



ATROPA BELLADONNA, DEADLY NIGHTSHADE AND ITS PECULIARITIES

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ABSTRACT

The Deadly Nightshade, *Atropa belladonna*, is a plant surrounded by myth, fear and awe. In antiquity, the Greeks and the Romans knew that it contained a deadly poison. In medieval times, it was widely used by witches, sorcerors and professional poisoners. Linnaeus later codified its remarkable properties as the genus *Atropa*, the Fate that slits the thin spun life and the species *belladonna* because of its power to dilate the pupils. In the 1830s, the pure alkaloid l-atropine was isolated from the plant. This proved to be a significant tool in the study of the autonomic nervous system leading to the identification of acetylcholine as an important neurotransmitter in mammals.

KEYWORDS

Acetylcholine, *Atropa belladonna*, murder, poisoning, quinine.

INTRODUCTION

THE PLANT. The *Atropa* genus comprises a group of four species of erect perennial herbs . They have simple typical alternate leaves and bell shaped five-

lobed flowers. The genus is widely distributed from Western Europe to the Himalayas. The best known species is *Atropa belladonna* which has erect stems up to two metres in height. The fruit is a purple-black



berry. All parts of the plant are poisonous (particularly the berries.)

NIGHTSHADE IN MYTHOLOGY

The plant was well known to the Ancient Greeks and indeed it is a strong candidate for the drug (or potion) that the sorceress Circe administered to the sailors on Odysseus' ship. This subsequently drove them mad and 'turned them into swine'! Odysseus resisted the poison by taking the antidote 'moli' which was probably either the snowdrop (*Galanthus nivalis*) or the snowflake (*Leucojum vernalis*). The Greeks realised the plant was extremely poisonous and they therefore identified it with one of the three Fates. Clotho spins the thread of human life; Lachesis measures it off and Atropa (the Inflexible) severs it.

The plant Atropa later became associated with the Greek cult of Dionysius (Bacchus to the Romans). Worshippers of these gods took wine and then dissolved in this liquid ivy, Atropa and other drugs to make a magic potion. On taking this decoction the devotees passed into a trance in which they danced with abandon and committed lewd and libidinous acts. Those initiated into the rite were promised eternal life and continued sexual potency! These Bacchanalian orgies presage those which would be carried out by the medieval witches. One problem that the Greeks faced was that initially Atropa was confused with the mandrake (*Mandragora*).⁴ Indeed they are closely related members of the Solanaceae family. Subsequently, Dioscorides recognised that Atropa was, in fact, a distinct plant and should not be used in preference to the mandrake because it was much more poisonous than the latter.

BELLADONNA

The species name for the deadly nightshade derives from the dramatic effect that the plant has on the eye and its functions. The eye occupied a central place in traditional healing, being regarded as the window to the soul. Matthiolus (Pietro Andrea Mattioli 1501–1577) was a distinguished physician practising in Sienna in Italy. Amongst other things he wrote a great commentary on the botanical works of the Greek physician Dioscorides. He also described the custom of the ladies of Venice who put Atropa into their eyes in order to dilate their pupils. As a result tincture of Atropa became known as 'belladonna' (or beautiful lady). When Linnaeus undertook his outstanding formal classification of the plant kingdom in the 1700s, he incorporated both ideas: the generic name Atropa (the cutting or deadly Fate) and the species name belladonna (an interesting conjunction).

THE ADVENT OF THE HERBALISTS

Throughout the medieval period the deadly nightshade was largely confined to the hidden world of witches, wizards and folkhealers. Then in the sixteenth and seventeenth centuries herbalists and apothecaries arrived on the scene and they embarked upon a systematic study of useful and dangerous plants. The major figures in Britain were Gerard, Culpepper and Parkinson. Gerard called the plant the lethal Solanum or Sleepy Nightshade. He recounts three cases of poisoning with the berries and instructs the readers of his Herball to banish these pernicious plants from their gardens. Otherwise, he said, women and children will lust after the shining black berries which are so beautiful. He concludes however that they are 'vile and filthie'. Eventually the plant came to be included in pharmacopoeias and dispensaries. One of the classic descriptions is that by Andrew Duncan in the Edinburgh Dispensatory of 1803. He says that Atropa can be used with benefit in the



following disorders: 1 Several febrile illnesses, particularly the plague. In nervous diseases such as palsy, apoplexy, epilepsy, chincough (whooping cough), hydrophobia, melancholy and mania. Duncan advises that the powdered leaves (or root) should be used first and if these fail then an infusion in warm water can be tried. The dose of all these preparations should be gradually increased on a day by day basis until 'tension in the throat' develops. It would then be imprudent to increase the dose further! In other words the toxic threshold had been passed. Duncan also mentions that Professor Reimarus, a Continental eye specialist, had used the infusion of Atropa to dilate the pupil in order to facilitate the removal of cataracts. This episode marks the beginning of the use of mydriatic drugs in intraocular surgery.

SOLVING THE CHEMICAL CONUNDRUM

At around the time that Duncan was compiling his dispensatory in Edinburgh, in the early 1800s, chemistry began its great leap forward with the work of Sir Humphrey Davy in London, and the activities of the French and German chemists. In particular, in Paris an assault was made on the plant kingdom and a number of important alkaloids were isolated and characterised, including quinine, morphine and strychnine. Atropine was isolated from the roots of belladonna in 1831 by Mein a German apothecary. In the plant, it occurs as the laevorotatory isomer of the compound, i.e. l-hyoscyamine, but during extraction it partially isomerises to the dextro compound. Accordingly, atropine is a racemic mixture of the two alkaloids and is properly called dl-hyoscyamine. In structure it is closely related to the alkaloid hyoscyne and in many ways their actions are similar .

MEDICAL USE OF BALLADONNA PLASTERS AND LINIMENT

From the middle of the nineteenth century to the late 1950s, belladonna was incorporated into plasters (and liniments). These could be purchased over the counter at pharmaceutical chemists; apothecaries and druggists The public had a high regard for such medications as they often saved an expensive visit to the doctor. These preparations were used in a wide variety of conditions including neuralgia, chronic rheumatism, lumbago, myalgia, pleurisy, pulmonary tuberculosis and acute mastitis. They seemed to have some analgesic and counterirritant effect and were less vicious than those plasters which incorporated the mustard plant. (*Brassica juncea* or *nigra*). Combinations with other plants were sometimes used. A famous (or infamous) example was the plaster that also included an extract of the monkshood (*Aconitum napellus*). This plant produces the deadly alkaloid, aconitine, which can cause cardiac and respiratory failure. Murderers were known to purchase this deadly plaster. They would then steep off the two alkaloids, aconitine and atropine in order to use the resulting poisonous liquid for their deadly activities.

ATROPINE POISONING

After the pure alkaloid was isolated, poisoning inevitably occurred, either deliberate or accidental. The largest collection of clinical cases ever brought together was that by Witthaus in 1911. He described a series of 682 patients (or individuals). Three hundred and seventy-nine were caused by preparations of belladonna (eye drops; plasters or liniments) and 303 by the pure alkaloid atropine. More than 500 of these poisonings were deemed to be accidental; there were also 37 suicides and 14 murders. The number of deaths reported was 60 (approximately 12%). This was of course before the days of intensive care and artificial ventilation. Since 1911, and Witthaus' classic series,



atropine poisoning has become rare. Plasters, liniments and eye drops have either become obsolete or have been banned. At the present time, it is much more difficult to obtain supplies of atropine. The drug is largely, if not entirely, confined to hospitals, pharmacies, research laboratories and drug companies. As a result, it is doctors, anaesthetists, pharmacists and research scientists who can obtain the pure alkaloid with relative ease in the course of their daily work. As we shall see in the case of Dr Agutter, described below, access to, and availability of the alkaloid, helped to determine the direction of the successful enquiry that was pursued by the police. Of course the most common type of poisoning still remains that of children, who swallow the attractive black berries of the plant, but they usually survive.

CLINICAL MANIFESTATIONS OF ATROPINE POISONING

When atropine (or Atropa) is administered in overdose (by accident or design) a peculiar conjunction of symptoms and signs results which can be summarised as follows: 'Hot as a hare, blind as a bat, dry as a bone, red as beet and mad as a hen.' When this peculiar constellation is observed, then the diagnosis becomes relatively straightforward and the only confusion tends to be with poisoning by other Solanaceae such as the henbane (*Hyoscyamus*) or the thorn apple.

CONCLUSION

The present article on the deadly nightshade brings to an end this short series on the Solanaceae in which I have examined in some detail the history and properties of the potato, the mandrake, the henbane and belladonna. There are many others in this fascinating plant family which pressed to be

considered but constraints of time and space eliminated them. Those plants that have been considered have told a compelling story that has travelled from the mists of antiquity in Peru and the Middle East, to Greece and Rome, and then onwards to medieval Europe, witchcraft and necromancy. Finally, hyoscine and atropine, in modern times, have helped to unravel the secrets of the parasympathetic division of the autonomic nervous system. In particular, these alkaloids, with the assistance of physostigmine (from the Calabar bean of West Africa), would make it possible to identify the cholinergic neurotransmitter acetylcholine. Had pure atropine and hyoscine not been available at the end of the nineteenth century this process would have taken a great deal longer.

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