IJP (2021), Vol. 8, Issue 7 **(Review Article)**

Received on 08 April 2021; received in revised form, 25 July 2021; accepted, 27 July 2021; published 31 July 2021

PHYTOCHEMICAL AND PHARMACOLOGICAL REVIEW ON IPOMEA AND RIVEA SPECIES

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Keywords:

Convolvulaceae species, *Rivea hypocrateriformis*, *Ipomea seperia*, Pharmacological and Phytochemical studies, Spectroscopical analysis

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ABSTRACT: Rivea and Ipomea species are Convolvulaceae species that were identified by its funnel-like flowers and radial-shaped corolla. The stems of these plants are slender and a creeper type. The leaves of Ipomea are simple, whereas the leaves of Rivea is velvety is texture and shiny appearance. The fruit can be a capsule, berry, or nut, all containing only two seeds per one locule. Mostly Convolvulaceae species are eaten as fresh leafy vegetables, which have been used traditionally for curing many ailments such as purgative, skin disease, and as a blood purifier for arthritis, piles, and urinary disorder. Both the plants possess anti- oxidant, anti-diabetic, wound healing, anti-snake venom activity, anti-ulcer, anti-bacterial, antimutagenic, acting as an immune booster and relieving respiratory congestion. On highlighting its phytochemical aspects, both the plants show the presence of flavonoids, terpenoids, polyphenols, carbohydrates, alkaloids, sterols, and glycosides. As these plants are creepers in the olden day's tribal people, use its leafy part for its nutraceutical value.

INTRODUCTION: Convolvulaceae is commonly known as the morning glory family. These plants' parts generally have folklore claims for treating various diseases. The plants show many biological activities and therapeutic properties that depend upon their chemical constituents, root, rhizome, stem, flower, leaf, fruit, or seed. Phytochemical and Pharmacological studies of these plants revealed their medicinal value. Before the plant can be taken up as a drug alone or in formulation with other compounds, it is of utmost importance to lay down standardization parameters that will enable to maintain the authenticity and quality of the drug and prevent it from being adulterated.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.IJP.8(7).290-96

The article can be accessed online on www.ijpjournal.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.8(7).290-96

***I. eriocarpa*:** The preliminary phytochemical analysis of the leaf extract *I. eriocarpa* shows the presence of alkaloids, phenols, saponins, phytosterols, flavonoids, and terpenoids. The major phytoconstituents found is Hentriacontane was found by GC-MS analysis along with the presence of eleven phytoconstituents. The leaf extract of *I. eriocarpa* possesses a pharmacological inhibitory action towards kidney stones. It has a significant anti-arthritic effect against the denaturation of protein due to the presence of terpenoids.

***I. aquatica*:** Phytochemical screening of the plant *I. aquatica* has been screened for various phytoconstituents among this vitamin, and S-methyl methionine is reported to treat gastrointestinal disorders such as acidity, gastritis, flatulence. The plant is also supported with minor chemical constituents such as aliphatic pyrolidine amides, carotenoids, hentriacontane, β-sitosterol, glycosides, prostaglandin, leukotriene, N-trans and N-cis-feruloyltyramines and certain amino acids. In

the case of the indigenous system of medicine such as Ayurveda and homeopathy, leaves extracts of *I. aquatica* are used against arsenic poisoning in folk medicine in India.

***I. alba* L:** *Ipomoea alba* L. (Convolvulaceae) is a perennial climber and locally known as moonflower or Sakankali. The material was also screened for the presence of fifteen different bioactive compounds such as alkaloids, flavonoids, Simple phenolics, Anthraquinones, Cardenolides, Leucoanthocyanin, saponins, Anthracene glycosides, and polyose. The whole herbs used in treating snakebite. The root bark of *I. alba* is used as purgative, and leaves are used to treat parasitic infections such as filariasis. The seeds contain major chemical constituents such as ipomine and dimethoxyipomine [1, 2].

***I. aquatica* Forssk:** From this species *I. aquatic* Isochlorogenic acid has been used in the treatment of diabetes and inhibition of HIV infection. The medicinal effects of this plant proved to be curing liver, eye diseases and act as an anti-diuretic. By column chromatographic method, glucopyranose was isolated, which has been investigated to prevent cancer [3, 4, 5].

***I. asarifolia* (Desr.) Roem. & Schult:** This species *I. asarifolia* contains ergoline alkaloids Chanoclacine I and ergine promote psychotomimetic effects. Domestic animals fed on these plants produce a tremorgenic sydrome that includes depression, tremors of the head, coordinated gait, and hypermetria. It is also used traditionally for various gynecological purposes. The ethnomedicinal importance of this plant reveals to cure the swelling and inflammation in the joints [6].

***Ipomoea batatas* (L.) Lam:** The polysaccharide, ipomine, Calystegines were identified in the roots of Ipomoea batatas, which improve the immune system and produce vascular relaxing properties. Chlorogenic acid and caffeoylquinic acid were also found in *I. batatas*. These compounds are also inhibitors of HIV replication and antimutagenic activities. The roots of *I. batatas* exhibit the coumarins, aesculetin, scopoletin and umbelliferone, which have anti-coagulation property [7-19].

***Ipomoea bahiensis* Willd. ex Roem. & Schult:** Four types of glycosides have been isolated from Ipomoea bahiensis; these compounds show a significant pharmacological action against breast cancer [20].

***Ipomoea cairica* (L.) Sweet (Syn. *I. palmata* Forssk.):** *I. cairica* contains arctigenin, which act as an anticancer, antioxidant and prevents inflammation as a property in curig autoimmune disease. The essential oil obtained from this acts as mosquito repellent [21].

***Ipomoea carnea* Jacq:** *I. carnea* showed the therapeutic action towards cenral nervous system due to the presence of polyhydroxylated alkaloids, swainsonine, calystegines of livestock [22-29].

***Ipomoea corymbosa* (L.) Roth ex Roem. & Schult**:
***I. corymbosa* (*Rivea corymbosa*):** In the seeds of this species were found alkaloids of the ergot type, such as lysergic acid amide and the following minor alkaloids chanoclavine, elymoclavine, also erginine or isoergine, and lysergol. These compounds act as a psychoactive agents in humans [30, 31].

***Ipomoea digitata* L:** A glycoside called paniculatin isolated from the tubers of *I. digitata*, showed a stimulant effect on myocardium infraction and bronchoconstrictor effect, a spasmogenic effect on smooth muscles of the stomach and produced the oxytocic activity in uterus. Many constituents were isolated suc as taraxerol, taraxerol acetate, N-butyl-β-D fructo pyranoside, octadecy l(E)-p-coumarate and coumarins, umbelliferone, scopoletin, scopolin and scoparone. This acetylcholine enzyme obtained from this species acts as a neurotransmitter for treating Alzheimer's disease [32-34].

***Ipomoea hederifolia* L:** *I. hederifolia* consists of several phytoconstituents such as Ipagulines, isoipaguline, pyrrolizidine, alkaloids, cyanogenic glycosides, caystegines, some ergoline derivatives [35].

***I. horrida* Huber:** From the aerial parts of *I. horrid* consists of methyl kaempferol and methyl quercetin are used to treat local and systemic pains respectively by inhibition of PCA2 and COX-2.

***Ipomoea imperati* (Vahl) Griseb:** Methanol extract of the leaves of *I. imperati* showed local and systemic anti-inflammatory actions, respectively. By inhibiting the acetylcholine and histamine receptor act as antispasmodic. It consists of penolsalkaloids and steroids.

***Ipomoea indica*:** Methanolic and aqueous extracts from the seeds of this species were investigated for anti-bacterial activity and evaluated for its ability to inhibit fungi growth of fungi. The glycoside, called ipolearoside, has significant activity against carcinoma.

***Ipomoea involucrata* P. Beauv:** *I. involucrate* possesses the following chemical constituents: chlorogenic acid, ferulic acid, hesperidine, lutein, resvaratol, and coumaric acid, myricetic, kaemferol and these act in curing the patients suffering from sickle cell anemia [36].

***Ipomoea muelleri* Benth:** From the seeds of *I. muelleri*, such as agroclavine, chanoclavine I, elymoclavine, ergine or LSA, erginine or isolysergic acid amide, ergometrine, festuclavine, lysergol, penniclavine, as well, isopenniclavine, α-dihydrolysergol, Isolysergol, isosetoclavine, setoclavine, molliclavine, isolysergamide, N-(1hydroxyethyl) chanoclavine II and ergometrinine, agroclavine and festuclavine were shown to be effective against antimicrobial activity potent uterine against action activity and is used as an oxytocic and in treating postpartum hemorrhages [38, 39].

***Ipomoea muricata* (L.) Jacq:** The seeds of *I. muricata* presented analgesic and antiseptic properties. The imidazolidine alkaloidal ipalbine, ipalbidine, ipalbinium, and ipomine were isolated from the seeds. Besides these alkaloids muricatins re present produces antimutagenic activities [40-45].

***Ipomoea murucoides* Roem. & Schult:** From the roots of *I. murucoides* were isolated the two new glycoresins called murucins 1-5. Murucin 1 presents marginal activity (ED50 -5.0 µg/mL) against ovarian carcinoma (OVCAR-5) cells, but was inactive (ED50 >20.0 µg/mL) against colon carcinoma (HCT-15) and cervical carcinoma (UISOSQC-1) cells. Murucins 2-5 were inactive against all three of these cell lines. From flowers of Ipomoea murucoides were isolated five lipophilic tetrasaccharide called murucoidins XII-XVI [46].

***Ipomoea nil* (L.) Roth:** From the roots of I. nil the constituents isolated are peonidins and anthocyan that presents protective effects against ultraviolet rays. A spermidine alkaloid was isolated from the seeds of I. nil.

***Ipomoea obscura* (L.) Ker Gawl:** *I. obscura* afforded indole alkaloids, such as ipobscurines, calystegins were also isolated from this species. Ursodeoxycholic acid is a novel compound, first isolated from this plant and the literature review reveals that the novel compound has much biological activity and long form consumption of this plant would act as antioxidant and helps to prevent cancer.

***Ipomoea orizabensis* (G. Pelletan) Ledeb. ex Steud:**

***I. orizabensis* Produced Strong Activity against Sarcoma:** The roots of this species isolated several glycoresins scammonine and a complex glycolipid scamonin and orizabins are useful as laxatives and which exhibits citotoxic activity against oral epidermoid carcinoma. These glycolipids contain intramolecular macrocyclic lactone. Due to the presence of lactone ring, it possesses anticancer activity [37, 47, 48].

***Ipomoea operculata* Mart. et Spix. (syn. *Operculina macrocarpa* (L.) Urb.):** Several glycoresins called operculins I-XVIII were isolated from the roots of *I. operculata*. However, its biological activities were not evaluated.

***Ipomoea parasitica* (Kunth) G. Don:** The seeds of *I. parasitica* were isolated a unique members of glycoresin. From seeds of this species were identified lysergol and elymoclavine and other ergoline alkaloids.

***Ipomoea pes-caprae* (L.) R. Br.:** From I. pes-caprae, such as quercetin, glucofuranoside, β-amyrin acetate, α-amyrin acetate, betulinic acid, and glochidone showed pronounced antinociceptive properties in mice. A study in mice indicated that both methanolic extract and two fractions (ethyl acetate and aqueous) exhibited antinociceptive activity against two classical models of pain, neurogenic and inflammatory [49-53]. From the leaves of *I. pes-caprae* were isolated the isochlorogenic acids a, b and c beyond that, others quinic acid esters were also isolated from the leaves of this

species. Isochlorogenic acids as well the quinic acid esters presented collagenase inhibitory activity. During aging occurs reduction of the collagen of the skin due to its decomposition by the action of the enzyme called collagenase. Compounds that inhibit this enzyme will avoid the reduction of the collagen and, consequently, maintain the skin's elasticity. The cytotoxic potential of six lipophilic glycosides isolated from the aerial parts of *I. pescaprae*, namely, pescaproside, pescapreins and the known stoloniferin was evaluated for anti cancr activity against humans. Flowers of *I. pes-caprae* were produced jalapinolic acid, pescapraeins.

***Ipomoea purge*:** The resin present in *I. purga* called as jalapin shows a strong purgative effect. Alkaline hydrolysis of jalapin yields volatile acids, tyglic, acetic, propionic, isobutyric, isovaleric, valeric and methylethyl-acetic, beside jalaponic acid, by acid hydrolysis yields the glucose, fructose and rhamnose, as well as jalapinolic acid.

***Ipomoea purpurea* (L.) Roth.:** A glycoresin called ipopurpuroside was isolated from I. purpurea. It consists of glucose, rhamnose and 6-deoxy-D-glucose glycosidically linked to ricinoleic acid. Other glycol resins called marubajalapins were isolated from the aerial part (leaves and stems) of (*I. purpurea*). From the flowers of this species were isolated cyanidins and pelargonidins [54].

***Ipomoea squamosa* Choisy:** From the leaves of I. squamosa were isolated the glycoresins called ipomoeassins. All the isolates showed citotoxic activity against the human ovarian cancer cell line. Ipomoeassins A-C and E were moderately active while Ipomoeassin D, which differs from C only by an acetyl group, is more active than C. These observations suggest that relatively minor structural variations may make significant differences in cytotoxicity [55].

***Ipomoea stans* Cav:** From the roots of *I. stans* stanins were isolated due to it exerts a vasorelaxant effect. This study supports the use of *I. stans* as an antispasmodic agent and possesses antioxidant and central nervous system activity. From a fraction of *I. stans*, three glycoresins fractions were isolated. From the roots of *I. stans* the glycoresins called stansins are produced used to treat carcinoma. Others glycoresins also isolated from *I. stans* were scammonic acid and orizabin. The coumarin scopoletin was also isolated from the roots of *I. stans* [56, 57, 58].

***Ipomoea stolonifera* (Cirillo) J.F. Gmel.:** From the leaves of *I. stolonifera* showed local and systemic anti-spasmodic and analgesic actions in mice and rats, respectively. From this species, a glycoside resin called stoloniferins I-XII was isolated in the pure state from the whole plants of *I. stolonifera* [59, 60].

***Ipomoea subincana* Meisn.:** From the chloroform extract of aerial parts of I. subincana were isolated scopoletin and methyl caffeoylquinate . Besides others compounds such as lupeol, β-sitosterol, vanillin, vanillic acid, aromadendrane, glycol-piranosyl sitosterol, cinamic acid, methyl caffeate, ethyl caffeate, methyl-3, 4-dimethoxy-cinnamate, stigmasterol, α-amyrin, β-amyrin, trans-n-icosyl-p-coumarates, cis-n-docosyl-p-coumarates, trans-n-nonadecyl p-coumarates, trans-n-henicosyl p-coumarates, trans-n-docosyl-p-coumarates, trans-n-tricosyl-pcoumarates, tyrosol and the novel glycolipid subincine and the new ceramides were present [61, 62].

***Ipomoea tyrianthina* Lindl.:** From this species were isolated tyrianthins A and B two new partially acylated glycolipid ester-type heterodimers which showed significant in vitro relaxant effect on arteries in rat. Scammonic acid A was determined as the glycosidic acid in both monomeric units. Also, these compounds were able to increase the release of GABA and glutamic acid in brain cortex, and displayed weak antimycobacterial activity [63].

***Ipomoea tricolor* Cav.:** From I. tricolor were isolated several ergoline alkaloids such as agroclavine, chanoclavine I, elymoclavine, ergine, ergocristine, ergotamine, ergometrine, penniclavine besides this, it also contains dihydrolysegol, isolysergol, ergometrinine, ergostine, and noragroclavine. Although all of these natural ergoline alkaloids increase the motor activity of the uterus, ergometrine is most active and also less toxic than ergotamine. Ergotamine also presents vaso-constrictor activity and is useful in the treatment of migraine headaches. Coumarin and scopoletin were also isolated from this species. The

coumarin presents antiedema properties and is also immunostimulant and exhibits cytotoxic activity [64, 65].

***Ipomoea violacea* L.:** From *I. violacea* were isolated several ergoline alkaloids, such as chanoclavine I, elymoclavine, egine, erginine, ergometrine, lysergol, penniclavine, chanoclavine II and ergometrinine.The main ergoline alkaloid in the seeds of *I. violacea* is ergine. The total alkaloid content of *I. violacea* seed is approximately five times as great as that of the seeds of *I. corymbosa*. Calystegins B1 and C1 were also isolated from this species.

***Rivea hypocateriformis*:** The LC-MS Chromatogram of crude extract of the root of *Rivea Hypocrateriformis* LC-MS chromatogram of the Methanol, Water, and chloroform (4:4:2) extract of the root of *Rivea Hypocrateriformis* clearly shows 54 peaks indicating the presence of 54 Phytochemical compounds. The identification of the phytochemical compounds was based on the peak area, retention time, and molecular formula. The results reveal the presence of Dulciol, Macrophylline, sphingosine, TomentolideA, Meteloidine, Cochlearine, Symlandine, Calophyllolide, Lucuminicacid, Glucopyrano-sylpilloin Mangostenone, Darlingine, Pyrimethanil, Deoxymaysin, Proansamitocin, Tetradecenyl-acetate, pentadecanal, Sparfloxacin, Serratanidine, 3Hydroxycoumarin, 3,7- Dimethyl-6- octene-1, 2, 3, 8- tetrol,(-)- menthyl beta-D- glucoside, Selegiline, 16-hydroxy hexadecanoic acid, N-(2-Methylpropyl) acetamide, 2-hexyl- decanoic acid, 2,4-Undecadienal,Peruvianoside II, Polyethylene 1-Palmitoyl Lysophosphatidic Acid, Crotamiton, Streptidine, Oleandrose, Tigloidine, Methoprene acid and Methyl jasmonate. The spectrum sketch out of LC-MS confirmed the presence of 54 components with the retention time [66, 67].

***Rivea ornate* Roxb:** Qualitative chemical examination of various extracts of *Rivea ornata* Roxb. was carried out, which revealed the presence of phytoconstituents like carbohydrates, phytosterols, phenolic compounds, alkaloid, triterpenoids, fixed oil, and tannins. The phenolic compound isolated was UV-spectroscopy, IR-spectroscopy, LC-MS spectroscopy, and NMR-spectroscopy. For final confirmation, UV spectra of compound C1 were taken with standard bergenin. Compound C1 was isolated as white crystals. From the spectral data, it was concluded that compound C1 was Bergenin.

***Rivea corymbosa*:** The ergot alkaloids, ergine, and isoergine, were found in the leaf and stem but not in the root of *Rivea corymbosa*, which had been grown in a greenhouse.

***Rivea argyrea*:** Various herbal drugs individually or in combination have been recommended for the treatment of different diseases. *Argyreia nervosa* Burm. F. (Syn. Argyreia speciosa), commonly known as 'Vridha daraka' in Sanskrit, belongs to the family Convolvulaceae has been used in different systems of traditional medication for the treatment of diseases and ailments of human beings. It is reported to contain several phytochemical constituents like Alkaloids, carbohydrates, Tannins, amber-colored resin, Sterols, Saponin. Economically it is used as folklore medicine as well as for ornamental purposes. Argyreia nervosa is an important source of compounds like 1-triacontanol, ß-sitosterol, epifriedeline, Kaemperol-3-o-l-rhamnopyranoside, agroclavine, ergine, isoergine, isolysergic acid amide, pennidavine, caffeic acid, Et-caffeate, chanoclavine-I, chanoclavine-II, racemic chanoclavine-I, festuclavine, lysergine, lysergol, isolysergol, molliclavine, penniclavine, steoclavine, iso-setoclavine, tetradecanyl palminate, 5,8-oxidotetraco san-10-one, stigmasteryl p-hydroxy-cinnamate, n-tricontanol, β-sitosterol and p-hydroxy innamoyloctadecanolate which are useful as Aphrodisiac, Immunomodulators, Hepato-protective, Hypoglycemic, Anti Inflammatory, Anticonvulsant and Nootropic *etc*.

CONCLUSION: The plants of the genus Ipomoea and Rivea have long been used in folk medicine to treat a wide variety of pathological conditions, including their use to treat inflammatory and analgesic processes, kidney ailments, constipation, colic, and digestive disorders. In recent years, the scientific interest in plants of the Ipomoea and Rivea genus has increased greatly. Substantial progress on chemistry and pharmacological properties of this genus have shown it. Some species showed antimicrobial, analgesic, spasmolytic, spasmogenic, hypotensive,

psychotomimetic, and anticancer activities. Pharmacological studies of Ipomea and Rivea have confirmed some uses in folk medicine. Although an extensive amount of research work has been done on some plants of genus Ipomoea and Rivea to date, a large number of species are still partially studied such as, *I. parasitica*, *I. operculata* (syn. *Operculina macrocarpa*), *I. lonchophylla*, *I. involucrata*, *I. hederacea*, *I. bahiensis*, *R. hypocrateriformis*, *R. ornata*, *R. corymbosa*, *R. argyrea*. Consequently, a broad field of future research remains possible in which the isolation of new active principles from these species would be of great scientific merit.

ACKNOWLEDGEMENT: Nil

CONFLICT OF INTEREST: Nil

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How to cite this article:
Nachiar GS, Kumar PR and Prabhu TP: Phytochemical and pharmacological review on ipomea and rivea species. Int J Pharmacognosy 2020; 8(7): 290-96. doi link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.8(7).290-96.