

POWER OF KNOWLEDGE

An International Multilingual Quarterly Peer Review Refereed Research Journal

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Counter muscarinic effects of Atropine derived from *Atropa belladonna*

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Abstract

Atropa belladonna, commonly known as belladonna or deadly nightshade, is a toxic perennial herbaceous plant in the nightshade family Solanaceae. It is native to Europe, North Africa, and Western Asia. Its distribution extends from Great Britain in the west to western Ukraine and the Iranian province of Gilan in the east. It is also naturalized or introduced in some parts of Canada and the United States. The foliage and berries are extremely toxic when ingested, containing tropane alkaloids. These toxins include atropine, scopolamine, and hyoscyamine, which cause delirium and hallucinations, and are also used as pharmaceutical anticholinergics. *Atropa belladonna* has unpredictable effects. The antidote for belladonna poisoning is physostigmine or pilocarpine, the same as for atropine.

Keywords: *Atropa belladonna*, atropine, muscarinic effects.

INTRODUCTION:

Atropa belladonna is classified under the family Solanaceae and grows in uncultivated barren lands. It is endemic in areas of the Mediterranean countries (including Greece), countries in western Europe, and from these areas to the Himalayas, and it has been introduced even to North America (Lee, 2007). The name of the plant comes from the Greek word "Atropos" and refers to one of the three Fates in Greek mythology, who cut the thread of life. "Belladonna" is an Italian phrase meaning "beautiful lady." This name was given to the plant because the ladies of Venice used *Atropa Belladonna* as a cosmetic (due to the mydriasis caused by its use). The plant is also known as "deadly nightshade." *Atropa belladonna* is a perennial bushy herb that grows in arid lands and quarries, reaches a height of 1.5 m, and has greenish purple flowers, oval leaves, and purple-black spherical sweet berries (Lee, 2007). All parts of the plant contain the alkaloids atropine, hyoscyamine, and scopolamine, making it poisonous and hallucinogenic (Zárate, el Jaber-Vazdekis, Medina, & Ravelo, 2006).

Atropa belladonna (Fig. 1) is a widely cultivated ornamental plant that contains neurotoxic alkaloids that act as competitive inhibitors of muscarinic acetylcholine receptors. Peripherally, *Atropa* poisoning reduces parasympathetic activation of smooth and cardiac muscle, resulting in sedation. The alkaloids in *Atropa* can cross the blood-brain barrier to act on central cholinergic synapses, causing ataxia, disorientation, short-term memory loss, coma, and death.

MATERIAL AND METHODS:

Atropa belladonna:

Scientific Name: *Atropa belladonna*

Common Names: Belladonna; Deadly nightshade

Toxins: The primary toxin atropine is present throughout the plant.

Molecular Formulas: $C_{17}H_{23}NO_3$ (atropine)



Fig. 1. *Atropa belladonna*

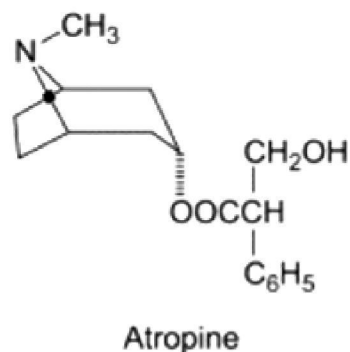


Fig. 2. Chemical formula of Atropine

HISTORICAL ASPECTS, USES, AND MISUSES:

The plant has been termed "the Mandragora of Theophrastus". It is so poisonous it was given the name "atropos", which is the Greek word for inflexible. Another meaning is that it refers to "one of three Fates who cut the thread of life".⁵ The Greek pharmacologist Dioscorides's five volume work *De Materia Medica* was the first systematic pharmacopoeia, containing objective descriptions of this species in the first century, but it wasn't "discovered" for another 1800 years. In Roman times, extracts of belladonna were used by women for the cosmetic value of the pupillary dilating effect; such use explains the origin of the common name "bella donna" (Italian for beautiful woman). There are many uses for the plant, both beneficial and harmful. The Romans contaminated the food reserves of their enemies with it. The famous Bacchanalian orgies in which women would tear off their clothes and throw themselves to waiting men could have been induced by A belladonna. The advent of Christianity stopped such rituals and then it started appearing only in the sorcerers' and witches' brews. Before surgery, a mixture of hemlock, mandrake, A belladonna, and henbane (known as "sorcerers' pomade") was applied to the skin to produce unconsciousness before operations were performed. The use of the plant for the dilatation of the pupil is still very important in the field of ophthalmology. The other active chemical agent, scopolamine was added to morphine in 1902 to produce "twilight sleep" so as to lessen the pain of childbirth. This chemical was also the infamous "truth serum" that was used in so many legal battles in the past. This "serum" may still be used in some countries for "brainwashing".

COUNTER MUSCARINIC EFFECTS OF ATROPINE:

In 1809, the active chemical was isolated and by 1819 it was classified an "alkaloid". All parts of the plant contain alkaloids (L-atropine, DL-hyoscyamine, and hyoscyne), but the

highest content is in the ripe fruit and the green leaves. These chemicals act by competitively blocking the binding of acetylcholine to the central nervous system and parasympathetic postganglionic muscarinic receptors. Atropine, a muscarinic acetylcholine receptor antagonist, is a commonly used drug to reduce mucous production during surgery. Because atropine blocks the parasympathetic action of acetylcholine, atropine may modulate the balance of parasympathetic and sympathetic activity. In jaw muscles, increased sympathetic drive decreases muscle contractility and reduces muscle spindle feedback. There is evidence for sympathetic innervation of laryngeal muscles, however, few studies have investigated the effects of changing sympathetic drive to laryngeal muscle recruitment during specific behaviors. As such we hypothesized that blocking parasympathetic activation would attenuate laryngeal muscle drive during swallow and breathing.

CONCLUSION AND FUTURE SCOPE:

Belladonna (*Atropa belladonna*) is a plant that grows from Western Europe to the Himalayas. It's also grown in the US. All parts of the plant are poisonous. Belladonna has chemicals that can alter the function of the body's nervous system and cause changes to saliva, sweat, pupil size, urination, digestive functions, and others. Belladonna can also cause increased heart rate and blood pressure. Despite known safety concerns, people use belladonna for asthma, the common cold, hemorrhoids, Parkinson disease, and many other conditions, but there is no good scientific evidence to support these uses.

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