



### Short Review Paper

## Medicinal plant of genus ipomoea: present scenario, challenges and future prospective

Deepa Srivastava

Department of Botany, D.D.U. Gorakhpur University, Gorakhpur, UP, India  
drdeepasrivastava@yahoo.com

Available online at: [www.isca.in](http://www.isca.in), [www.isca.me](http://www.isca.me)

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### Abstract

The members of the family Convolvulaceae are called “Morning Glories” as they blossom to glory with the rising sun. The pleasing shape and the variety of flower colors make morning glory an ideal ornamental plant for tropics and subtropics. The genus *Ipomoea* contributes as largest genus of this family, having a wide range of economic important plant species. The medicinal value of this genus is also noteworthy as many species are useful for treatment of various ailments such as constipation, inflammations, dysentery, rheumatism, meningitis, diabetes and hypertension. This genus also shows antibacterial, antimicrobial, antifungal, antiviral and anti-cancerous activities. Bioactive compounds such as glycolipids, lignans, phenolic compounds and alkaloids are major constituents of this genus. This work reviews the present scenario, challenges and future prospective of the genus for its medicinal value.

**Keywords:** Convolvulaceae, *Ipomoea*, Bioactive compounds, Traditional medicine, Medicinal plant.

### Introduction

The genus *Ipomoea* contributes about 600-700 species all over the world and honored as the largest genus of family Convolvulaceae<sup>1</sup>. Utility wise also they are at leading edge. Sweet Potato (*Ipomoea batatas*) is the well known nutritional source all over the world<sup>2</sup>. Sweet potato vines serve as nutritive and palatable green feed for cattle. The young twigs and leaves of *Ipomoea aquatica* are used as vegetable in India, China, Sri Lanka, Taiwan, Hong-Kong and Malaysia<sup>3</sup>. The fleshy and tender fruits of *Ipomoea turbinate* are used as vegetable in Ceylon and India. Several species of *Ipomoea* are used as hallucinogenic. The species like *Ipomoea purpurea*, *Ipomoea alba* and *Ipomoea pes-caprae* are used in preparations that are offered to attain a state of mind suitable for divination and for adaptation of Catholic religion<sup>4</sup>. It has been used in religious ritual and ceremonies from ancient time and even today, the ritual contains many elements including the names given to the plants, such as, “Seeds of the Virgin”, “Holy Mary Herb” and “Virgin’s Cloak”<sup>5</sup>.

The wood of the weedy species *Ipomoea carnea* is used locally as a source of fuel<sup>6</sup>. Very little work has been done in about chemical identification and isolation of various compounds present in this genus. The future prospective of different species of this genus is very bright in consideration of medicinal purposes. This genus is quite economical as they are mostly wild climbers they need very little or no efforts for cultivation in large scale. The present study compiles the available knowledge about the Present scenario, challenges and future prospective of the genus “*Ipomoea*” as a source of therapeutic agents.

### Present scenario

The genus *Ipomoea* since ancient time has been in incessant use for various purposes, such as food, vegetable, medicine, ornamentals, and hallucinogens and in religious rituals. At present due to advancement of techniques in horticulture, floristic and genetics many new hybrid varieties are formed, advances in biochemical tools has made possible to identify and isolate bioactive compounds from these plants. As genus *Ipomoea* is rich in phyto-chemicals many medicinal important species have been worked out for their active ingredients but many of them are still to be discovered. At present the species of genus *Ipomoea* are used in different ways as described here:

**As Ornamental:** The magnificent colour of flowers of genus *Ipomoea* has attracted human concern from ancient time for its cultivation as ornamental plant in gardens. Many new varieties have been developed for commercial and aesthetic purposes. For example *Ipomoea sloteri*, is a hybrid plant crossed between *Ipomoea coccinea* (red morning glory) and Indian pink or Cypress vine (*Ipomoea quamocilt*), a delicate annual with pinnate leaves with bright scarlet red flowers. *Ipomoea cairica* (railway creeper) is suitable for garden fences, producing flowers almost throughout the year. The Lady Doorly morning glory or Cardinal creeper (*Ipomoea horsfalliae*) with deep rose flowers is a native of West-Indies and is very common in Indian gardens. *Ipomoea nil*, *Ipomoea leari*, *Ipomoea indica*, *Ipomoea hederifloia*, *Ipomoea macrantha* etc, are the common garden plants in India. *Ipomoea alba* is also called “Moon Flower” since it is nocturnal, and has white fragrant flowers<sup>7</sup>.

**Nutritional:** The most widely used *Ipomoea* species for nutritional purpose is *Ipomoea batatas*, commonly known as sweet potato. A variety of products such as edible and fermentable syrups; industrial alcohol, acetone, lactic acid, vinegar and yeast can be prepared from the tubers. Apart from the tuber, the tender parts of the plant are used as vegetable in Africa, Philippines, Indonesia, Malaysia, Ceylon and India<sup>2</sup>. The important species used as vegetable in Asian country is *Ipomoea aquatica* commonly known as water spinach. There are many other species which are used on a small scale, e.g. White star Potato (*Ipomoea lacunose*) eaten by some Native Americans, *Ipomoea costata* known as Australian Bush Potato is also used in small scale for nutritional purposes. *Ipomoea aquatica* is one of the richest sources of carotenoids and chlorophylls<sup>7</sup>. The leaves of *I. aquatica* contain adequate quantities of most of the essential amino acids and are comparable to conventional foodstuffs such as soybean or whole egg, indicating the potential of *I. aquatica* for utilisation as a food supplement<sup>8</sup>. Moreover the leaves of *Ipomoea aquatica* are an excellent source of bio-elements such as calcium, magnesium, iron, zinc and copper<sup>9</sup>. In Ceylon and India fleshy tender fruits of *Ipomoea turbinate* are used as vegetable. Other species consumed for nutritional purposes are *Ipomoea alba*, *Ipomoea albivenia*, *Ipomoea involucrata* and *Ipomoea leptophylla*, etc.

**Psychoactive:** Seeds of *Ipomoea tricolor* are used by Mexican tribes for their psychoactive properties under the name “Tliltliltzin”. They contain active ingredient LSA, which is also known as LA-111. By soaking the seeds in water and the consumption of the resulting emulsion hallucinogenic intoxication can be achieved<sup>4</sup>. The *Ipomoea* species known for entheogen activities are *Ipomoea tricolor*, *Ipomoea violacea* and *Ipomoea purpurea* these species are rich in ergoline derivatives (Lysergamides), ergine (LAS), isoergine, D-Lysergic acid N-( $\alpha$ -Hydroxyethyl) amide and lysergol. Lysergamides are present in seeds of *Ipomoea* species. Though most often noted as a drug, the lysergamides are also of medicinal importance. Ergonovine enhances the action of oxytocin, used to still post-partum bleeding. Ergine induces drowsiness and a relaxed state and might be useful in treating anxiety disorder. Indole diterpenes are detected in *Ipomoea asarifolia* and *Ipomoea muelleri* which are of therapeutic properties<sup>10</sup>.

**Religious Uses:** The root called “Jhon the Conqueror” in hoodoo and used in lucky and sexual charms usually seems to be from *Ipomoea jalapa*. The testicle like dried tubers are carried as an amulet and rubbed by the user to gain good luck in gambling or flirting. Seeds of *Ipomoea tricolor* commonly known as Mexican Morning glory were used by Aztecs in shamanistic and priestly divination rituals, and also as poison to give the victim a “horror trip”<sup>8</sup>.

Beach Moon Flower that is *Ipomoea violaceae* was known for its heavenly properties. Some of them were used in pre-columbian times by ancient people to attain a state of mind suitable for divination during religious ceremonies and magical healing practices<sup>11</sup>.

**As Medicinal plants:** The medicinal use of this genus is also significant. The purgative property of this genus is due to glycoresins, an important chemo-taxonomical marker present in this family<sup>12</sup>. In India the laxative properties of *Ipomoea turpethum* (Trivrit) is noted from long history. Its root and bark are purgative, cathartic and particularly useful in rheumatic and paralytic disorders. It is administered for dropsy due to kidney, heart and liver disease<sup>13</sup>. Prasarini (*Ipomoea tridentate*) is reported to promote sexual vigour, youthful glow, enhanced body strength and increase in semen, it is also used for the treatment of piles, oedema, rheumatic disorders and stiffness of the joints<sup>14</sup>. In India *Ipomoea marginata* is known as Putrajani or Putrada and is believed to be capable of bestowing a male child. It is considered as an ultimate drug to cure sterility in women in Ayurvedic system of medicine<sup>8</sup>. The tuber of *Ipomoea mauritiana* is used to produce a galactagogue drug. *Ipomoea nil* is used as a purgative and it possess hepatoprotective properties<sup>15</sup>. The leaves of *Ipomoea batatas* are used for treatment of inflammatory tumours and it also possess antihyperglycemic and antidyslipidemic potentials<sup>16</sup>. It is also reported for anticancerous activities<sup>17</sup>. *Ipomoea carnea* has been pharmacological studied by many workers and found to be useful in scorpion sting and several other diseases<sup>18</sup>. The poultice made by areal part of *Ipomoea pes-caprae* is applied to ulcerating tumours and rheumatic pains. It has shown excellent results in cnidarians poison in rat model<sup>19</sup>. Its infusion is used in digestive disorders, kidney ailments and internal pains. It has also been reported as insulinogenic, and possess hypoglycaemic activity<sup>20</sup>. The complex alkaloid found in the seeds of several members of this family has hallucinogenic properties<sup>21</sup>. *Ipomoea cairica*, possess antioxidant, anti-inflammatory, antiviral and anti-malarial properties<sup>22</sup>. *Ipomoea jalapa* and *Ipomoea simulans* is used to accelerate the passage of stool. *Ipomoea mauritiana* i.e. giant potato is one of the main ingredient of Ayurvedic preparation Chyawanprash. *Ipomoea digitata* is used for lowering blood pressure, chloesterol and Immune enhancement<sup>23,24</sup>.

**Other uses:** There are many other applications of this genus: i. As Food Additive: Species like *Ipomoea tricolor* “Heavenly Blue” flowers produce significant amount of “Peonidin”, an anthocyanidin which is useful as food additive<sup>4</sup>. ii. As fuel: The wood of weed species *Ipomoea carnea* is used locally as a source of fuel<sup>6</sup>. iii. In paper industry: *Ipomoea carnea* is used in paper industry<sup>25</sup>. iv. As cover crop: Some of the members of genus *Ipomoea* are used as cover crops, due to their luxuriant growth. For example *Ipomoea cairica*. v. As Sand binders: In sandy coast *Ipomoea pes-caprae* is used as sand binder. vi. As Herbicide: Several species of this genus possess allelopathic properties i.e. reducing growth of other plants. This property is utilised by farmers as herbicide. *Ipomoea tricolor* and *Ipomoea cairica* has shown allelopathic effect in crop weeds<sup>26,27</sup>.

## Challenges

**Nature of trade:** The present scenario shows that about 95% of traded medicinal plants are collected from wild, genus *Ipomoea*

is also not violated from this. The demand of the plant based treatments has increased a lot these days due to side effects of chemical drugs, and large scale exploitation of medicinal plants occurs to fulfil this demand. This has caused drastic disturbance on ecology, availability and sustainability of medicinal plants for future generations. At present the collections of medicinal plants are unscientific and unsustainable. Lack of agricultural practices, random harvest and post harvest management, poor processing techniques, lack of authentic germplasm, unorganized and invisible markets are other features which need proper attention to assure sustainability of medicinal plant of this genus and avail benefits of the available material.

**Role of Ayurveda:** Ayurveda is a traditional Indian system of medicine which has been direct consumer of herbs from ancient time. The popularity of Ayurvedic drugs are increasing day by day due to its advantages towards synthetic drugs. The Government of India has recently set up a "National Medicinal Plant Board" (NMPB) to meet out the challenges present in medicinal plant sector which works under Ministry of AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy). The main motive of this board is the conservation, cultivation, trade and export of medicinal plant in states, country and at International level. This will also promote the conservation of medicinal important *Ipomoea* species and their further utilization.

### Future Prospective

In recent years considerable progress has been made in pharmacological and biochemical aspects of this genus, which has confirmed the scientific basis of its pharmacological uses in folk medicine<sup>28</sup>. For example, *Ipomoea eriocarpa*, has been traditionally used in Indian medicinal system has been proved for anti-diabetic activity recently<sup>29</sup>. Anticonvulsant and sex enhancing effects of *Ipomoea hederacea* seeds extract has been conformed in recent studies<sup>30</sup>. Phytochemical basis of medicinal properties of *Ipomoea pes-tigridis* has been confirmed<sup>31</sup>. The presence of active vaso-relaxant substance has established the popular use of *Ipomoea stans*, as antispasmodic agent. The present scenario shows that some species has been studied extensively for its medicinal properties but there are still a large number of species with considerable potential to be work out. There are some species like *Ipomoea parasitica*, *Ipomoea operculata*, *Ipomoea lonchophylla*, *Ipomoea involucrata*, *Ipomoea hederacea*, *Ipomoea bahiensis* etc which has been partially studied<sup>32</sup>. Many plants of this genus such as *Ipomoea digitata*, *Ipomoea batatas*, *Ipomoea aquatica*, has been commercialised for their medicinal and nutritive aspects but there are many potential medicinal plants in this genus which has been studied only preliminary and produced good results, for example *Ipomoea cairica* as potential drug plant for Japanese Encephalitis, whose detail study is required to understand the structure and activity of bioactive components<sup>33</sup>. The successful in vitro, response should further proceed towards the advance clinical trials so that better future prospect can open for human beings.

### Conclusion

The cultivation of medicinal plant is gaining momentum in this respect genus *Ipomoea* is one of the most economical genera as most of the species are wild, grows very fast and needs very less attention. The genus is rich in many potential bioactive compounds such as alkaloids, lignans, glycolipids and phenolic compounds. Nutritional aspects of *Ipomoea* species also cannot be ignored as *Ipomoea batatas*, has high nutritional value, many species of this genus possess large tubers which are rich source of proteins and carbohydrates, hence proper cultivation of these species may provide food to many of the starving people which are rich source as nutraceuticals *i.e.* food as well as medicine. One of the important aspect which should be consider specially in case of genus *Ipomoea* is to educate the local community for cultivation and protection of different species of this genus as these species has tremendous potential. Therefore, a wide field of future research with great scientific and medicinal advantages remains possible to identify and isolate therapeutic important bioactive compounds from different species of this genus "*Ipomoea*".

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