++ (b) --	[289]
212	<i>Nymphoides macrosperrum</i> Vasud. Nair (menyanthaceae) Granthika tagara	90% ethanol extract of roots and rhizomes	500 or 750 mg/kg, body weight, p.o.	Swiss albino mice	PTZ	-----	++	[290]
213	<i>Ocimum basilicum</i> Linn. (Lamiaceae) Sweet basil, Common basil	Essential oil of aerial parts of plant contains variety of terpenes	0.2, 0.4, 0.8 or 1.2 ml/kg, i.p.	Swiss albino mice	PTZ, PIC, STR	-----	++	[291]
214	<i>Ocimum gratissimum</i> Linn. (Lamiaceae) Clove basil, African basil	Essential oil of leaves Petroleum ether and methanolic extract of leaves Petroleum ether and methanol fractions of methanol extract of leaves	0.5-1 ml/kg, p.o. 200 or 400 mg/kg, p.o. 200 or 400 mg/kg, p.o.	Male Swiss mice Albino mice Male Swiss albino mice	PTZ, MES PTZ PTZ	----- ----- -----	++ ++ ++	[292] [293] [294]
215	<i>Ocimum sanctum</i> Linn. (Lamiaceae) Tulsi, Holy basil	Ethanol extract of dried leaves 1 g/10 ml of 2.5% ethanol Ethanol and chloroform extracts of stem, leaf and stem callus culture	0.5 ml for 5 days twice daily 400 or 800 mg/kg, p.o. 200 or 400 mg/kg, p.o.	Wistar albino rats Laca mice Albino Wistar rats	PTZ, MES MES PTZ, MES	Involvement of dopaminergic neurons ----- Potentiation of the activity of GABA receptors and their signal transduction process	++ ++ ++	[295] [296] [297]
216	<i>Oxalis corniculata</i> Linn. (Oxalidaceae) Creeping wood sorrel, Procrumbent yellow sorrel, Sleeping beauty	Methanolic extract of leaves	200 or 400 mg/kg, p.o.	Albino Wistar rats	PTZ, MES	-----	++	[298]
217	<i>Paeonia emodi</i> Linn. (Paeoniaceae) Udesaleeb (Unani medicine) Himalayan Peony	Aqueous and alcoholic extracts of tubers	1g/100g, p.o.	Male albino rats	MES, PTZ	-----	++	[298]

218	<i>Peoniae lactiflora</i> Pall var. <i>trichocarpa</i> (Paeoniaceae) Peony root	(a) Water, Water/ acetone, methanol extracts (b) Paeoniflorin (51), Albiflorin (52), Pentagalloyl- glucose (53)	(a) 1 g/kg, p.o. (b) 25 mg/kg, p.o.	Male Wistar rats	EEG power spectrum changes induced by PTZ administration, Extracellular Ca++ and K+ concentration changes due to seizure activity	++	[299]
		(a) Aqueous extract of roots (b) Gallotannin fraction	1 g/kg/day, p.o. for 30 days	Wistar rats	Cobalt focus epilepsy model Neuron damage in the CA area of the hippocampus and frequent spike discharges induced by application of metallic cobalt to the cerebral cortex of rats	++	[300]
219	<i>Peonia suffruticosa</i> Andrews (Paeoniaceae) Moutan cortex	Total glucoside fraction from roots Total glycoside fraction	60 or 80 mg/kg, i.p.	Albino mice	MES, STR, MTZ, Semicarbazide	++	[301]
		Water extract of roots	40 or 80 mg/kg/ day, i.p. 0.5 g/kg, p.o. once daily for 20 days	Albino mice and rats Male C57BL/6 mice	MTZ, STR, MES Cobalt focus model	++	[302]
					Protection of mouse cerebral neurons involves neurotrophic events caused by thyroid hormones and/ or retinoids and enhanced glycolysis	++	[303]
220	<i>Palisota ambigua</i> (P. Beauv.) C. B. Clarke (Commelinaceae) Luokittelü, Kuvia, Levinnaizyys <i>Panax ginseng</i> C.A. Meyer (Araliaceae) Ginseng	Absolute ethanolic extract of leaves	50, 100 or 1000 mg/kg, i.p.	Male Swiss mice	(a) PTZ (b) PIC, MES	(a) ++ (b) –	[304]
221		Ginsenosides Rb2 (54) and Rc (55)	50 mg/kg, i.p.	Wistar rats	KA	++	[305]
		Ginsenosides Rb1 (56), Rb2 (54) and Rc (55)	50 mg/kg, i.p.	Wistar rats	KA	++	[306]
		Standardized extract of roots (60 mg/g of ginsenosides)	100 mg/kg, p.o.	Male Wistar rats	PTZ	++	[307]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
		(a) 95% ethanol extract of roots (b) 95% ethanol extract of leaves/ stems (c) A partially purified extract containing ginsenosides Rb1 (56) (24.8%), Rb3 (57) (46.4%) and Rd (58) (13.14%) Ginsenosides (56–58) (Rb1, Rb3 and Rd) and mixture of purified ginsenosides Aqueous extract of leaves	(a) 450 or 600 mg/kg, i.p. (b) 120 or 160 mg/kg, i.p. (c) 36 or 48 mg/kg, i.p. 5, 9 and 2.6 mg/kg, i.p. respectively	Male Sprague Dawley rats Male SD rats	PTZ, KA, PILO Kainic acid, PTZ, PILO	----- -----	++ ++	[308] [309]
222	<i>Passiflora alata</i> Dryander (Passifloraceae) Winged-stem Passion flower	Aqueous extract of leaves	75 or 150 mg/kg, i.p.	Male and female albino mice	PTZ	-----	++	[310]
223	<i>Passiflora incarnata</i> Linn. (Passifloraceae) Passion flower, Maypop	Ethanol extract of aerial parts Hydro-alcoholic extract of aerial parts Pasipay prepared from flower 65% ethanol and water extracts of herb prepared at different temperatures Ethanol extract of aerial parts	160 mg/kg, i.p. 0.05–0.4 mg/kg, i.p. 0.05– 0.4 mg/kg, i.p. 1000 mg/kg/day, p.o. for 1 week	Male SD rats and Swiss albino mice Male Balb/c mice Albino mice Male CF-1 mice	PTZ PTZ PTZ PTZ	----- Involvement of GABAergic and opioid system GABAergic and opioid system -----	++ ++ ++ ++	[311] [312] [313] [314]
224	<i>Paulinia pinnata</i> Linn. (Sapindaceae) Agberi-akuko, Obi-omode, Asofeyeje	70% methanolic stem bark extract	250 or 500 mg/kg, i.p.	Placebo-controlled double-blind crossover study on 25 patients with partial epilepsy (a) Swiss albino mice (b) White cockerels	Seizure frequency, neurological and quality of life questionnaires (a) PTZ, STR (b) MES	-----	++	[315] [316]
225	<i>Persea americana</i> Mill. (Lauraceae) Avocado	Aqueous extract of leaves	50– 800 mg/kg, i.p.	Male Balb/c	PTZ, PIC, BIC	Enhances GABAergic neurotransmission and/or action in brain	++	[317]

226	<i>Persea indica</i> (L.) Spreng (Lauraceae) Madeira mahogany	70% ethanol extract of leaves	2 g/kg, p.o.	Albino mice	PTZ	-----	++	[318]
227	<i>Petasites japonicus</i> (Siebold & Zucc.) Maxim. (Asteraceae) Fuki, Bog rhubarb, Giant butterbur	A furfuran lignin 2 α -(4'-hydroxyl-3'-methoxyphenyl)-6 α -(4''-hydroxyl-3''-methoxyphenyl)-8 α -hydroxyl-3,7-dioxabicyclo[3.3.0]octane 4'-o-(β -d-glucopyranoside) isolated from n-butanol fraction of methanolic extract of leaves	10 mg/kg, i.p.	Albino mice	KA	-----	++	[319]
228	<i>Petiveria alliacea</i> Linn. (Phytolaccaceae) Guinea henweed, Anamu	Hydro-alcoholic (50% ethanol), hexane, ethyl acetate fractions and remaining hydro-alcoholic extract	100 or 200 mg/kg, i.p. or p.o.	Female Swiss mice	PTZ	-----	++	[320]
229	<i>Phaeodactylum tricornutum</i> Bohlin (Chlorophyceae) Pennate diatom	Aqueous extract of microalgae	150 or 300 mg/kg, i.p.	Charles River CD 1 mice	PTZ	-----	++	[170]
230	<i>Phoenix dactylifera</i> Linn. (Arecaceae) Date palm	3, 4- dimethoxy toluene (59) the major constituent of the date palm	100 mg/kg, i.p.	Male albino mice	PTZ, PIC, Nicotine, MES	-----	++	[321]
231	<i>Phyllanthus discoides</i> (Baill.) Mull. Arg. (Euphorbiaceae) Adjansi	Decoction of leaves	500-4000 mg/kg, i.p.	Male Swiss albino mice	(a) PTZ, STR, Isonicotinic acid, NMDA (b) PIC	-----	(a) ++ (b) –	[322]
232	<i>Pisonom acarna</i> (L.) Cass. (Asteraceae) Yellow plumed thistle, Shawk-ul-far	Alkaloids from blossoms	558 mg/kg, i.p.	Albino mice	PTZ	-----	++	[323]
233	<i>Pilosigma reticulatum</i> (DC) Hochst. (Leguminosae) Abafe, Kalga	Decoction of leaves	50 mg/kg, p.o.	Swiss male mice	NMDA, STR	-----	++	[9]
234	<i>Pimpinella anisum</i> Linn. (Apiaceae) Aniseed	Aqueous extract of leaves and stems (10 g/100 ml) Essential oil from fruits	0.2 ml 0.5, 0.75 or 1 ml/kg, i.p.	White female mice Male NMRI mice	PIC PTZ, MES	-----	++	[43] [324]
235	<i>Pinellia ternate</i> (Thunb.) Breit. (Araceae) Rhizoma pinelliae, Ban Xia	Water soluble extract	100 mg/kg, i.p.	Albino mice	STR	-----	++	[325]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
236	<i>Piper guineense</i> Thonn. & Schun. (Piperaceae) West African pepper, Ashanti pepper, Benin pepper	Water and 90% ethanolic extract of fruits	1S or 2S, i.p. (1S = 100 g/500 ml, dried and reconstituted to 4 ml)	Male DBA/2 mice and male T.O mice	(a) PTZ (b) Androgenic, NMDA, MES	-----	(a) – (b) ++	[326]
237	<i>Piper methysticum</i> Forst. (Piperaceae) Kava, Kava	2 α -pyrones: kavain (60) and Dihydromethysticin (61) Methanol extracts of: (a) leaf (b) root	----- (a) IC50 – 3 μ g/ml (b) IC50 – 5 to 87 μ g/ml	Guinea pig hippocampal slice <i>In vitro</i>	Calcium dependent <i>in vitro</i> model -----	----- GABA(A), Dopamine D2, Opioid (μ and δ), histamine (H1 and H2) receptors -----	++ ++	[327] [328]
238	<i>Piper nigrum</i> Linn. (Piperaceae) Black pepper	Piperine (62) Ethanolic extract of roots Water extract of fruits	10 mg/kg, p.o. 2g/ kg, p.o. 0.5S, 1S or 2S (1S = 100 g/500 ml, dried and reconstituted to 8 ml Mg++ free artificial CSF)	Albino mice Albino mice DBA/2 mice	Amino acids induced convulsions PTZ <i>In vitro</i> ; NMDA induced depolarizations in cortical wedges	----- ----- Antagonist action at NMDA receptors	++ ++ ++	[329] [330] [331]
239	<i>Pistacia integerrima</i> J.L. Stewart ex Brandis (Anacardiaceae) Pistachio tree, Kakar singhi, Kakra	95% ethanolic extract of galls	0.5-1.0 ml/kg, i.p. of concentration 500 mg/ml in 10% ethanol	Wistar rats and Swiss mice	PTZ, STR, MES	-----	++	[332]
240	<i>Platonia insignis</i> Mart. (Clusiaceae) Baruri, Maniballi, Naranjillo	Ethanolic extract of fruits	10 mg/kg, i.p.	Wistar rats	PILO	Protective effect on oxidative damage in brain	++	[333]
241	<i>Plectranthus barbatus</i> Andr. (Lamiaceae) Indian Coleus, Kikuyu	Hydro-alcoholic extract (20% ethanol) of leaves	1, 10, 30 or 100 mg/kg, p.o.	Swiss albino male mice	STR, PILO	-----	++	[334]
242	<i>Polygala sabulosa</i> A.W. Benn. (Polygalaceae) Timutu-pinheirinho	Three dihydrosteryl-2-pyrones I-III (63–65) and four styryl-2-pyrones I-IV (66–69) isolated from ethyl acetate fraction of hydro-ethanol (HE) extract of whole plant	HE, fractions (250, 500 and 1000 mg/kg), p.o., Dihydrosteryl-2-pyrones and styryl-2-pyrones (0.3 μ mol–25 μ mol, i.c.v.)	Male adult Swiss mice	PTZ	-----	++	[335]

		Dihydrostyryl-2-pyrones (63-65) and styryl-2-pyrones (66-69) isolated from ethyl acetate fraction of hydro-ethanol (HE) extract of whole plant	0.3 fmol–25 pmol, i.c.v.	Male adult Swiss mice	PTZ	BZD binding site mediation system	++	[336]
243	<i>Polypodium vulgare</i> Linn. (Polypodiaceae)	Aqueous extract of roots	100 mg/kg, i.p.	Wistar albino rats	PTZ, MES	-----	++	[337]
244	Common polypody <i>Pongamia pinnata</i> (Linn.) Pierre (Fabaceae)	70% ethanolic extract of leaves	250 mg/kg, i.p.	Wistar albino mice	MES	-----	++	[338]
	Indian beech, Karanj, Pongam, Pungal	70% ethanolic extract of leaves	250 mg/kg, i.p.	Wistar albino rats	PTZ	-----	++	[339]
245	<i>Portulaca quadrifida</i> Linn. (Portulacaceae)	Ethanolic extract of whole plant	400 or 800 mg/kg, i.p.	Male Swiss albino mice	MES	-----	++	[340]
	Chickenweed, Wild purslane							
246	<i>Psidium guajava</i> Linn. (Myrtaceae)	Hexane extract of leaves and its active e fractions	100 mg/kg, i.p.	Male albino mice	(a) Leptazol (b) STR	Blockade of extracellular Ca ²⁺	(a) ++ (b) –	[341]
247	Apple guava, Amrud, Amrudh <i>Psidium guyanensis</i> Pers. (Myrtaceae)	Essential oil obtained from leaves	100, 200 or 400 mg/kg, p.o.	Male Swiss mice	(a) PTZ (b) STR, PIC	Participation of endogenous adenosine mechanism	(a) ++ (b) –	[342]
248	Araça azedo (sour araca) <i>Psychotria umbellata</i> Vell. (Rubiaceae)	Psychollatine (70) (Glycoside indole monoterpene alkaloid) from ethanol extract of leaves	3-200 mg/kg, i.p.	CF1 male mice	PTZ	5 HT 2A/C serotonin modulator; Involvement of glutamate and dopamine receptors	++	[343, 344]
249	Wild coffee <i>Pterocarpus santalinus</i> Linn. (Fabaceae)	Decoction of heart wood	1 to 8 g/kg, p.o.	Albino mice and rats	PTZ	-----	++	[345]
250	Red sandalwood, Red sanders <i>Pueraria tuberosa</i> (Roxb. ex Willd.) DC (Fabaceae)	Alcoholic extract of tubers	50, 100 or 200 mg/kg, p.o.	Albino mice	PTZ, STR, MES	-----	++	[346]
251	Indian Kadzu <i>Pyrenacantha staudtii</i> Engl. (Icacinaeae)	Aqueous extract of leaves	100- 400 mg/kg, i.p.	Male Swiss mice	(a) STR (b) PIC	-----	(a) ++ (b) –	[347]
252	Orokotomu, Ohogha, Iru-okete <i>Qualea grandiflora</i> Mart. (Vochysiaceae)	(a) Hydro-alcoholic (70% ethanol) extract of leaves (b) Hexane and diethyl ether fractions	(a) 500 mg/kg, i.p. (b) 300 mg/kg, i.p.	Swiss albino mice	PTZ	-----	++	[348]
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(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
253	<i>Randia nilotica</i> Stapf. (Rubiaceae) Giel goti	Hydro-alcoholic (70% ethanol) extract of stem bark	5, 10 or 20 mg/kg, i.p.	(a) Swiss albino mice (b) Chicks	(a) (i) PTZ (ii) STR (b) MES	-----	(a) (i) ++ (ii) – (b) ++	[349]
254	<i>Rauwolfia ligustrina</i> Willd. ex Roem. & Schult. (Apocynaceae) Arrebenta-boi	Ethanol extract of roots	125 or 250 mg/kg, i.p.	(a) Swiss mice (b) Male Wistar rats	(a) (i) STR (ii) MES (b) PTZ induced kindling	GABAergic system	(a) (i) ++ (ii) – (b) ++	[350]
255	<i>Rauwolfia vomitoria</i> Afzelius (Apocynaceae) Poison devil's pepper	Aqueous extract of leaves	200 mg/kg, i.p.	Male albino mice	PTZ, STR, PIC	-----	++	[351]
256	<i>Rhamnus procumbens</i> Edgew. (Rhamnaceae) Man sheng shu li	Ethyl acetate fraction of 95% ethanolic extract of bark	200 mg/kg, i.p.	Albino rats	MES	-----	++	[352]
257	<i>Rhus chirindensis</i> Baker f. (Anacardiaceae) Red currant, Bostaalbos	Aqueous extract of stem bark	50- 800 mg/kg, i.p.	Albino mice	PTZ, BIC, PIC	Enhances GABAergic neurotransmission and/or action in brain	++	[353]
258	<i>Rhus pyroides</i> Burch. (Anacardiaceae) Common currant rhus	(a) Agathisflavone (71) (b) Amentoflavone (72) isolated from ethanol extract of leaves	(a) 28 nM (b) 37 nM	<i>In vitro</i>	-----	Inhibits binding of 3 H-Ro15-1788	++	[354]
259	<i>Rosa damascena</i> Mill. (Rosaceae) Damask rose	Essential oil obtained from shrubs Essential oil from shrubs	500, 750 or 1000 mg/kg, i.p. 750 or 1000 mg/kg, i.p.	Male wistar rats Male wistar rats	PTZ Amygdala kindling convulsions	GABA receptors system	++ ++	[355] [356]
260	<i>Rosamarinus officinalis</i> Linn. (Lamiaceae) Rosemary	Aqueous extract of leaves and stems (10 g/100 ml)	0.2 ml, i.p.	White female mice	PIC	-----	++	[43]
261	<i>Rubia cordifolia</i> Linn. (Rubiaceae) Common madder, Indian madder	A triterpene isolated from acetone soluble part of petroleum ether extract of roots and rhizomes	25-200 mg/kg, p.o.	NIN albino rats and mice	(a) PTZ, Lithium-PILO, MES (b) STR	Raises GABA and 5- HT contents in brain	(a) ++ (b) –	[357]
262	<i>Rubus brasiliensis</i> Mart. (Rosaceae) Amorinha, Amorapreta	Hexane fraction of 96% ethanolic extract of leaves	300 mg/kg, p.o.	Male swiss mice	PTZ	GABA(A) –BZD receptor	++	[358]
263	<i>Rubus ellipticus</i> Smith (Rosaceae) Yellow himalayan raspberry	Alcoholic extract of leaves	100 mg/kg, p.o.	Albino rats	MES	-----	++	[359]

264	<i>Russelia equisetiformis</i> Schlecht & Cham. (Plantaginaceae) Fire cracker plant, Coral plant, Fountain plant	Methanolic extract of aerial parts Methanolic and n-hexane fractions	100 or 200 mg/kg, i.p. 100- 400 mg/kg, i.p.	Male swiss mice Albino mice	PIC PIC, STR	----- Enhances GABAergic neurotransmission, and/or facilitates GABAergic action in brain -----	++ ++	[360] [361]
265	<i>Ruta chalepensis</i> Linn. (Rutaceae) Fringed rue	Aqueous and methanolic extract of leaves and stem Ethanol extract of aerial parts	150, 450 or 850 mg/kg, i.p. 300 or 1000 mg/kg, p.o.	Male Balb/c mice and Female wistar rats Male Swiss albino mice	PTZ, STR, MES PTZ	----- -----	++ ++	[362] [363]
266	<i>Salvadora persica</i> Wall. (Salvadoraceae) Arak, Meswak	Aqueous extract of stems	500 mg/kg, p.o. or i.m.	Male Wistar rats	PTZ	-----	++	[364]
267	<i>Salvia haematodes</i> Linn. (Lamiaceae) Safflower, Sader red	Aqueous extract of roots	1 g/kg, p.o.	Albino mice	MES	-----	++	[365]
268	<i>Salvia transsylvanica</i> Linn. (Lamiaceae) Transylvanian sage, Blue spires	Ethanol extract	100 mg/kg, p.o.	Albino mice	MES	-----	++	[366]
269	<i>Sansevieria liberica</i> Ger. & Labr. (Dracaenaceae) Bow-string hemp, African bow-string hemp, Leopard lily	Aqueous extract of roots	100- 400 mg/kg, p.o.	Albino mice	PTZ, BIC, STR, PIC	-----	++	[367]
270	<i>Sapindus trifoliatus</i> Linn. (sapindaceae) Soapnut fruit	Unspoonifiable components of fixed oil and fatty acid of the seed kernels	-----	Albino mice	MES	-----	++	[368]
271	<i>Saussurea lappa</i> C.B. Clarke (Compositae) Kuth, Costus root	Petroleum ether, 90% ethanol, water extract of roots	100- 300 mg/kg, i.p.	Male Swiss albino mice	PTZ, PIC, MES	Elevates the seizure threshold through GABAergic system	++	[369]
272	<i>Schizandra chinensis</i> (Turcz.) Baill. (Schisandraceae) Pinyin, Five flavor berry	Schizandrin (73) and daucosterol (74) isolated from ethanolic and methanolic extract	50-250 µM	<i>In vitro</i>	-----	Increases neurotransmitter GABA levels in CNS by inhibitory action on GABA degradative enzymes	++	[370]
273	<i>Sclerocarya birrea</i> (A. Rich) Hochst. (Anacardiaceae) Marula	Aqueous extract of stem bark	100- 800 mg/kg, p.o.	Male Balb/c mice	PTZ, BIC, PIC	-----	++	[371]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
274	<i>Scutellaria baicalensis</i> Georgi (Labiatae) Huangqin	Wogonin (75)	5 or 10 mg/kg, i.p.	Male ICR mice	(a) PTZ, MES (b) Electrogenic response score model, STR	GABAergic neuron mediated system	(a) ++ (b) –	[372]
275	<i>Scutellaria lateriflora</i> Linn. (Labiatae) Blue skullcap, Hoodwort	Ethanol extract of roots Commercially available fluid extract 12 phenolic compounds including 10 flavonoids and two phenylethanoid glycoside from 70% ethanol extract of commercial batches of American Skullcap	150 or 300 mg/kg, i.p. 15 drops/2L water for 30 days 67.5 mg/kg, i.p.	Albino mice Wistar rats Male SD rats	PTZ, MES Lithium- PILO PTZ, PILO	----- ----- -----	++ ++ ++	[44] [155] [373]
276	<i>Searsia dentata</i> (Thunb.) F.A. Barkley (Anacardiaceae) Nana berry	95% ethanolic extract of leaves	ED50 – 0.62 mg/ml	Male NMRI mice	NMDA	NMDA receptor antagonistic effect	++	[374]
277	<i>Searsia pyroides</i> (Burch.) T.S. Yi et al. (Anacardiaceae) Fire-thorn karce	95% ethanolic extract of leaves 95% ethanolic extract of leaves	250 or 500 mg/kg, i.p. 1.67 mg/ml	Male Wistar rats Male NMRI mice and <i>In vitro</i> ; spontaneous epileptiform discharges in mouse cortical slices	PTZ, KA, NMDA, BIC NMDA and [3H] GP39653 binding assay	----- NMDA receptor antagonistic effect	++ ++	[375] [374]
278	<i>Securidaca longepedunculata</i> Fresen. (Polygalaceae) Ipeta, Uuwarmaagunguna, Violet tree	Methanolic extract of roots Aqueous extract of roots	5-10 mg/kg, i.p. 100, 200 or 400 mg/kg, p.o.	Albino mice and rats Albino mice	Leptazol STR, PIC	----- -----	++ ++	[376] [377]
279	<i>Senna spectabilis</i> (DC) Irwin & Barneby (Fabaceae) Casia amarilla, Spectacular cassia	Ethanolic extract of leaves Iso-6- cassine (76) isolated from ethanol extract of leaves	100, 200, 500 or 1000 mg/kg, i.p. 0.5, 1.0 or 1.5 mg/kg, p.o. for 30 days	Male Swiss mice Male Swiss mice	PTZ, STR, NMDA, MES PTZ, PIC	----- GABAergic neurotransmission	++ ++	[378] [379]

280	<i>Sesbania grandiflora</i> (L.) Poiret (Fabaceae) Agati	(a) Petroleum ether extract of leaves (b) Acetone soluble part (c) Acetone insoluble part	(a) 25, 50, 100 or 125 mg/kg, p.o. (b) 100 mg/kg, p.o. (c) 25-200 mg/kg, p.o.	Male NIN mice	PTZ, STR	Raises GABA and serotonin content in brain	++ (c) did not show activity	[380]
281	<i>Sida tiagi</i> Bhandari (Malvaceae) Kharinti	Ethyl acetate fraction obtained from 95% ethanol extract of fruits	50, 100, 200 or 500 mg/kg, p.o.	Male Swiss mice	PTZ	-----	++	[381]
282	<i>Smilax china</i> Linn. (Liliaceae) Jin gang ten, Madhusnuhi, Dweepantaravacha	Ethanol extract and ethyl acetate fraction of rhizomes	200 or 400 mg/kg, p.o.	Albino mice	PTZ, MES	-----	++	[382]
283	<i>Solanum dasycarpum</i> Schum. & Thonn. (Solanaceae) Gboma, African eggplant	Ethyl acetate extract of fruit	100 mg/kg, p.o.	Albino mice	PTZ	-----	++	[383]
284	<i>Solanum indicum</i> Linn. (Solanaceae) Indian nightshade	Methanol extract of fruits	100 mg/kg, p.o.	Albino mice	MES	-----	++	[121]
285	<i>Solanum melongena</i> Linn. (solanaceae) Egg plant	95% ethanolic extract of roots	100, 200 or 300 mg/kg, p.o.	Wistar albino mice	PTZ, PIC, MES	-----	++	[384]
286	<i>Solanum nigrum</i> Linn. (Solanaceae) European black nightshade	96% ethanol extract of aerial parts Aqueous extract of leaves	255 mg/kg, i.p. 30-60 mg/kg, i.p.	Wistar rats Albino mice and rats	PTZ PTZ, PIC, MES	-----	+ ++	[385] [386]
287	<i>Solanum sisymbrium</i> Lam. (Solanaceae) Sticky nightshade	Solasodine (77) isolated from water: toluene: concentrated HCL (2:3:1) extract of fruits	25, 50 or 100 mg/kg, i.p.	(a) Swiss albino mice (b) Wistar albino rats	(a) PTZ, PIC (b) MES	-----	++	[387]
288	<i>Solanum surattense</i> Burm. F. (Solanaceae) Kantakari	Methanolic and aqueous extract of whole plant	200 mg/kg, p.o.	Wistar albino rats and Male Swiss albino mice	PTZ, MES	-----	++	[388]
289	<i>Solanum tuberosum</i> Linn. (Solanaceae) Potato	Potato juice	100 mg/kg, p.o.	Albino mice	BIC	GABAergic system	++	[389]
290	<i>Solenostemon monostachyus</i> (P. Beauv.) Briq. (Labiatae) Monkey's potato, Olojoum-gbudu	Ethanolic extract of roots	100 mg/kg, p.o.	Albino mice	PTZ	-----	++	[390]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
291	<i>Spathodea campanulata</i> P. Beauv. (Bignoniaceae) Fountain tree, African tulip tree, Rudra palash	70% ethanolic extract of leaves A glycoside urs-12-en-27 α , 30-di-oic acid 3-O- α -L-rhamnopyranosyl (1 $\rightarrow$ 2) α -L-arabinopyranoside (78) isolated from 70% ethanolic extract of leaves	250- 1000 mg/kg, p.o. 25, 50, 75 or 100 mg/kg, p.o.	Swiss albino mice Swiss albino mice	PTZ, PIC, MES PTZ, MES	Enhancement of GABA inhibitory action and inhibition of voltage dependent sodium channels -----	++ ++	[391] [392]
292	<i>Sphaeranthus indicus</i> Linn. (Asteraceae) Mahamundi, Mundi	Hydro-alcoholic (50% ethanol) extract of flowering herb	500 mg/kg, p.o.	(a) Albino Wistar mice (b) Albino Wistar rats	(a) PTZ (b) MES	-----	++	[393]
293	<i>Spinacia oleracea</i> Linn. (Amaranthaceae) Spinach	Aqueous extract of leaves	400 mg/kg, body weight, p.o.	Holtzman male albino rats	PTZ	Modulates the monoamines in different brain areas	++	[394]
294	<i>Spondias mombin</i> Linn. (Anacardiaceae) Hog plum, Java plum	50% methanolic and 50% ethanolic extract of leaves	25, 50 or 100 mg/kg, i.p.	Swiss albino mice	PIC	GABAergic neurotransmission	++	[395]
295	<i>Stereospermum kunthianum</i> Cham. (Bignoniaceae) Pink jacaranda, Khash khash	Aqueous extract of stem bark	100- 400 mg/kg, i.p.	(a) Wistar rats (b) Swiss mice	(a) MES (b) PTZ	Enhances GABAergic neurotransmission and/or action in brain	++	[396]
296	<i>Sutherlandia frutescens</i> (L.) R. Br. (Fabaceae) Cancer bush, Balloon pea	Aqueous extract of aerial parts	50- 400 mg/kg, i.p.	Male Balb/c mice	PTZ, PIC, BIC	Enhances GABAergic neurotransmission and/or action in brain	++	[397]
297	<i>Swietenia mahagoni</i> (L.) Jacq. (meliaceae) West Indies Mahogany	Methanolic extract of bark	25 or 50 mg/kg, i.p.	Swiss male albino mice	PTZ, STR	-----	++	[398]
298	<i>Syzygium cumini</i> (L.) Skeels (Myrtaceae) Jamun, Jambul	Hydro-alcoholic extract of seeds	0.5 or 1.0 g/kg, p.o.	Swiss mice	PTZ, MES	GABA involvement	++	[399]
299	<i>Tabernaemontana pandacaqui</i> Poir (Apocynaceae) Banana bush	Alkaloidal fraction of stem	50, 100 or 200 mg/kg, i.p.	SD rats and Swiss albino mice	PTZ	-----	++	[400]

300	<i>Tacazzea apiculata</i> Oliv. (Asclepiadaceae) Craw crow vine	n- butanol fraction of 98% methanolic extract of roots bark	10 or 20 mg/kg, i.p.	(a) Swiss albino mice (b) White Ranger Cockerels	(a) PTZ (b) MES	-----	++	[401]
301	<i>Taxus wallichiana</i> Zucc. (Taxaceae) Himalayan yew	Methanolic extract of leaves	100 or 200 mg/ kg, i.p.	Swiss albino mice	PTZ	-----	++	[402]
302	<i>Terminalia chebula</i> Retz. (Combretaceae) Black myrobalan	Ethanolic extract of fruits Methanol and Aqueous extracts of fruits	200 or 500 mg/kg, p.o. 300 mg/kg, p.o.	Swiss albino mice Male Swiss albino mice	PTZ, PIC, MES PTZ, MES	-----	++	[403] [404]
303	<i>Termstroemia pringlei</i> (Rose) Standl. (Pentaphyllacaceae) Flor de tila, Tilia estrellia	Aqueous and methanolic extract of flowers	450 or 850 mg/ kg, i.p.	Male Balb/c mice and female Wistar rats	PTZ, STR, MES	-----	++	[362]
304	<i>Flor de tila, Tilia estrellia</i> <i>Tetrapleura tetrapectera</i> Taub. (Fabaceae) Prekese	Volatile oil extracted from fresh fruits	0.4 ml, i.p.	White albino mice	Leptazol	-----	++	[405]
305	<i>Tetraselmis</i> <i>suecica</i> Stewart (Prasinophyceae) <i>Tiliacora racemosa</i> Colebr. (Menispermaceae) Yanang	Aqueous extract of fruits Aridanin (79), an N-acetylglycoside of oleanolic acid isolated from fruits	50- 800 mg/kg, i.p. 15 or 30 mg/kg, i.p.	Balb/c albino mice Male Swiss albino mice	PTZ, PIC, BIC (a) PTZ (b) STR, PIC	----- Membrane stabilizing property but not through GABA and glycine neurotransmitter	++ (a) ++ (b) --	[406] [407]
306	<i>Tinospora cordifolia</i> (Thunb.) Miers. (Menispermaceae) Guduchi	Aqueous extract of microalgae Tiliacrine (80), a di- phenylbisbenzyliso- quinoline alkaloid isolated from roots	400 mg/kg, i.p. 10 mg/kg, i.p.	Male CD1 albino mice Albino mice	PTZ STR	-----	+	[243] [408]
307	<i>Tinospora cordifolia</i> (Thunb.) Miers. (Menispermaceae) Guduchi	Petroleum ether and ethanol extract of leaves	250 mg/kg, p.o.	Male albino Wistar rats	MES	-----	++	[409]
308	<i>Tragia involucrata</i> Linn. (Euphorbiaceae) Choriyanam	Methanolic extract of roots	600 mg/kg, i.p.	Charles Foster rats and Swiss albino mice	STR, PTZ	-----	+	[410]
309	<i>Trema orientalis</i> (L.) Blume (Cannabaceae) Pigeon wood, Tree peach, Gunpowder tree, Nalita	Methanolic and water extracts of leaves	0.5 g/kg, p.o.	Albino mice	PTZ, MES	-----	++	[411]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
310	<i>Uncaria rhynchophylla</i> (Miq.) Jacks (Rubiaceae) Gou teng, Fish hook vine, Cat's claw	Methanolic extract and its ethyl acetate fraction, ursolic acid (47) and hyperin (81) Aqueous extract of aerial parts Aqueous extract of aerial parts	----- 250, 500 or 1000 mg/kg, i.p. <i>In vivo</i> - 1 g/kg, p.o. + 1 g/kg, p.o. <i>In vitro</i> – Rat brain tissues (a) IC ₅₀ – 43.2 μM (b) IC ₅₀ – 48.3 μM	Albino mice; <i>In vitro</i> Male Sprague Dawley rats SD rats	PTZ KA KA	Decreases activities of GABA-T, xanthine oxidase and lipid peroxidase levels ----- -----	++ ++ ++	[412-414] [415] [416]
311	<i>Uncaria</i> Spp.	Tetracyclic oxindole alkaloids – (a) Rhynchophylline (82) (b) Isorhynchophylline (83)	(a) IC ₅₀ – 43.2 μM (b) IC ₅₀ – 48.3 μM	<i>In vitro</i>	-----	NMDA receptor noncompetitive antagonist	++	[417]
312	<i>Uncaria sinensis</i> (Oliv.) Havil. (Rubiaceae) Gou teng	Methanolic extract and its ethyl acetate fraction	200 mg/kg, p.o.	Albino mice	PTZ	-----	++	[412]
313	<i>Urtica dioica</i> Linn. (Urticaceae) Stinging nettle	Infusion and aqueous extract	100 mg/kg, p.o.	Albino mice	Caffeine induced convulsions	-----	++	[418]
314	<i>Valeriana alliariifolia</i> Adams (Valerianaceae) Valerian sirene	Valepotriates (84)	10 mg/kg, p.o.	Albino mice	Caffeine, Corasol and Thiosemicarbazide induced convulsions	-----	++	[419]
315	<i>Valeriana edulis</i> Nutt. ex Torr. & Gray (Valerianaceae) Tobacco root	Hydro-alcoholic (70% ethanol) extract of roots	100, 300 or 1000 mg/kg, i.p.	Male ICR mice	PTZ	-----	++	[420]
316	<i>Valeriana officinalis</i> Linn. (Valerianaceae) Garden valerian	Aqueous extract of roots Ethanollic total extract and pure valerenic acid (85) from roots	100 mg/kg, p.o. Ethanollic total extract (0.5- 800 mg) and for valerenic acid (12.5 mg/kg)	Albino rats Male albino mice	STR PIC	----- -----	++ ++	[120] [421]

317	<i>Valeriana pavonii</i> Poepp. (valerianaceae) Columbian valerian, Heliotrope <i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	95% ethanol extract of roots	EC ₅₀ – 4.13 × 10 ⁻¹⁰ mg/ml	Swiss Webster mice and SD rats	<i>In vitro</i>	[3H] flunitrazepam binding assay, [3H] GABA uptake assay, [3H] GABA release from hippocampal slices, GABA(A) receptor, interact at other presynaptic components of GABAergic neurons	++	[422]
318	<i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	Methanolic extract of rhizomes	100 mg/kg, p.o.	Albino mice	Chemically and electrically induced convulsions	-----	++	[423]
319	<i>Valeriana pavonii</i> Poepp. (valerianaceae) Columbian valerian, Heliotrope <i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	Aqueous extract of roots	200, 500 or 800 mg/kg, i.p.	Male Sprague Dawley rats	Temporal lobe epilepsy	Activation of adenosine system	++	[424]
320	<i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	Isovaleramide (86) isolated by using acid base purification	100 mg/kg, p.o. and 300 µM	ICR mice and <i>In vitro</i>	MES	Inhibition of the binding of 3H FNZ to its site	++	[425]
321	<i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	6-methyl-apigenin (87) isolated from 70% ethanol extract of rhizomes and roots	495 nM	<i>In vitro</i>	-----	Agonist action on GABA- BZD binding site	++	[426]
322	<i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	Aqueous extract of brown broad beans (300 g in 50 ml) Methanol extract of stems	0.01 ml/g, p.o.	Balb/c mice	STR, PIC	Inhibitory action on glycine receptors	++	[427]
323	<i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	Hydro-alcoholic (50% ethanol) extract of fruits	50-100 mg/kg, i.p.	Albino mice	PTZ, BIC, NMDLA	-----	++	[428]
324	<i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	Petroleum ether extract of dried leaves	60, 120 or 180 mg/ kg, i.p.	Male albino Wistar rats	Amygdala kindled convulsions	-----	++	[429]
325	<i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	Hydro-alcoholic (50% ethanol) extract of fruits	250 mg/kg, body weight, i.p.	Swiss albino mice	STR, Leptazol	Blocks multineuronal pathway in spinal cord with the minimal effect of mono- synaptic pathway and alteration of GABAergic transmission	++	[430]
326	<i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	Methanolic extract of leaves	0.15, 0.2 or 0.3 g/ kg, i.p.	Swiss albino mice	STR, Leptazol	-----	++	[431]
327	<i>Valeriana wallichii</i> DC (Valerianaceae) Indian valerian	Ethanol extract of leaves	100, 250, 500 or 1000 mg/kg, p.o.	Wistar albino rats and Swiss mice	PTZ, MES	-----	++	[432]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
323	<i>Voacanga africana</i> Stapf. (Apocynaceae)	Decoction of bark	140 mg/kg, p.o.	Swiss male mice	(a) PTZ, NMDA, MES, STR (b) PIC	-----	(a) ++ (b) --	[9]
324	Voacanga <i>Withania ashwagandha</i> Kaul (Solanaceae)	Acetone soluble alkaloidal fraction of roots	75-150 mg/kg, i.p.	Albino rats	MES, MTZ	-----	++	[433]
325	Ashwagandha <i>Withania somnifera</i> Linn. (Solanaceae)	Methanolic extract of roots	100 or 200 mg/kg, p.o.	Albino mice	PTZ	GABAergic mechanism	++	[434]
	Ashwagandha	Root extract	100 mg/kg, p.o.	Wistar rats	MES	-----	++	[435]
		Root extract	100 or 200 mg/kg, p.o. for 7 days	Wistar rats	Lithium-PILO model of status epilepticus	Involvement of GABAergic mechanism	++	[436]
		Ethanol extract of roots	100 mg/kg, i.p.	Wistar rats	Lithium-PILO model of status epilepticus	Involvement of GABAergic mechanism	++	[437]
		Glycowithanolides isolated from hydro-alcoholic (50% ethanol) extract of roots	100 or 200 mg, p.o.	Wistar rats	Haloperidol induced rat model of tardive dyskinesia	-----	++	[438]
326	<i>Xeromphis nilotica</i> (Stapf.) Keay (Rubiaceae)	Standardized root extract	100 or 200 mg/kg, p.o.	Male albino mice	PTZ	GABA(A)ergic modulation	++	[439]
	Chibira, Ishibra <i>Zanthoxylum capense</i> (Thunb.) Harv. (Rutaceae)	Aqueous extract of root bark	100 mg/kg, p.o.	Albino mice	PTZ	-----	++	[440]
327	Small knobwood <i>Ziziphus jujuba</i> Miller (Rhamnaceae)	Methanolic and aqueous extract of leaves	50-200 mg/kg, i.p.	Male albino mice	PTZ, BIC, PIC, NMDLA	GABAergic, glutaminergic, and glycinergic mechanisms	++	[441]
328	Desi Ber	Sanjoinine A (88), a component of alkaloid fraction from methanol extract of fruits	4 or 8 mg/kg, i.p.	ICR mice	NMDA	-----	++	[442]
		Sanjoinine A (88), a component of alkaloid fraction from methanol extract of fruits	4 or 8 mg/kg, p.o.	Swiss albino mice	KA	Increases intracellular chloride and reduces intracellular calcium levels	++	[443]
329	<i>Zizyphus rugosa</i> Lam. (Rhamnaceae)	Triterpenoid saponins mixture isolated from methanol extract of bark	100, 200, 300 or 400 mg/kg, i.p.	Albino rats	MES, MTZ	-----	+	[444]
	Willd. jujube, Wrinkled jujube, Toran kanika							

330	<i>Zizyphus xylophora</i> (Retz.) Willd. (Rhamnaceae) Kat-ber, Gote, Kakor, Ghont	Methanol extract of bark	100 mg/kg, i.p.	Albino mice	MES	-----	++	[445]
331	Nigerian plant decoctions	Aqueous extracts of (a) <i>Calliandra portoricensis</i> root (b) <i>Cleome cileata</i> leaves (c) <i>Cynodon dactylon</i> leaves (d) <i>Holarrhena floribunda</i> leaves (e) <i>Newboldia leavis</i> leaves (f) <i>Tetrapleura tetraptera</i> volatile oil of fruits	(a) 280 mg/kg. i.p. (b) 65 mg/kg. i.p. (c) 450 mg/kg. i.p. (d) 70 mg/kg. i.p. (e) 165 mg/kg. i.p. (f) 45 mg/kg. i.p.	Albino mice	PTZ, MES	-----	++	[446]
332	21 Bulgarian plants <i>Delphinium consolida</i> Linn. (Ranunculaceae; Lark's claw, Lark's heel, Knight's spur), <i>Asparagus officinalis</i> Linn. (Liliaceae; Garden asparagus), <i>Convolvulus arvensis</i> Linn. (Convolvulaceae; Field blindweed, Leli, Withy wind), <i>Galium sylvaticum</i> Linn. (Rubiaceae; Wood bedstraw), <i>Salvia sclarea</i> Linn. (Lamiaceae; Clarry, Clary sage), <i>Echium vulgare</i> Linn. (Boraginaceae; Viper's bugloss, Blueweed), <i>Salvia nemorosa</i> Linn. (Lamiaceae; Woodland sage)	Ethanol extract	100 mg/kg, p.o.	Albino mice	MES	-----	++	[447]

(continued)

Sr. No.	Biological source	Extract / Fraction / Isolate	Dose	Animal / Human being	Experimental model / Assessment of clinical parameters	Mechanism of action	Activity	Ref.
333	43 plants	Aqueous and ethanol extracts (Out of 118 extracts from 43 plants tested, only 18 ethanolic extracts showed activity, especially from leaves of <i>Rhus tridentata</i> Sond. (Anacardiaceae; Skunkbush sumac), <i>R. rehmanniana</i> Engl. (Anacardiaceae; Blunt leaved currant), <i>Hoslundia opposita</i> Vahl. (labiatae; Bird gooseberry , Orange birdberry) and corm extract of <i>Hypoxis colchicifolia</i> Baker (Hypoxidaceae; Broad leaved hypoxis)	25 µl of 10 mg/ml concentration	<i>In vitro</i>		GABA-BZD receptor binding assay	++	[448]

++ Strong anticonvulsant activity, + Weak anticonvulsant activity, – No anticonvulsant activity

Table 2: List of various class of phytoconstituents reported to possess anticonvulsant activity.

Class of Phytoconstituent	Phytoconstituent	Dose	Animal / Human beings	Experimental model / Assessment of clinical parameters	Mechanism of action	Ref.
Lipids	Linoleic (89) and α -linolenic (90) polysaturated fatty acids (4:1)	200 mg/kg, i.p. for 21 days	Long Evans hooded rats	PTZ	Raises omega-3 polyunsaturated fatty acid composition in unesterified fatty acid fraction of brain lipids	[449]
	Oleamide (12)	2 mg/kg, i.p.	Albino rat	PTZ	-----	[450]
Alkaloids	(a) Ergocornine (91) (b) Ergometrine (92) (c) Bromocriptine (93) (d) Allylglycine (94) + Lysergic acid diethylamide (95)	(a) 1-2 mg/kg, i.v. (b) 1 mg/kg, i.v. (c) 0.5-4 mg/kg, i.v. (d) 180-200 mg/kg + 0.1 mg/kg	Baboons <i>Papio Papio</i>	Photically induced epilepsy	Simulation of dopamine receptors	[451]
	Geissoschizine methyl ether (96) and hirsuteine (97) (Indole alkaloids)	50, 100 or 200 mg/kg, p.o.	ddY albino mice and <i>In vitro</i>	Glutamate induced convulsions	Glutamate neuronal death in cultured cerebral granule cells by inhibition of Ca++ influx	[452, 453]
Morphine (98)		(a) i.c.v. or microinjection into discrete subcortical areas (1 mg/kg) (b) Systemic (15 mg/kg)	Albino rats	(a) Fluro ethyl induced seizures (b) PTZ	(a) Opiate receptor of the β subtype (b) GABAergic system (c) Specific μ type opiate receptor	[454, 455]
	Nantenine (99) (Aporphine alkaloid)	20-50 mg/kg, i.p.	Male albino mice	PTZ, MES	Stimulation of Na ⁺ , K ⁺ ATPase and decrease in calcium influx into cells	[456]
	Piperine (62)	15 μ g/ml	Rat E 17-19 hippocampus cells	<i>In vitro</i>	Suppression of synchronization of neuronal networks, presynaptic glutamic acid release and calcium overloading	[457]
	Reserpine (100) (Serpasil)	1 mg/kg, i.v.	Epileptic monkey	Chronic experimental epilepsy produced by the application of alumina cream to cerebral hemisphere	-----	[458]

(continued)

Class of Phytoconstituent	Phytoconstituent	Dose	Animal / Human beings	Experimental model / Assessment of clinical parameters	Mechanism of action	Ref.
Terpenes and volatile oil constituents	Yohimbine (101)	4 mg/kg, i.p.	Quaking mice, neurological mutants of C 57 BL/6J strain	Tactile stimulation induced seizures	Actions on presynaptic α - adrenergic receptors	[459]
	(-)-bisabolol (102) (unsaturated monocyclic sesquiterpene alcohol)	0.5, 1, 5 or 10 mM	Female Swiss mice	<i>In vitro</i> (Modified single sucrose-gap method in mice sciatic nerve)	Decreases neuronal excitability by irreversible blockade of voltage dependent Na ⁺ channel	[460]
	(-)-borneol (103)	50, 100 or 200 mg/kg, i.p.	Male Swiss mice	PTZ, MES	GABAergic neurotransmitter receptor	[461]
	Carvacrol (104)	200 mg/kg, i.p.	Male Swiss mice	PTZ, MES	GABAergic neurotransmitter receptor	[461]
	(S)-(+)-carvone (105) Citral (106)	200 mg/kg, i.p. 50, 100 or 200 mg/kg, i.p.	Male Swiss mice Male Swiss mice	PTZ, PIC PTZ, MES	----- GABAergic neurotransmitter receptor	[462] [461]
	Citronellol (107) (monoterpene alcohol)	100, 200 or 400 mg/ kg, i.p.	Male Swiss mice	PTZ, MES, PIC	Reduction of neuronal excitability through the voltage dependent sodium channel	[463]
	γ -decanolactone (7)	(a) 300 mg/kg, s.c. (b) >100 μ M	(a) Albino mice (b) Rat	(a) PTZ, MES (b) <i>In vitro</i>	Inhibitory effect on [3H] glutamate binding in rat cortex membrane	[23]
	α , β -epoxy carvone (108) (monocyclic monoterpene)	(a) 178.7 mg/kg, i.p. or 1189.1 mg/kg, p.o. (b) 169.8 mg/kg, i.p. 300 or 400 mg/kg, i.p.	CS1 albino male mice Male Swiss mice and male Wistar rats	(a) PTZ (b) Trans corneal electroshock PTZ, MES, PIC	----- Voltage gated sodium channel blockade	[22] [464]
	β eudesmol (109) (Sesquiterpenol)	(a) 300 mg/kg, s.c. (b) >100 μ M	(a) Male ICR mice (b) Wistar rats	(a) MES (b) High potassium treated rat hippocampal slices (<i>In vitro</i>)	Neuronal excitability by acting on sodium channel	[465]
	Eugenol (110)	10-100 μ M/L	Rat neocortical and hippocampal slices	<i>In vitro</i>	Reversibly suppressed epileptiform field potential elicited by extracellular Mg ⁺⁺ and spreading depression induced by KCl microinjection	[466]
	Linalool (8)	(a) 300 mg/kg, s.c. (b) >100 μ M	(a) Albino mice (b) Rat	(a) NMDA, quinolenic acid, PTZ (b) <i>In vitro</i>	Modulation of Glu activation expression	[467]
α -Terpineol (111)		(a) 300 mg/kg, s.c. (b) >100 μ M	(a) Albino mice (b) Rat	(a) PTZ, MES (b) <i>In vitro</i>	Inhibitory effect on [3H] glutamate binding in rat cortex membrane	[23]
		100, 200 or 400 mg/kg, p.o.	Male Swiss mice	PTZ, MES	-----	[468]

	Terpinen-4-ol (112) (monoterpenoid alcohol) V.O. constituents from 30 species of 23 genera and 13 families	100, 200 or 300 mg/kg, p.o. 100 mg/kg, i.p.	Male Swiss mice Albino mice	PTZ, MES, PIC MES	----- -----	[469] [470]
Triterpenoid Coumarin	Friedelan-3 β -ol (113) Coumarin (Base)	100 mg/kg, i.p. 20 or 40 mg/kg, i.p.	Albino mice Male Swiss mice	PTZ <i>In vitro</i> (20 mg/kg – Increased level of glutamate taurine; 20-40 mg/kg – Increased GABA; 40 mg/kg – Increased glycine)	----- Stimulates release of endogenous amino acids; increasing level of inhibitory and excitatory amino acids in prefrontal cortex; decrease glutamate levels in hippocampus	[471] [472]
	Imperatorin (114) Osthole (115) isolated from petroleum ether extract of roots of <i>P. ostruthium</i> (L.) Koch Coumarins –Calophyllolide (116) and inophyllolide (117)	167-290 mg/kg, i.p. 253-639 mg/kg, i.p. 100 mg/kg, i.p.	Male Swiss mice Male Swiss mice Albino mice	MES MES PTZ	----- -----	[473] [473, 474] [471]
Flavonoids	Hispidulin (118) Rutin (119)	10 mg/kg/day, p.o. for 7 days 50 or 150 nM, i.c.v.	Male Mangolian gerbils Male Wistar rats	----- PTZ	Modulation of $\alpha 6\beta 2\gamma 2s$ - GABA Positive allosteric modulation of GABA(A) receptor complex via interaction at BZD site	[475] [476]
Miscellaneous	Adenosine (120) Botulinum neurotoxin E	25-250 mg/kg, i.p. 1.5 μ l injection in dorsal hippocampus	Albino mice Long Evans hooded rats	PTZ (a) <i>In vitro</i> rat hippocampus (b) KA induced seizures	----- (a) Inhibits glutamate release; blocks spike activity of pyramidal neurons (b) reduces KA induced seizures	[477] [478]
	Cannabidiol (19), CBD-aldehyde- diacetate, 6-oxo-CBD- diacetate, 6-hydroxy-CBD- triacetate, 9-hydroxy-CBD- triacetate Manganese complex of curcumin (121) and diacetyl curcumin (122)	100-200 mg/kg, i.p. 50 mg/kg, i.p.	Swiss mice Male Wistar rats	MES KA-induced seizures followed by neural cell damage in the CA1 and CA3 subfields of hippocampus	----- Suppression of KA-induced increase in NO levels by NO scavenging activity and antioxidative activity	[479] [480]
	GABA (123)	25-100 mg/kg, i.p.	Albino mice	PTZ	-----	[477]

(continued)

Class of Phytoconstituent	Phytoconstituent	Dose	Animal / Human beings	Experimental model / Assessment of clinical parameters	Mechanism of action	Ref.
	Ghrelin	20, 40, 60 or 80 µg/kg, i.p.	Male Wistar rats	PTZ induced oxidative stress	Prevents lipid peroxidation; increases activities of GABA and neuropeptide Y	[481, 482]
	Melatonin (124)	25 µg, s.c. daily for 13 weeks	Male gerbils	PTZ	Endocrine effects	[483]
	Δ9-tetrahydrocannabinol (18)	0.25 mg/kg, i.v.	Chickens	Intermittent photic stimulation in epileptic chickens;	-----	[484]
				MTZ in both epileptic and non-epileptic chickens		
		Chronic administration, 0.25 mg/kg, i.p.	Cat and Senegales e baboons rats	Kindled amygdaloid	-----	[485- 487]
	Δ9-THC (18) and Δ8-THC (17)	12.5-50 mg/kg, i.p.	Male Swiss Webster mice	PTZ, MES	-----	[488, 489]
	Δ9-THC (18) and cannabidiol (19) with phenobarbitone	50 mg/kg, p.o.	QS male mice	Electrically induced seizures	-----	[490]
	(a) Δ9-THC (18)	(a) 100 mg/kg, i.p.	Male ICR mice	MES	-----	[491, 492]
	(b) CBD (19)	(b) 120 mg/kg, i.p.			-----	[5]
	(a) Δ6-THC (18)	(a) 25 mg/kg, i.p.	Male Sabra rats	PTZ	-----	
	(b) Δ6-THC-DMH or SP-175	(b) 2.5 mg/kg, i.p.			-----	
	Δ9-tetrahydrocannabinavarin (125)	(a) 0.25 mg/kg, i.p. (b) ≥ 20 µM (c) 290 nm	(a) Albino rats (b) and (c) <i>in vitro</i>	(a) PTZ (b) Piriform cortex brain slice model of epileptiform activity (c) Cannabinoid CB1 receptor radioligand and binding assay	CB1 receptor mediated mechanism	[493]
	Thiopaenimetabolin I adducts – 8-(n-hexylthio)- and 8-benzoyl thiopaenimetabolins obtained by incubation of paeoniflorin (51) with <i>Lactobacillus brevis</i> in presence with various thiols	0.125, 0.25 or 0.5 mM/ kg, i.p.	Male ddY mice	PTZ	-----	[494]
	Valproate (126)	189-255 mg/kg, i.p.	Male Swiss albino mice	MES	-----	[473]

Table 3: List of various plant-based anticonvulsant formulations.

Sr. No.	Plant formulation	Composition	Dose	Animal / Human beings	Experimental model / Assessment of Clinical parameters	Mechanism of action	Ref.
01	Annao tablet	β -asarone (127)	Oral administration of tablet	Chronic epileptic rats	-----	Depress the epileptic degree, postpone spasm latent period, reduce wet dog sample times decline	[495]
02	Brahmi Rasayana (Ayurvedic preparation)		1-30 g/kg, p.o.	(a) Albino rats	(a) MES	Involvement of GABAergic system	[496]
03	Chaihu-tongu-muli-tang, i.e., TW970 (Chinese medicine)	Chai-Hu: Bupleuri radix (8g) Long-Gu: Fossiliaossis mastodi (3g)	8 mg/day for 4 months therapy	(b) Albino mice 20 patients with refractory epilepsy and 20 patients with benign epilepsy ddY albino mice	(b) PTZ Seizure frequency, serum malondi-aldehyde, glutathione and copper zinc superoxide desmutase	Positive effect in patients with refractory epilepsy but not in benign epileptic patients	[497]
04	Chofosan preparation with chotoko (Chinese herbal preparation)	Hooks of <i>Uncaria</i> spp. (Rubiaceae) Geissoschizine methyl ether (96), Hirsuteine (97)	3 g/kg, p.o.	ddY albino mice	Glutamate-induced convulsion	-----	[452]
05	Cow's urine concoction	<i>Nicotiana tabacum</i> Linn. (Tobacco leaves; Solanaceae), <i>Ocimum viride</i> Willd. (Basil leaves; Labiatae), <i>Citrus limon</i> (L.) Burm. F. (Lemon juice; Rutaceae), <i>Allium sativum</i> Linn. (Garlic leaves; Amaryllidaceae), <i>Allium cepa</i> Linn., <i>A. ascalonium</i> Linn. (Onion bulbs; Amaryllidaceae), Trona, Cow's urine	50, 100 or 200 mg/kg, p.o.	ddY albino mice	Glutamate-induced convulsion	-----	[452]
06	Habb-e-Shifa (Unani compound formulation)	70% ethanol and aqueous extract of <i>Datura stramonium</i> (Jauz masil seeds; Solanaceae) - 300 g, <i>Rheum emodi</i> Wall ex. Meissn. Roots (Rava chini; Polygonaceae)- 200 g, <i>Zingiber officinale</i> rhizomes (Zanjabeel; Zingiberaceae) - 100 g, <i>Acacia arabica</i> (Lam.) Muhl. Ex. Willd. gum (Samageh-e-Arabi; Leguminosae) - 100 g	Aqueous extract (8 mg/100 g, p.o.); Alcoholic extract (10 mg/100g, p.o.)	Wistar albino rats and albino rabbits	PTZ, DPT	-----	[499]
07	Kanbaku-taiso-to (Chinese herbal medicine)	Aqueous extracts of Glycyrrhizae Radix (5 g), Triticum semen (20 g), Zizyphi fructus (6 g)	2 or 4 g/kg, p.o.	Male ddY mice	PTZ, MES, STR	-----	[500]

(continued)

Sr. No.	Plant formulation	Composition	Dose	Animal / Human beings	Experimental model / Assessment of Clinical parameters	Mechanism of action	Ref.
08	Mentat syrup	-----	One teaspoonful twice daily for 6 months	50 children with a history of febrile convulsions	Placebo-controlled clinical study	Improves behaviour pattern in children	[501]
09	Nigerian herbal recipe	Hydro-alcoholic extract of <i>Nicotiana tabacum</i> leaves, <i>Allium ascalonicum</i> Linn. (Amaryllidaceae; Red onion , Shallot) leaves, <i>Tetrapleura tetraptera</i> Taub. (Fabaceae; Prekese) fruit containing coumarins, cinnamic acid derivatives, alkaloids, flavonoids and terpene derivatives	-----	Albino mice	Leptazole	-----	[502, 503]
10	Processed Nux vomica seeds	95% ethanol extracts of (a) <i>Strychnos nux vomica</i> Linn. (Loganiaceae; Poison nut) seeds (b) processing with aloe and ginger (c) trying with cow ghee (d) boiling in cow milk	Suspension containing 0.001 g drug, i.p.	Swiss albino mice and Wistar rats	PTZ, only (d) showed activity	-----	[504]
11	Panchagavya Ayurvedic formulation (Amatkadi Ghrita)	<i>Embellica officinalis</i> Gaerth, <i>Glycyrrhiza glabra</i> Linn. and Cow's ghee	500 or 750 mg/kg, p.o.	Male Swiss albino mice	MES, PTZ	-----	[505]
12	Polyherbal formulation	Aqueous extract of <i>Withania somnifera</i>	250 or 500 mg/kg for 15 days	Wistar albino rats	MES	Restoration of biogenic amines – dopamine, serotonin, noradrenaline in forebrain region	[506]
13	Saiko-Keishi-To (Chinese medicine)	Aqueous extract	2% solution	<i>In vitro</i>	Inhibition of bursting activity in an identifiable snail neurons PTZ	Intracellular potential change of neurons in the cerebral cortex of cats during seizure discharge	[507]
14	Sehlaire sa Seebana (Northern Sotho remedy)	Ethanol and aqueous extracts of <i>Acrotome inflata</i> Benth. (Lamiaceae), <i>Aptosimum indivisum</i> Bunch. ex. Benth. (Scrophulariaceae; Karoo violet), <i>Asparagus suaveolens</i> Burch. (Asparagaceae; Wild asparagus), <i>Barleria bolusii</i> Oberm. (Acanthaceae), <i>Commiphora marlothii</i> Engl. (Burseraceae; Paper bark tree , Makina), <i>Sesamum triphyllum</i> Welw. ex. Asch. (Pedaliaceae; Wild sesame , Thunderbolt flower)	25 µl of 10 mg/ml	<i>In vitro</i> , cerebral cortices of rats	-----	GABA(A)/BZD receptor binding assay	[508]

15	Shitei-To (Chinese medicine formulation)	Mixture of extracts of Shitei [Calyx of <i>Diospyros kaki</i> Thunb. (Ebenaceae; Japanese persimmon)], Shokyo [Rhizome of <i>Zingiber officinalis</i> Roscoe (Zingiberaceae; Ginger)], Choji [Flower bud of <i>Syzygium aromaticum</i> (L.) Merril. Et Perry (Myrtaceae; Clove)]	3 g/kg, p.o., repeated administration	Albino Mice	PTZ	-----	[509]
16	Siotone granules (Herbal formulation)	<i>Withania somnifera</i> , <i>Mucuna pruriens</i> (L.) DC (Fabaceae; Velvet bean , Cowitch), <i>Tribulus terrestris</i> Linn. (Zygophyllaceae; Gokhru , Cat's head), <i>Asparagus racemosus</i> Willd. (Asparagaceae; Satavar , Shatavar)	200 mg/kg, p.o.	Albino Laca mice and Wistar rats	PTZ, MES, STR, Hypoxic stress induced convulsations	GABAergic system	[510]
17	Shosaiko-to-go-Keishika-Shyakuyaku-to (TJ-960) Japanese Kampo medicine system of medicine	Baicalin (128)	1 mg/kg, p.o.	Male Wistar rats; <i>In vitro</i>	PTZ	Inhibition of EEG power spectrum changes; Free radical induced neural cell damage	[511, 512]
18	Ustukhuddus (Unani system of medicine)	<i>Lavendula stoechas</i> Linn. (Lamiaceae) French and Spanish Lavender	5-10 g/day	Clinical trials	Decreased seizure frequency	-----	[513]
19	Zhenxianling (Chinese medicine)	White peony root, Cassia twig, <i>Codonopsis pilosula</i> , <i>Pinellia ternate</i> , Bupleurum, Baical Skullcap Root, Liquorice, Acid jujube kernel, Resh ginger, Chinese- jujube Essential oil constituents – Hinesol (129), β -eudesmol (109)	Oral and local for 6 months to 2 year followed up for 6 months to 3 years	239 cases of epilepsy (Grandmal epilepsy)	Decreased Seizure frequency	-----	[514]
20	Zhu (a) Changzhu - <i>Atractylodes lancea</i> and <i>A. lancea</i> var. <i>chinensis</i> (b) Baizhu - <i>A. ovata</i> and <i>A. japonica</i>		100 mg/kg, i.p.	Albino mice	MES	-----	[515]

Table 4: List of anticonvulsant patents having plant products.

Sr. No.	Plant formulation, extract, fraction or isolate	Activity	Ref.
01	Liquid or dry extract (water or hydro-alcoholic or carbon dioxide extract) of <i>Myosotis</i> Linn. (Boraginaceae; Forget-me-not)	Anxiolytic, nootropic, anticonvulsant, cerebroprotecting and ability to normalize transfer process in brain synapses	[516]
02	Pharmaceutical composition comprising mixture of saponins prepared from the pericarp of <i>Sapindus trifoliatu</i> s Linn. (Sapindaceae; Soapnut) with acceptable additives	Anticonvulsant activity through binding affinities for receptor sites such as GABA(A) agonist site, glutamate AMPA, glutamate kainate, glutamate NMDA, glutamate NMDA glycine, sodium channel	[517]
03	Marsilin (43) isolated from whole plant of <i>Marsilea</i> species	Anticonvulsant and sedative	[518]
04	Pharmaceutical oral preparation or injections prepared from raw material, processed product or extract of the plants – <i>Cynoglossum zeylanicum</i> (Vahl.) Thunb. Ex Lehon. (Boraginaceae; Ceylon forget-me-not , Ceylon hound's tongue), <i>C. lanceolatum</i> Forssk. (Boraginaceae; Khuyen thiet , Xiao hua liu li cao), <i>C. amabile</i> Stapf. & J.R. Drumm. (Boraginaceae; Chinese hound's tongue)	Treatment of epilepsy, parkinson disease, depression and psychosis	[519]
05	Preparation of pongamol (130) obtained from <i>Pongamia pinnata</i> (L.) Pierre (Fabaceae; Karanj, Indian beech)	Antiepileptic	[520]
06	<i>Piper methysticum</i> aerial parts extract	Anxiolytic, anticonvulsant, muscle relaxant, narcosis increasing, analgesic, sleep inducing, anti-inflammatory and neuroprotective	[521]

dose, route of administration, animals/human beings, experimental model/clinical parameters assessed and mode of actions (if reported) have been depicted in table 3. Six anticonvulsant plant products and formulations have been patented and shown in table 4. Various review articles published on anticonvulsant plants and plant products are shown in table 5. Table 6 shows the list of plants evaluated for anticonvulsant activity but did not exhibit activity.

CONCLUSION

In the present era, a sudden increase in mental disorders and recognition of the severe side effects and addiction liabilities associated with long term administration of widely prescribed synthetic drugs has aroused the attention of researchers towards natural resources. Plants like *Valeriana officinalis*, *Nardostachys jatamansi*, *Withania somnifera* and *Panax ginseng* have been used extensively in various traditional systems of therapy because of their adaptogenic and psychotropic properties. Inclusion of these well-established CNS affecting plants in the arsenal of modern therapeutics has revived the faith of researchers in the plants.

In the present review article, amongst 342 plants reported to possess anticonvulsant activity (Table 1):

- (a) Only three plants have been tested for anti-convulsant activity clinically,

- (b) The preliminary anticonvulsant activity screening on crude extracts has been carried out on 288 plants. Such plants need to be explored with a view to isolate active constituents and their mode of actions,
- (c) Chemical constituents responsible for anti-convulsant activity have been reported in 54 plants and
- (d) The possible mechanism of action has been reported for 103 plants.

Seven well known classes of phytoconstituents (Table 2), 20 formulations of plant drugs (Table 3) and 133 pure constituents present in various plants reported to possess anticonvulsant activity in battery of experimental models of seizures have been compiled in the present work. Six anticonvulsant plant products and formulations have been patented (Table 4). A survey of literature revealed that 46 review articles have been published on anticonvulsant plant formulations and specific plants covering broad aspects as phytochemistry, pharmacology, clinical studies, toxicology and safety profiles (Table 5). Forty plants have been evaluated for anticonvulsant activity, but did not exhibit activity (Table 6).

It is anticipated that this review article will be of immense help to natural product researchers to select traditionally used plants with medicinal potential for their future research work.

Table 5: Review articles published on anticonvulsant plants, and their constituents and formulations.

Sr. No.	Information available	Plant drugs	Phytoconstituents reported	Therapeutic activity reported	Mode of action reported	Ref.
01	Plant parts, nature of extract or fraction, active constituents (with structures)	334 medicinal plants	-----	Anticonvulsant	-----	[522]
02	Pharmacological reports	16 Brazilian plants and 355 species	-----	Anticonvulsant	-----	[523]
03	Phytochemical reports, Pharmacological reports	56 traditional plants	Flavonoids, alkaloids, terpenes, lactones, coumarins, xanthones	Anticonvulsant	-----	[2]
04	Pharmacological reports	41 traditional plants	-----	Anticonvulsant	-----	[524]
05	Phytochemical report, Pharmacological reports	22 traditional herbs and 6 marketed herbal preparations	Nantenine	Anticonvulsant	-----	[525]
06	Pharmacological reports	21 herbs and 1 formulation	-----	Anticonvulsant	-----	[526]
07	Pharmacological reports	150 traditional plants and 4 formulations	-----	Anticonvulsant	-----	[527]
08	Pharmacological reports	15 aromatic plants from Northeast Brazil	Essential oils	Antispasmodic, analgesic, anti-inflammatory, anticonvulsant and antibacterial	-----	[528]
09	Pharmacological reports	50 Amerindian and African tradition plants	-----	Anticonvulsant	-----	[529]
10	Pharmacological report	53 Medicinal plants	-----	Anticonvulsant	-----	[530]
11	Phytochemical reports, Pharmacological reports	African plants – <i>Catha edulis</i> (Vahl.) Forssk. ex Endl. (Celastraceae; Khat, Qat, Gat), <i>Cola</i> spp., <i>Datura</i> spp., <i>Pausinystalia yohimbe</i> Pierre ex Beille (Rubiaceae; Yohimbe), <i>Tabernanthe iboga</i> (L.) Nutt. (Apocynaceae; Iboga)	-----	Anticonvulsant	-----	[531]
12	Pharmacological reports	Five prescriptions from Hausa/Iulani tribe of Northern Nigeria from eight plants <i>Securidaca pedunculata</i> Fres. (Sanya ; Polygalaceae), <i>Mitragyna inermis</i> (Willd.) O. Ktze. (Etiyaya ; Rubiaceae), <i>Celtis integrifolia</i> Lam. (Zuwo ; Ulmaceae), <i>Centaurea pratensis</i> Thuill. (Gwander), <i>Diospyros</i> (Daji ; Asteraceae), <i>Mespiliformis</i> Hochst. Ex A. DC (Kanya ; Ebanaceae), <i>Parkia clappertoniana</i> Keay (Dorawa ; Leguminosae), <i>Combretum hypopiliun</i> (Katenkara ; Combretaceae), <i>Acacia seyal</i> (Jushi ; Mimosae)	-----	Antiepileptic	-----	[532]

(continued)

Sr. No.	Information available	Plant drugs	Phytoconstituents reported	Therapeutic activity reported	Mode of action reported	Ref.
13	Pharmacological reports	Herbal and dietary supplements Ethanol extracts of 31 traditional plants	-----	Anticonvulsant	-----	[533]
14	Pharmacological reports, Mode of action		-----	Anxiolytic and antiepileptic	GABA(A) – BZD receptor, Inhibition of GABA transaminase	[534]
15	Phytochemical reports, Pharmacological reports	Gentianaceae	Bitter principles – amarogentin, bellidifolin, gentianine and swerchirin, and xanthones	Anti-inflammatory, analgesic, antispasmodic, anticonvulsant, antihistaminic, antimalarial, antiamoebic, cytoprotective, diuretic, hepatoprotective and hypoglycaemic	-----	[535]
16	Phytochemical reports, Pharmacological reports	<i>Abrus precatorius</i>	Flavonoids, triterpene glycosides, abrin and alkaloids	Neuromuscular effects, antihelmintic, antiepileptic, antimalarial, antithrombin, antifertility, nephroprotective, immunomodulator, antidiabetic, alzheimer's disease and anti-inflammatory	-----	[536]
17	Phytochemical reports, Pharmacological reports	<i>Acorus calamus</i> Linn.	Phenyl propanoids, sesqui- and monoterpenes, xanthone glycosides, flavones, lignans, steroids and inorganic constituents	Insecticidal, larvicidal, antibacterial, mutagenic, cytotoxic, hepatoprotective, anticonvulsant, neuroleptic and smooth muscle relaxant	-----	[537]
18	Pharmacological reports	<i>Bacopa monniera</i> Linn.	-----	Memory enhancer, anti-inflammatory, antioxidant, analgesic, antipyretic, sedative, cardiotonic and antiepileptic	-----	[538]
19	Phytochemical reports, Pharmacological reports	<i>Bridelia</i> Spp.	Gallic catechin (4'-O- 7)-epigallocatechin, quercetin, myricetin, bridelone, bridelonine and isoflavone	Antiamoebic, antianemic, antibacterial, anticonvulsant, antidiabetic, antidiarrheal, antihelmintic, anti-inflammatory, antimalarial, antinociceptive, antiviral, hypoglycaemic, and for abdominal pain, cardiovascular, gynaecological and sexual diseases	-----	[539]
20	Phytochemical reports, Pharmacological reports	<i>Canscora decussata</i> Roem. & Schultz.	Phenolic compounds, xanthones, triterpenoids	Immunomodulatory, analgesic, anticonvulsant, antitubercular, anti-inflammatory, spermicidal, CNS depressant and cardiostimulant	-----	[540]
21	Phytochemical reports, Pharmacological reports	<i>Carissa congesta</i>	-----	Cardiotonic, hepatoprotective, free radical scavenging, xanthine oxidase inhibitory, antirheumatic, antibacterial, antiviral and anticonvulsant	-----	[541]

22	Phytochemical reports, Pharmacological reports	Celery		Volatile oil (3-n butylphthalide and analogs)	Antisthmatic, anticonvulsant, antitumorogenesis, hypotensive, inhibit platelet aggregation and PGF2a	[542]
23	Phytochemical reports, Pharmacological reports	<i>Clitoria ternatea</i> Linn. (Fabaceae) Butterfly pea		Triterpenoids, flavonol glycosides, anthocyanins and steroids	Antimicrobial, antipyretic, anti- inflammatory, analgesic, diuretic, local anesthetic, antidiabetic, insecticidal, blood platelet aggregation inhibitor and vascular smooth muscle relaxant	[543]
24	Ethnopharmacology, Phytochemical reports, Pharmacological reports	<i>Eryngium foetidum</i> Linn. aerial parts		-----	Anticonvulsant, antelmintic (Eryngial), antibacterial, antimalarial, antidiabetic and anti-inflammatory (Phytosterols)	[544]
25	Pharmacological reports	<i>Hypericum perforatum</i> Linn.		-----	Antidepressant, anxiolytic, sedative, nootropic, antischizophrenic,	[545]
26	Phytochemical reports, Pharmacological reports	<i>Moringa oleifera</i>		Proteins, vitamins, carotene, amino acids, phenolics, zeatin, quercetin, β -sitosterol, caffeoylquinic acid and kaempferol	Anticonvulsant and analgesic Cardiac and circulatory stimulant, antitumour, antipyretic, antiepileptic, anti-inflammatory, antiulcer, antispasmodic, diuretic, antihypertensive, cholesterol lowerig, antioxidant, antidiabetic, hepatoprotective, antibacterial and antifungal	[546]
27	Pharmacological reports	<i>Mucuna pruriens</i>		-----	Antidiabetic, aphrodisiac, antineoplastic, antiepileptic and antimicrobial	[547]
28	Ethnopharmacology, Phytochemical reports, Pharmacological reports	<i>Salvadora persica</i> Linn.		Trimethylamine and salvadorine	Antibacterial, antiphlogistic, gingiva stimulation, antiplaque, antifungal, antipyretic, hepatoprotective, antioxidant, antiulcer, hypolipidemic and anticonvulsant	[548]
29	Pharmacological reports	<i>Salvia lerifolia</i> Benth. (Lamiaceae) Nowroozak		-----	Attenuation of morphine dependence, hypoglycaemia, antinociceptive, anti- inflammatory, antioxidant, antiischaemia, anticonvulsant, antiulcer, antibacterial and mutagenic	[549]
30	Pharmacological reports	<i>Salvia</i> Spp.		-----	Sedative, hypnotic, hallucinogenic, skeletal muscle relaxant, analgesic, memory enhancing, anticonvulsant, neuroprotective and antiparkinsonian, and decrease of ethanol and morphine withdrawal syndrome	[550]

(continued)

Sr. No.	Information available	Plant drugs	Phytoconstituents reported	Therapeutic activity reported	Mode of action reported	Ref.
31	Phytochemical reports, Pharmacological reports	<i>Sclerocarya birrea</i> (A. Rich) Hochst.	Polyphenols, tannins, coumarins, flavonoids, triterpenoids, phytosterols	Antidiarrheal, antidiabetic, anti-inflammatory, antimicrobial, antispasmodic, antihypertensive, anticonvulsant, antinociceptive and antioxidant	-----	[551]
32	Pharmacological reports	<i>Scutellaria</i> spp.	-----	Antitumor, antiangiogenesis, hepatoprotective, antioxidant, anticonvulsant, antibacterial and antiviral	-----	[552]
33	Pharmacological reports, Clinical reports	<i>Solanum nigrum</i> Linn.	-----	Hepatoprotective, antitumor, cytostatic, anticonvulsant, antiulcer and anti-inflammatory	-----	[553]
34	Phytochemical reports, Pharmacological reports	<i>Stellera chamaejasme</i> Linn. (Thymelacaceae) Lang du, Re lcag pa	Flavonoids, coumarins, diterpenes, triterpene and lignans	Antitumor, cytotoxic, antiviral, anticonvulsant, immunomodulatory and antibacterial	-----	[554]
35	Phytochemical reports, Pharmacological reports	<i>Sutherlandia frutescens</i>	Free amino acids, non-protein amino acids such as canavanine, GABA, cyclitol, pinitol, flavonols and triterpenes	Antiproliferative, anti-HIV, antidiabetic, anti-inflammatory, analgesic, antibacterial, antistress, anticonvulsant, antithrombotic	-----	[555]
36	Phytochemical reports, Pharmacological reports	<i>Trichilia emetica</i> Vahl. (Meliaceae) Natal Mahogany	Limonoids, polysaccharides, pectin, rhamnogalacturonan with side chains of arabinogalactan	Antitumefactive, anti-inflammatory, antischistosomal, antiparasitodal, anticonvulsant, antitrypanosomal, antioxidant, antitussive, antimutagenic, hepatoprotective, antifungal, bactericidal, antiviral	-----	[556]
37	Phytochemical reports, Pharmacological reports	<i>Vitex negundo</i> Linn.	Essential oil, polyphenols, terpenoids and fatty acids	antifeedant and wound healing Antidiabetic, antibacterial, anti-inflammatory, antifungal, antinociceptive, antiandrogenic, anticonvulsant, antioxidant and antitumor	-----	[557]
38	Phytochemical reports, Pharmacological reports	-----	Monoterpenoids (linalool, α-thujone, borneol, valepotriates); Sesquiterpenoids (valeric acid, artemisinin); Diterpenoids (gingkolides, forskolin, salvinorin A); Triterpenoids (ginsenosides); Meroterpenoids (cannabinoids)	CNS activities	-----	[558]

39	Pharmacological reports and therapeutic uses	-----	Cannabinoids	Spasmodic disorders, pain, bronchial asthma, epilepsy, mood disorders, glaucoma, appetite stimulation, antiemetic -----	[559]
40	Mode of actions	-----	Flavonoids	(1) Subtype selectivity in recombinant receptor studies <i>in vitro</i> , behavioural effects <i>in vivo</i> (2) Flumazenil insensitive modulation of GABA(A) receptor (3) Second order modulators of first order modulation by BZD (4) GABA(A) receptor complexes Weak Na ⁺ antagonistic effect ----- (1) Subtype selectivity in recombinant receptor studies <i>in vitro</i> , behavioural effects <i>in vivo</i> (2) Flumazenil insensitive modulation of GABA(A) receptor (3) Second order modulators of first order modulation by BZD (4) GABA(A) receptor complexes Weak Na ⁺ antagonistic effect -----	[560]
41	Pharmacological reports, MOA	-----	Kavapyrones – (+/-)-Kavain (60)	Anticonvulsant, anxiolytic and analgesic	[561]
42	Pharmacological reports	-----	Cannabinoids, cannabidiol (19) and δ 9-tetrahydrocannabinol (18) Losigamone (131)	Sedative, hypnotic, anxiolytic, antidepressant, antipsychotic and anticonvulsant Anticonvulsant	[562]
43	Pharmacological reports, Clinical Reports	-----	β -carboline alkaloids	Sedative, anxiolytic, hypnotic, anticonvulsant, antitumour, antiviral, antiparasitic and antimicrobial	[563]
44	Pharmacological reports, MOA	-----		Intercalate into DNA, inhibit CDK, topoisomerase and MAO, and interact with BZD and 5-hydroxyserotonin -----	[564]
45	Pharmacological reports, Clinical reports, MOA	-----	Omega-3 and -6 polyunsaturated fatty acids Vanillin	Antiseizure	[565]
46	Pharmacological reports	Tian ma		Anticonvulsant	[566]

Table 6: List of plants, phytoconstituents and plant formulations evaluated for anticonvulsant activity, but did not possess activity.

Sr. No.	Plant/Phytoconstituent/Plant formulation	Extract/fraction	Dose	Animal	Experimental model	Ref.
01	<i>Alchornea cordifolia</i> Mull. Arg. (Euphorbiaceae)	Aqueous extract of leaves	100-400 mg/kg, p.o.	Swiss albino mice	PIC	[567]
02	Christmas bush, Xmas tree <i>Areca catechu</i> Linn. (Arecaceae)	Arecaidine (132)	1 g/kg, s.c.	Albino mice	BIC	[568]
03	Areca palm, Pinang <i>Artemisia annua</i> Linn. (Asteraceae)	(a) ethanol extract of leaves (b) Essential oil from leaves	(a) 450 mg/kg, i.p. (b) 470 mg/kg, i.p.	Male Wistar rats and Swiss albino mice	PTZ, PIC, STR, PILO	[569]
04	<i>Astragalus hamosus</i> Linn. (Papilionaceae)	Hydro-alcoholic extract (80% ethanol) of fruits	0.25 to 3 g/kg, i.p.	Male albino mice	PTZ, MES	[570]
05	European milk-vetch <i>Cassia angustifolia</i> vahl. (Caesalpinaceae)	Hydro-alcoholic extract (80% ethanol) of aerial parts	0.25 to 3 g/kg, i.p.	Male albino mice	PTZ, MES	[570]
06	Senna <i>Chelidonium majus</i> Linn. (Papaveraceae)	Ethanol extract of aerial parts	150 or 300 mg/kg, i.p.	Albino mice	PTZ	[44]
07	Greater Celandine, Tetterwort <i>Cleome viscosa</i> Linn. (Cleomaceae)	95% ethanol extract of seeds	1 g/kg, i.p.	Albino SD rats	PIC	[571]
08	Asian spiderflower, Sticky viscome <i>Corydalis sibirica</i> (L.F.) Pers. (Papaveraceae)	Ethanol extract of aerial parts	150 or 300 mg/kg, i.p.	Albino mice	PTZ	[44]
09	Bei-zi-jin <i>Crocus haussknechtii</i> Boiss. (Iridaceae)	Hydro-alcoholic extract (80% ethanol) of corms	0.25 to 3 g/kg, i.p.	Male albino mice	PTZ, MES	[570]
10	Jowqasem <i>Cymbopogon citratus</i> DC (Stapf) (Poaceae)	(a) Abafados (infusion of leaves) (b) Citral	(a) C208 (b) 50 or 100 mg/kg, p.o.	Male albino mice	PTZ, transcorneal electroshock	[572]
11	<i>Euphorbia hirta</i> Linn. (Euphorbiaceae)	Lyophilized aqueous extract of whole plant	200, 600, 1600 or 3200 mg/kg, i.p.	Male Swiss mice	PTZ	[573]
12	Tawa tawa <i>Ferula</i> (Apiaceae) Species such as <i>F. diversivittata</i> Regel and Schmalh. (Sambul root, Musk root) roots and flowers; <i>F. persica</i> Willd. (Sagapenum) aerial parts; <i>F. ovina</i> Boiss. (Yang shia-wei) roots; <i>F. badrakema</i> Kos. Pol. (Koma) roots and fruits; <i>F. latifolia</i> Rech. F. & Aell. (Koma) roots; <i>F. asafoetida</i> Linn.	Methanol extract	300 mg/kg, i.p.	Male NMRI mice	PTZ	[574]
13	Compound preparation of <i>Gardenia</i> (Rubiaceae); Nanu and <i>Ziziphus zizyphus</i> (L.) H. Karst. (Rhamnaceae); Jujube, Red date, Indian and Chinese date seed oil	Seed oil	100 mg/kg, i.p.	Albino mice	PTZ	[575]
14	<i>Icacina trichantha</i> Oliv. (Icacinaceae)	Aqueous extract of tubers	80 mg/kg, i.p.	White albino mice	STR, lapazole	[576]
15	Ibugo, Ogwa <i>Indigofera suffruticosa</i> Mill. (Fabaceae)	Fluid extract of leaves	0.06 g/kg, p.o.	Balb/c mice	MES, PIC	[577]
16	Wild indigo, West Indian Indigo, Guatemalan indigo, Small leaved indigo <i>Juglans regia</i> Linn. (Juglandaceae)	Hydro-alcoholic extract (80% ethanol) of leaves	0.25 to 3 g/kg, i.p.	Male albino mice	PTZ, MES	[570]
17	Persian walnut <i>Lupinus albus</i> Linn. (Fabaceae)	Aqueous extract of seeds	10 g/100 ml; 6 ml/kg, i.p.	White female mice	PIC	[43]
18	White lupin <i>Matricaria chamomilla</i> Linn. Synonym - <i>Matricaria recutita</i> Linn. (Asteraceae)	Apigenin isolated from aqueous extract of branchlets with flowers	20-80 mg/kg, i.p.	CF1 mice	PTZ	[578]
19	German chamomile <i>Maytenus aquifolium</i> Mart. (Celastraceae); Cangorosa , <i>M. ilicifolia</i> Mart. (Celastraceae); Quebrachillo, Somba-de-toro	Decoction of leaves	6.8 mg/kg, p.o.	Swiss male mice	Transcorneal electroshock	[579]

20	<i>Mentha suaveolens</i> Ehrh. (Lamiaceae) Applemint	Methanol extract of leaves and stems	200 mg/kg, i.p.	Male albino mice	MES	[580]
21	<i>Nardostachys jatamansi</i> DC (Valerianaceae) Nard, Nardin, Musk root	(a) Jatamansone (133) isolated from crude oil obtained from petroleum ether extract of rhizomes (b) Essential oil	(a) 30 mg/kg, i.p. (b) 200 mg/kg, i.p.	Albino rats	MES, MTZ	[581, 582]
22	<i>Olea europea</i> Linn. (Oleaceae) Olive	Aqueous extract of flowers, leaves and stems	10 g/100 ml; 6 ml/kg, i.p.	White female mice	PIC	[43]
23	<i>Origanum vulgare</i> Linn. (Labiatae) Oregano, Wild marjoram	Aqueous extract of flowers, leaves and stems	10 g/100 ml; 6 ml/kg, i.p.	White female mice	PIC	[43]
24	<i>Panax ginseng</i> C.A. Meyer (Araliaceae) Ginseng	Aqueous extract of root powder	20 or 50 mg/kg, i.p.	CF albino rats and Wistar albino mice	MES, PIC	[583]
25	<i>Plumbago zeylanica</i> Linn. (Plumbaginaceae) Chitrak	Hydro-alcoholic extract (70:30) of leaves	250 or 500 mg/kg, p.o.	Albino Wistar rats	PTZ, MES	[584]
26	<i>Pluchea indica</i> Less (Asteraceae) Indian Camphorwood	Resinous mass from methanol extract of roots	100-400 mg/kg, p.o.	Male ddY mice	PTZ	[585]
27	<i>Pterocarpus marsupium</i> Roxb. (Fabaceae) Indian kinotree	(-)-epicatechin (134) isolated from 95% ethanol extract of bark	30, 100, 200 or 300 mg/kg, i.p.	Albino rats	MES, PTZ	[586]
28	<i>Pterocarpus santalinus</i> Linn. (Leguminosae) Red Sanders	90% ethanol extract of heartwood and bark	1000 mg/kg, i.p.	Albino rats	MES, MTZ	[587]
29	<i>Rhazya stricta</i> Decaisne (Apocynaceae) Sehar, Harmal, Dogbane	Aqueous lyophilized extract of leaves	2, 4 or 8 g/kg, p.o.	Male albino mice	PIC	[588]
30	<i>Sideritis taurica</i> Stephen ex Wild. (Lamiaceae) Scardica	Petroleum ether, 70% ethanol, dichloromethane and n-butanol fractions of aerial parts	200-450 mg/kg, p.o.	Male albino rats and mice	MES	[589]
31	<i>Sphenostylis stenocarpa</i> (Hochst. Ex A. Rich) Harms (Fabaceae) African Yam bean	Aqueous extract of seeds	60 mg/kg, i.p.	Albino mice	STR, leptazole	[590]
32	Substituted coumarins - Coumarinythiazolines, Coumarinythiazolidinenone, Chromenothiazoles <i>Galphimim B</i> (135), a nor secotriterpenoid isolated from <i>Galphimia glauca</i>	Isolated from ethyl acetate fraction of methanol extract of aerial parts	200 mg/kg i.p.	Male albino mice	PTZ, STR	[591]
33	(a) Myoinositol (11) (b) Scyllo-inositol (136) <i>G. biloba</i> phytosomes	-----	10, 40 or 80 mg/kg, i.p.	Male albino mice	STR, Leptazole	[592]
34		-----	(a) 30 mg/kg, i.p. (b) 5 mg/kg, i.p.	Wistar rats	PTZ	[593]
35		Soy phospholipid + <i>G. biloba</i> extract	25, 50 or 100 mg/kg, p.o.	Wistar rats and Haffleine albino mice	MES, INH	[594]
36	Niu Huang pill and simplified prescription (realgar and cinnabar)	-----	-----	Albino mice	STR, PTZ	[595]
37	298 traditional plant materials	50% ethanol extract of different plant parts	1g/kg, p.o.	Albino rats and mice	MES	[596]
38	287 traditional plant materials	50% ethanol extract of different plant parts	1g/kg, p.o.	Albino rats and mice	MES	[597]3
39	300 traditional plant materials	50% ethanol extract of different plant parts	1g/kg, p.o.	Albino rats and mice	MES	[598]
40	295 traditional plant materials	50% ethanol extract of different plant parts	1g/kg, p.o.	Albino rats and mice	MES	[599]

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ABBREVIATIONS

ATP	Adenosine triphosphate
BIC	Bicuculline
BZD	Benzodiazepines
CA	Cornu Ammonis
CBD	Cannabidiol
CNS	Central nervous system
DA	Dopamine
DMCM	Methyl-6,7-dimethoxy-4-ethyl- β -carboline-3-carboxylate
ED	Effective dose
EEA	Excitatory amino acid
EEG	Electroencephalographic
FNZ	Flunitrazepam
GABA	Gamma-amino butyric acid
5-HT _{1A}	5-hydroxytryptamine 1A
IC	Inhibitory concentration
i.c.v.	Intracerebroventricular
i.m.	Intramuscular
INH	Isoniazid
i.p.	Intraperitoneally
MDA	Malondialdehyde
MES	Maximal electro-shock
MTZ	Metrazole
NA	Noradrenaline
NMDA	N-methyl-D-aspartic acid
NOS	Nitric oxide synthase
PD	Protective dose
PIC	Picrotoxin
PILO	Pilocarpine
p.o.	Per oral
PTZ	Pentylenetetrazole
s.c.	Subcutaneously
STR	Strychnine
TDS	Thrice daily
THC	Tetrahydrocannabinol

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