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REVIEW ARTICLE

Medicinal importance of Genus *Atropa* Royle -A review

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Abstract

Genus *Atropa* is medicinally important as it has anticholinergic, antispasmodic, and antidote, anodyne, analgesic, hallucinogenic, Parkinsonism, encephalitis, carcinoma, and spastic dysmenorrhoea, mydriatic, narcotic and sedative. A large number of bioactive compounds have so far been isolated from *Atropa.* This emphasizes on the need for the review of literature for reporting the additional information on the medicinal importance of other species of genus *Atropa.*

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Introduction

The genus *Atropa* belonging to family Solanaceae, tribe Hyoscyameae, and consists of 4 species, ***Atropa acuminata* Royle**, ***Atropa belladonna* L.,** ***Atropa baetica* Willk**., ***Atropa pallidiflora* Schönb.-Tem**., which are distributed in the Mediterranean region, South Europe and Asia (Nasir 1972).Diverse biological activities have been attributed to this genus like anticholinergic, antispasmodic, (Tyler et al; 1988). Antidote, anodyne, analgesic, hallucinogenic, Parkinsonism, encephalitis, carcinoma, spastic dysmenorrhoea, mydriatic, narcotic and sedative its pharmacologically active ingredients include atropine, scopolamine, hyoscyamine all tropane alkaloids (Grieve and Chiej 1948).

Atropa acuminata Royle

Atropa acuminata Royle is an important medicinal plant belongs to family Solanaceae, (Anonymous, 1948). It is commonly known as Maitbrand and in Hindi it is known as Sagangur, Angurshefa. It is endemic to india and is known as indian Belladonna. It is found in the Western Himalayan ranges, extending from Kashmir at the altitude of 1800-3600m asl to the adjoining hills of the Himachal Pradesh up to 2500m asl. In North West Himalaya it is distributed in Kashmir, Muzzafarabad and Chakrata (Anonymous, 1948; Dhar and Kachroo, 1983).

Rhodes *et al*., 1978 have reported that the roots of this plant have been used as a sedative. Grieve and Chiej 1984, has reported that it is also been used as an antidote in cases of mushroom or toadstool poisoning. All parts of the plant are analgesic, antispasmodic, hallucinogenic, mydriatic, narcotic and sedative. Grieve, 1984; Castro, 1990 have reported that the extract of the plant has been used as eye drops in the past by women so as to make eyes look larger and thus more beautiful The entire plant, harvested when coming into flower, is used to make a Homeopathic remedy. This is used especially in cases where there is localized and painful inflammation that radiates heat. Chopra *et al*., 1986 have reported that the roots and leaves of *Atropa acuminata* are used in india as anodyne, diuretic, mydriatic, narcotic and sedative.

Jeffrey *et al*., 1990 measured the tropane alkaloids content in leaves of *Atropa acuminata* after mechanical damage showed a maximum increase to 153 percent of the control 8 days later the plant responded to repeated mechanical damage by doubling its alkaloid content at 11 days after the initial wounding. Bown, 1991 reported that it is used to treat sunstroke and painful menstruation.

Bashir *et al*., 1991 determined alkaloid levels in roots, leaves and stems of *Atropa acuminata* after varying degrees of mechanical damage and of larval feeding on the leaves. Khana and Harborne 1991 determined the total biomass, percentage of tropane alkaloid, total alkaloid per plant, ornithine decarboxylase activity (ODC), arginine decarboxylase (ADC) activity and putrescine levels separately in roots, stems and leaves of *Atropa acuminata* containing varying concentrations of potassium ion.

Chevalier, 1996 have reported that *Atropa acuminata* is used to dilate the pupils in eye operations, to relieve intestinal colic and to treat peptic ulcers. Also can be used to treat the symptoms of Parkinson's disease, reducing tremors and rigidity whilst improving speech and mobility. Chevalier, 1996 has also reported that all parts of this plant contain different concentrations of tropane alkaloids. The leaves contain on average 0.4% active alkaloids, whilst the root contains around 0.96%. The alkaloid content also varies according to the development of the plant, being low when the plant is flowering and very high when it is bearing green berries. These alkaloids inhibit the parasympathetic nervous system which controls involuntary body activities. This reduces saliva, gastric, intestinal and bronchial secretions, as well as the activity of the urinary tubules, bladder and intestines.

Ceha *et al*., 1997; Duncan and Collision, 2003 have reported that it is used against con- junctivitis, fever, encephalitis, muscle and joint pain, acute inflammation, pan- creatitis, peritonitis, scarlet fever. Kaul, 1997 have reported that the rhizome of *Atropa acuminata* has been traditionally used since ages for the treatment of arthritis related inflammatory disorders, muscle and joint pain, muscle spasms. Baricevic *et al*., 1999 determined a 10 fold increase in nitrogen fertilization of *Atropa acuminata* resulted in an increase in the content of hyoscyamine and of scopolamine in the whole plant and in stems, while their contents in leaves and in roots remain unchanged. Better mann *et al*., 2001 have reported that the aerial parts of this plant have been used in traditional medicine to treat innumerable ailments such as acute infections, anxiety, asthma, chicken pox.

Mehmood *et al*., 2002 have reported that *Atropa acuminata* contains tropane alkaloids and highly oxygenated triterpenes. Shanafelt *et al*., 2002 have reported that it is also used against sore throat, ulcerative colitis and whooping cough. Banerjee *et al*., 2008 reported that the DART spectrometric technique has been applied for the first time for profiling alkaloids expressed in the hairy root clone of *Atropa acuminata.* Ashtiana and sefidkonb 2011 determined the tropane alkaloid content in different parts of the wild and cultivated *Atropa acuminata* Royle. Determination of alkaloids was performed by high-performance liquid chromatography (HPLC) method.

Jayakanthi *et al*., 2011 have reported the main constituents of *Atropa acuminata* such as monoterpene, sesquiterpene, phenylpropanoid, flavonoid and quinine. Rubina *et al*., 2012 carried out studies on the phenolic content of the aqueous and ethanolic extract of *Atropa acuminata* has been found to be significant (88.8 and 59.6) microgram gallic acid equivalent per microgram extract as done by single tons procedures. Nisar and Akhtar 2013 have reported that the *Atropa acuminata* has been used in folk medicines for several inflammatory disorders such as arthritis, asthma, conjunctivitis, encephalitis, pancreatitis, peritonitis, acute infections and neuroinflammatory disorders.

Atropa Belladonna L.

Atropa belladonna commonly known as belladonna or deadly nightshade, is a perennial herbaceous plant and most important commercial source of pharmaceutical tropane alkaloids in the family of Solanaceae native to Europe, North Africa and Western Asia (Zhang *et al*., 2005).

Guggisberg and Hesse, 1983 have reported that this plant species is of interest due to its pharmaceutical tropane alkaloids, including hyoscyamine and scopolamine which are widely used as anticholinergic agents that acts on parasympathetic nervous system.Erofeev *et al*., 1991; Bisignano, *et al*., 2000 isolated anticancerous molecules from the roots of this plant such as podophyllotoxin, etoposide, teniposide, combretastatin, colchicin posses antimicrobial activities.

Drager *et al*., (1994) reported that the transformed roots of *Atropa belladonna* accumulate the tropane alkaloid hyoscyamine and the precursor's tropane-3α-ol (tropine) and tropane-3β-ol (pseudotropine).Ganchev, 1995 have reported the curative effect of the drugs isolated from roots and leaves of *A. belladonna* is due to the high alkaloid content that makes them a valuable material mainly for the production of spasmolytic medicines. Giancarlo *et al*., 2004 reported the active agents present in *belladonna* include atropine, hyoscine (scopolamine), and hyoscyamine has anticholinergic properties and in humans its anticholinergic properties causes the disruption of cognitive capacities, such as memory and learning.

Lee *et al*., 2007 reported that this plant species is a source of alkaloid atropine ($C_{17}H_{23}NO_3$, dl-hyoscyamine) which has been to be the cornerstone in the study of autonomic pharmacology. Ebadi *et al*., 2007 reported that it is used in herbal medicine for centuries as a pain reliever, muscle relaxer, and anti-inflammatory, and to treat menstrual problems, peptic ulcer disease, histaminic reaction, and motion sickness. Wilson *et al*., 2008 reported that the foliage and berries of this plant are extremely toxic, containing tropane alkaloids. These toxins include scopolamine and hyoscyamine which cause a bizarre delirium and hallucinations and are also used as pharmaceutical anticholinergic.

Mallinson T 2010; Lee MR 2007 reported that the symptoms of belladonna poisoning include dilated pupils, sensitivity to light, blurred vision, tachycardia, loss of balance, staggering, headache, rash flushing, severely dry mouth and throat, slurred speech, urinary retention, constipation, confusion, hallucinations, delirium and convulsions. Yang *et al*., 2011 reported that transgenic hairy roots of *Atropa belladonna* can be used as bioreactor to produce pharmaceutical tropane alkaloids. Taha, 2003 developed an efficient protocol for enhancement of total alkaloid production from suspension cultures of *Atropa belladonna*. Srivastava *et al*., 2012 reported three different aromatic carbonyl compound that is 3,4,5-trimethoxybenzaldehyde(1),3,4,5-trimethoxyacetophenone(2)and3,4,5-trimethoxybenzoic acid(3) from the roots of *Atropa belladonna* having anticancerous properties.

***Atropa baetica* Willk.**

Atropa baetica is a perennial plant native to central and southern Iberian Peninsula and North Africa and has been recently classified as a rare endangered species commonly known as *Belladonna Andalusian* (Hernandez *et al.*, 1994).

Tyler *et al*., 1988 reported that *Atropa baetica* contain various tropane alkaloids, including atropine *(dl-hyo*scyamine) and scopolamine, which possess anticholinergic and spasmolytic properties and they are commonly used as an anesthetic and spasmolytic and in eye surgery. Waterman, 1993 reported that the main roots of this plant constitutes the major storage site and had the highest amount of these alkaloids. These alkaloids may be transported to other plant organs providing potential deterrent and antimicrobial activities.

Zarate *et al*., 1997 reported a new compound, namely trigloylpseudotropine was identified in hairy roots of *Atropa baetica* and another compound namely 3α-isobutyryloxytropane was also identified in leaf tissue and hairy roots. Banares *et al*., 2004 reported that *Atropa baetica* is a critically endangered species, with only 25 known populations in the south and central east of the Iberian Peninsula and several more in northern Morocco and Algeria.

Vazdekis *et al*., 2008 reported that the anticholinergic agent's scopolamine and hyoscyamine are used for the treatment of motion sickness, ophthalmology, anesthesia and for cardiac and gastrointestinal diseases. Victor *et al*., 2009 reported for the first time the isolation and characterization of eight microsatellite markers from enriched libraries for the critically endangered *Atropa baetica*. These are the first microsatellite loci reported for *Atropa* species.

Atropa pallidiflora Schönb.-Tem.

The leaves of *Atropa pallidiflora* contain relatively large portions of scopolamine upto 30% of alkaloid content (Heltmann 1980). No literature is available regarding its medicinal importance.

Conclusion:

The synthesis of medicinally important biochemical compounds by *Atropa* has been established beyond doubt. The genus *Atropa* is medicinally important as it has anticholinergic, antispasmodic, and antidote, anodyne, analgesic, hallucinogenic, Parkinsonism, encephalitis, carcinoma, and spastic dysmenorrhoea, mydriatic, narcotic and sedative. This genus *Atropa* is used both in allopathic and traditional system of medicine as a remedial measure for number of ailments. Mechanisms of action of a few bioactive compounds have been identified so far. Hence, extensive research is required to find out the mechanisms of action as well as bioactivity of other compounds in crude extracts and to exploit their therapeutic potential to combat various diseases.

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