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Datura stramonium L.: Old or New World?

ALAIN TOUWAIDE

Consejo Superior de Investigaciones Científicas, Centro de Estudios Históricos, 6, Duque de Medinaceli, 28014, Madrid, España

Riassunto Datura stramonium *L.: vecchio o nuovo mondo?*
In questo articolo, cerchiamo di chiarire la controversa questione dell'origine della datura (*Datura stramonium* L.): è originaria del Vecchio o del Nuovo Mondo? Seguendo la seconda ipotesi, la pianta sarebbe stata introdotta nel Vecchio Mondo dall'America dopo la scoperta del nuovo continente nel 1492. Sulla base di una rilettura critica dei testi antichi greci e latini che trattano della pianta, abbiamo dedotto che la *Datura stramonium* è stata descritta da autori come Teofrasto, Plinio, Dioscoride e Galeno, anche se, nel testo di Dioscoride, in seguito ad una sua alterazione, la pianta è stata confusa con l'*Atropa belladona*. Di conseguenza, la pianta era già conosciuta nel Vecchio Mondo e non sarebbe originaria del Nuovo. Il presente studio ha inoltre rivelato che le piante vicine alla *D. stramonium* dal punto di vista tassonomico erano considerate specie dello stesso genere e, inoltre, con simili se non identiche proprietà. Ciò suggerisce che il principio di interrelazione tra affinità tassonomica e similarità dell'attività farmacologica era nell'Antichità, se non esplicitamente già noto, perlomeno empiricamente conosciuto.

Key words: Ancient botany, Dioscorides, Galen, New World, Theophrastus, Thorn apple.

INTRODUCTION

The origin of thorn apple (*Datura stramonium* L.) is a species of mystery in the bibliography: the plant is generally considered to be native of America; but, according to certain authors, it would be Asiatic and probably also Mediterranean. In the first case, it was brought from the New to the Ancient World after the discovery of America, while, in the second, it would have been spread in the Old World at least since Antiquity.

In this paper we would like to examine this question, on the basis of a reconsideration of ancient treatises of medical botany in which the

plant could be described, i.e. Greek and Latin works dating back to Antiquity, so as to determine whether or not it is possible to trace a description of the plant. In case it would be possible, it would mean at least that thorn apple was not imported from the New to the Old World, even though it could have been "re-discovered" on the occasion of the arrival of Spanish peoples in Southern American continent.

Sources and method

The main source we shall use here is the treatise entitled "*Peri ulês iatrikês*" (*De materia medica*) by the Greek Dioscorides (1st C. AD). Complementarily, we shall quote also the "*istoria futôn*" of Theophrastus (372/370 - 288/286 BC), better known under its Latin title *Historia plantarum*, as well as the *Naturalis Historia* of the Latin Pliny the Elder (23/24 - 79 AD), and the main pharmacological treatise of Galen (129 - post 216 AD).

As for the method, it will be manifold: philological, with the lecture of the texts directly from their original language, Greek or Latin; botanical and pharmacological for the interpretation of their data; and historical, for the analysis of the tradition of the texts, with a special emphasis on the history of the book, which probably played an important role in the problem we are faced with, as we shall see.

Current state of research

The question of the origin of thorn apple (*D. stramonium* L.) is not a new one: already a century ago, the two herbal pharmacologists Friedrich A. Flückiger (1828 - 1894) and Daniel Hanbury (1825 - 1875) wrote (Flückiger-Hanbury, 1874: 413): *The question of the native country and early distribution of D. stramonium has been much discussed by botanical writers. Alphonse De Candolle (Géographie Botanique, II. [1875] 731), who has ably reviewed the arguments advanced in favour of the plant being a native respectively of Europe, America or Asia, enounces his opinion thus:- that D. stramonium L. appears to be indigenous to*

the Old World, probably the borders of the Caspian Sea or adjacent regions, but certainly not of India; that is very doubtful if it existed in Europe in the time of the ancient Roman Empire, but that it appears to have spread itself between that period and the discovery of America.

More recently, Oleg Polunin and Anthony Huxley considered, in a first publication (POLUNIN-HUXLEY, 1965: 214), that the origin of *D. stramonium* is unknown and that it was introduced accidentally in a large part of Europe, without specifying however from where and in which circumstances; moreover, they quoted a description by Theophrastus, in the *Historia plantarum*, without any precise reference. But, in a second publication, Polunin alone wrote that *D. stramonium is native of Central America and locally naturalized in vaste places* (POLUNIN, 1980: 409).

Further bibliography demonstrates an uncertainty. For example and in chronological order, the German scholar Hellmut Baumann, in his book on Greek plants in Ancient Myths, Arts and Literature, presented thorn apple as non Mediterranean, and thought it was introduced into Greece during the 16th century; simultaneously, he noted that its origin is unknown and that the plant was commonly used for magic at the end of the Middle Ages (BAUMANN, 1982: 215).

In his *Renewed Dioscorides*, the Spanish botanist Pio Font Quer (b. 1888) noted (FONT QUER, 1983: 597) (we translate into English the original Spanish, 8th edition): *It doesn't appear that Dioscorides or other authors of Antiquity knew thorn apple, because, as it was believed, it was not present in the Mediterrean regions of which they described the plants. Mattioli* (i.e. the Renaissance Italian botanist Pietro Andrea Mattioli [1501 - 1577]), *in the edition ... of 1548, says that "the plant to which the name of stramonia has been given, is now common in all the gardens"; he speaks thus of thorn apple, but, through the illustration of other editions, we can see that it did not refer to Datura stramonium we are analysing here, but to Datura metel, easy to recognise by means of its fruit ... The major part of the authors considers it native of the region of the Caspian Sea and of other Asiatic countries; other authors believe, since a while, that it came from America.*

In a brief notice, the French classicist Suzanne Amigues took into consideration the passage of Theophrastus quoted by Flückiger and

Hanbury, as well as the one of Dioscorides we shall discuss below: she considered that the latter is a copy of the former, and, at the same time, she stressed that Dioscorides' description of *D. stramonium* text ends with the characteristics of the deadly nightshade (*Atropa belladona* L.) (AMIGUES, 1990).

Finally, in a recent work, the German ethnobotanist Christian Rätsch considered that the origin of *D. stramonium* is uncertain; in his presentation of the current state of research on the question, he quoted all the origins already contemplated: the Old World, especially the Caspian Sea, proposed, according to Rätsch, by the majority of authors; the East coast of Northern America, suggested by some of them; and, finally, Eurasia for others, who believe, besides, that thorn apple was imported into Mexico after colonisation. On the question of the passages by Theophrastus and Dioscorides, Rätsch thinks that their interpretation is highly uncertain, and suggests that they deal with Nux vomica (*Strychnos nux-vomica* L.) (RÄTSCH, 1998: 209).

Between the *Pharmacographia* of Flückiger and Hanbury and the recent works we have quoted, however, classical philologists and editors or translators of Theophrastus and Dioscorides' treatises traced *Datura stramonium* in ancient texts: in 1902, Julius Berendes was the first of the post-Linnean period to identify it in Dioscorides' *De materia medica* (BERENDES, 1902: 407). Arthur Hort did the same in his English translation of Theophrastus' *Historia plantarum* (HORT, 1916: vol. 2, 478), as well as Jacques André, in his inventory of Latin plant names (ANDRE, 1956: 306; with a revised edition in ANDRE, 1985: 251), who suggested however that Dioscorides' Greek text confused the plant with *Atropa belladona* L. Similarly, in his annotated edition of Pliny's *Naturalis Historia*, book 21, the same author identified with *Datura stramonium* the plant described under the name *trychnos/strychnos* (ANDRE, 1969: 158). While John Scarborough saw without any hesitation *D. stramonium* in the *struchnos manikos* of Theophrastus (SCARBOROUGH, 1978: 367-368), Manuela García Valdés, in her recent Spanish translation of Dioscorides' *De materia medica*, thinks that the plant described under the same name by Dioscorides is more probably *Atropa belladona*, although she refers the identification as *D. stramonium* and notes that both the plants were

confused in Antiquity (GARCÍA VALDÉS, 1998: vol. 2, 56-57, note 102). As for Galen's text, Richard J. Durling proposed *D. stramonium* for the *struchnon manikon* (DURLING, 1993: 301), probably following the dictionary of Classical Greek which he referred to in the introduction of his work (DURLING, 1993: VII), that of Henry George Liddell and Robert Scott in which appears this identification (LIDDELL-SCOTT, 1968: 1657, 9th ed. with a suppl.), where the phytonyms were studied by the English historian of ancient biological sciences D'Arcy Thomson (1860 - 1948).

Strangely enough, none of these works is referred to in botanical literature and, conversely, none of the authors quoted here appears to have been aware of the historical importance of the identification, probably due, in both cases, to the separation of the fields.

THE ANCIENT TEXTS

If we come back to ancient texts and if we study them in their probable chronological order, we have to deal first with Theophrastus, *Historia plantarum*, in the 9th book of which appears the fragment quoted by Flückiger-Hanbury and taken a new by AMIGUES (1990): *Historia plantarum*, IX.11.6. It has no importance that 9th book, considered as spurious for a long time (REGENBOGEN, 1940: 1450-1452), is now believed to be a work of its own, which was probably written before the *Historia plantarum* (AMIGUES, 1988: XXXIV-XXXV; SHARPLES, 1995: 129; AMIGUES, 1999: 138). The plant under examination is that called in Greek "*struchnos manikos*", i.e. textually the *struchnos* which *provokes madness*.

As for the description of the plant (HORT, 1916: 272-273), we learn that it has a white root, long circa 45 cm, hollow; leaves like those of rocket (*Eruca sativa* L.) but larger; a fruit like a bulb of onion, but bigger and rougher, similar to the fruit of the plane-tree (*Platanus orientalis* L.). If we have to believe Theophrastus, a draught made with its root provokes the following physiological effects, according to the doses: happiness (1 drachma = 4.37 grams); madness and hallucinations (2 drachmae = 8.74 grams); continuous madness (3 drachmae =

13.11 grams); dead (4 drachmae = 17.48 grams) (on this passage, see also SCARBOROUGH, 1978: 367-368).

Dioscorides' text is more complete, even if it is not free of problems. Before examining it, we have to note that, in none of the works quoted above except that of Amigues, it has been referred to further to a personal consultation by the authors; instead, when it was quoted, it was on the basis of previous bibliography, so that the works mentioning it are, on this point, secondary literature. Moreover, we need to turn back to Dioscorides' original Greek version (WELLMANN, 1906-1914: vol. 3, 231-232), which we shall translate into English, although there are translations at disposal: a German one (BERENDES, 1902: 407-408), an English (GUNTHER, 1934: 470) and, recently, a Spanish one (GARCÍA VALDÉS, 1998: vol. 2, 56-57).

The text is the following : *... its leave is very similar to that of rocket, larger, similar to that of acanthus ... it sends out tall stalks from the same root, ten or twelve, having a length of ...; a head like the olive, rougher like the plane-tree balls, bigger and larger; a dark flower; after that, it has a grape - like fruit, round, dark - ten or twelve grapes similar to the corymbs of ivy - soft as grape; under, there is a white root, thick, hollow, circa 46.8 cm; it grows in regions of mountain, windy and similar to those in which there are plane trees.*

The root, administered in quantity of one drachma as a draught with wine, has the property of provoking hallucinations which are not unpleasant; drank in a dose of drachmae, they become crazy for three days; four drachmae may even kill. The counterpoison is melikraton (wine mixed with honey), abundantly drunk and vomited.

As for Pliny (*Naturalis Historia* 21.178; ANDRE, 1969: 120-121), his text is a summary of that by Theophrastus, not without some errors: for example, the leaves are no more compared with those of rocket (*Eruca sativa* L.), but with those of basil (*Ocimum basilicum* L.), maybe due to the similarity of both the phytonyms in Greek "*euzômon*" and "*ôkimon*", respectively (FOUCAUD-MAHE, 1974).

Finally, in Galen's main pharmacological treatise, the one better known under its Latin title *De simplicum medicamentorum temperamentis et facultatibus*, we have a brief description of a plant considered to be a species of the genre struchnos and a study of the therapeu-

tical and toxicological properties of the genre and of its species (8.19.15 = KÜHN, 1821-1833: vol. 12 145-146): *... the cultivated species ... among the other species which are not comestible, one, called alikakkabon, has an orange fruit similar to a grape for its form and its dimension, which is used in the crowns (of flowers) ... the third among them is the one which provokes madness. Of the alikakkabon ... the fruit is diuretic ... The other species are useless for internal treatment: 4 drachmae of them provokes death and less provoke madness; 1 drachma is harmless, without being useful. In external use, it treats malignant and gangrenous wounds.*

ANALYSIS OF THE TEXTS

The descriptions in our possession are mainly three: that of Theophrastus (summarised by Pliny), that of Dioscorides, even though it may be considered an extension of the previous, and that of Galen, which is quite different and deals not specifically with *struchnos manikos*, but also with the plant called *alikakkabos*, which was a species of the genre *struchnos*; although it is different to the one we are studying, this plant has to be taken into consideration, however, at least to avoid possible confusion, because its description is precise enough to suggest an identification.

In Theophrastus' description, some characteristics of the *struchnos* may suggest *D. stramonium*: the comparison of its leaves with those of rocket may suggest the sinuate-dentate leaves of thorn apple, and the comparison of the fruit with those of the plane-tree could be an evocation of the spiny ovoid capsule of *D. stramonium*. However, the effects attributed to the plant seem at first glance not realistic enough to be considered significant for an identification, so that we have no sufficient element to propose an equivalence with a plant, even if we cannot exclude the ones of the bibliography.

The text of Dioscorides is more complete, but presents a major problem as we shall see. Before analysing it, we have to verify its integrity. From a direct examination of all the oldest extant manuscripts which bear the Greek version of Dioscorides' treatise (Paris, Biblio-

thèque Nationale, *graecus* 2179, 9th/10th c.; New York, Pierpont Morgan Library, M 652, 10th c.; Athos [Mount -], "Megistê Laura", ? 75, 11th c.; El Escorial, Bibliotheca del Real Monasterio, R III 3, 11th c., and Firenze, Biblioteca Medica Laurenziana, 74.23, 14th c.), it appears that the text was well transmitted and is that of the edition by Wellmann, i.e. the one we have translated.

From a botanical point of view, it appears quite clearly that it describes two plants as already argued by Amigues (AMIGUES, 1990): in the first part, the main characteristics of the plant are the same as in Theophrastus' text (especially the fruit compared to the balls of plane-tree) and could be those of *D. stramonium*; but, in the second part, the structure of the fruit suggests without doubt the deadly nightshade (*Atropa belladona* L.), of which we recognise the typical grape-like form, the dark blue colour, and even the similarity with ivy's fruit.

The effects attributed by Dioscorides to *struchnos manikos* may not be used to distinguish these two plants, as they are close, due to the similarity of their active principle (BRUNETON, 1987: 367-375).

The suggestion made by Rätsch, that the plant described by the Ancients would not be *D. stramonium* but *Strychnos nux vomica* does not fit as it appears by the comparison of the effects of the plant described by Dioscorides and those of *S. nux-vomica*, characterised by excitation in a first time, and, furtherly and according to the doses, by paralysis, especially of the respiratory system (BELLAKHDAR, 1997: 378-380, and RÄTSCH, 1998: 482-484 for *S. nux-vomica*, to be compared to 494-496 and 208-214 of the same works, respectively, for *D. stramonium*)

Unfortunately, although other plants studied in Dioscorides' treatise are represented in the Byzantine manuscripts containing Dioscorides' text, there are no images of *struchnos manikos* to help us in our diagnosis.

Finally, in Galen's treatise, we may identify *alikakkabos* with *Physalis alkekengi* L. because of the colour and form of the fruit, which recalls that of *P. alkekengi* and which could very well have been the reason why the plant was used in the crowns of flowers (in the Antique world, ornamental flowers were used in this form, instead of

our bunches). This identification is confirmed by the description of *alikakkabos* in Dioscorides (4.71 = WELLMANN, 1906-1914: vol. 2, 229-230), where we read that its fruit, contained in a capsule like a vesicle, is orange, round and grape-shaped, and is diuretic (on this plant see RÄTSCH, 1998: 608-609, who lists *alikakkabos* among the non identified psychoactive drugs; for the physiological effects of *P. alkekengi*, see FROHNE & PFÄNDER, 1997: 212-213). As for the effects of the non therapeutical species of the genre *struchnos*, they are a re-elaboration of the data presented by Theophrastus and Dioscorides.

So far, we have no element to identify *struchnos manikos* without doubt, even though we may suppose, on the one hand, that it could be *Datura stramonium* (possibly confused with *Atropa belladona*) and, on the other hand, that it is not *Physalis alkekengi*.

The solution of the problem lies in a correct interpretation of Dioscorides' text. From a philological point of view, it appears, indeed, that, at the passage from the possible description of *Datura stramonium* to that of *Atropa belladona*, there is the expression *after that*, which manifestly indicates a change. The question is its right interpretation: the previous translators considered that it means a chronological change, i.e. that the plant described has, in a first time, a fruit like that of the plane-tree and, in a second time, like that of grapes and ivy. In our opinion the expression has to be interpreted not in this chronological sense, but in a spatial one, i.e.: after the description of the plant with a fruit like that of the plane-tree, there is another one with the fruit like grapes and ivy.

In this view, Dioscorides' text would describe two plants: in the first part, *Datura stramonium* and, in the second part, *Atropa belladona*.

That's for the fruit. As for the root and the physiological effects, they could seem, at first glance, to be those of *D. stramonium* because they are those attributed to the *struchnos manikos* by Theophrastos; but, from a closer examination, they could also correspond to those of *Atropa belladona* because of the similarity of both plants under these aspects (for the botanical description of the *D. stramonium* and *A. belladona*, see: *Flora europea*, 3, 200 & 3, 94, respectively; for their physiological effects, see BELLAKHDAR, 1997: 494-496 & 491-493, respectively).

On this point, we would have two possibilities: or, we consider that the root and the physiological effects are those of *D. stramonium*; in this case, the description of *A. belladona* would have been inserted into that of *D. stramonium*, at least partially, because it deals only with the fruit of the plant; or, we consider that the roots and physiological effects are those of *A. belladona*; in this case, the description of *D. stramonium* is incomplete, as it doesn't present, as usual in Dioscorides, the full analysis of all the parts of the plant, and the study of its properties.

History of the ancient book may be useful to shed a new light on the problem. It suggests indeed that it happened on this point of Dioscorides' text what is called an *accident*, i.e. an alteration of a copy which contained the text, and, consequently, an alteration of the text itself; for example, the loss or cut of a page, or a voluntary intervention by a user.

In the hypothesis of loss or cut of a page, a part of the text would have been lost; it would be that one from the root of *D. stramonium* to the fruit of *A. belladona*. This loss/cut would have provoked the fusion of two different chapters, so as to form the unique one we currently have. In this case, the expression "after that" would have meant that, after the cut, the text which followed was that of the next chapter; i.e.: *after that* (i.e. after this text), *there is the following one*; the second part of the sentence (*there is the following one*) is implicitly included in the expression *after that*. Consequently, the description of the root and of the physiological effects would be those of the second plant, i.e. of *A. belladona*.

In the hypothesis of a human intervention, it could be a note in the margins of a copy of Dioscorides' treatise, which indicated that, after that (i.e. after the analysis of the *struchnos manikos* = *D. stramonium*), the work dealt with another plant with a fruit similar to grapes and ivy's fruit, and with similar properties (i.e. *A. belladona*). As it is often the case, this note would have been integrated furtherly in the chapter in front of which it appeared; on the occasion of a revision of the text, the chapter dealing with the plant would have been cancelled as it seemed to be redundant. In this case (which was frequent, due to the editions of ancient texts, necessary because of their hand-written reproduction), the part of the text which begins with *after that* and deals with *A. belladona* would be an insertion into the one on *D. stramo-*

nium, and the description of the root and of the physiological effects would be those of *D. stramonium*.

If we admit this explanation, we have to conclude that Theophrastus' description of *struchnos manikos*, which manifestedly was the source of Dioscorides' first part, deals with *D. stramonium* and constitutes thus the first description of the plant as it is currently known.

Conclusion

Our archaeology of texts and book leads to suggest that, in the ancient sources at disposal, *struchnos manikos* was not *Physalis alkekengi*, but corresponded to *Datura stramonium* as it could be indicated by the description of its fruit, as well as of its effects. Due to a material accident in a copy of Dioscorides' treatise or a voluntary intervention on its text, the name has been erroneously associated with the description of a plant with similar or identical roots and physiological effects, which seems to be *Atropa belladona*.

In a historical perspective, this conclusion means that *Datura stramonium* was present in the Ancient World. Although this statement does not solve the question of the origin of the plant, it contributes at least to clarify the question: *D. stramonium* was not imported from the New to the Old World or, more precisely, it was not re-discovered in the Old World on the occasion of its importation from the New World, since it was already present in the Old World before. Nevertheless, the plant could very well have been forgotten in the Old World after Antiquity, perhaps because of its toxicity which could have provoked its elimination in daily use, and re-discovered during the Renaissance.

Although it answers our question in this paper, this conclusion is far from being the unique or the most important to which our study leads: besides showing that *Physalis alkekengi* and *Atropa belladona* were also known, it stresses, indeed, that their botanical similarity was well perceived as all the three plants were considered as species of the same genre (*struchnos*); moreover, their physiological effects were well observed and considered as similar, if not identical.

This fact suggests that the correlation between taxonomy and therapeutical properties was if not known as such, at least empirically observed from Dioscorides onwards.

But this chronology has not to be considered as a starting point; it is rather an arrival, as Dioscorides codified popular practice, just like Theophrastus before him. The fact explicitely appears in Theophrastus' *Historia plantarum*, for example: in book IX.16.8 & 17 (HORT, 1916: vol. 2, 302-309), he tells, indeed, that the use of certain medicinal plants was regulated by empirical observations made by empirical practitioners who recuperated and codified in this way previous popular experience.

In this view, the appearance, in medical treatises, of medicinal plants and, in our case, of *D. stramonium, A. belladona* and *P. alkekengi*, doesn't result from a discovery, but from a phenomenon of assimilation of folk practice into erudite medicine. In our specific case, this interpretation of history would be confirmed, in a certain sense, by the fact that *struchnos manikos* doesn't appear in the collection of medical treatises gathered, rightly or not, under the name of the *Father of Medicine*, Hippocrates (460 - between 375 and 351 BC); there is only the cultivated *struchnos*, the other(s) one(s) still being used at this epoch by healers and not by educated physicians.

Consequently, *Datura stramonium*, *Atropa belladona* and *Physalis alkekengi* could have been known in Antiquity quite before their first written record, in Theophrastus, Dioscorides and Galen; instead, their botanical description and therapeutical effects (and possibly the latter before the former) were probably observed by empirical popular tradition before codification by actual science, in an epoch which cannot be determined, but was ancient. This conclusion includes the fact that the link between proximity in botanical taxonomy and similarity of pharmacological activity was perceived.

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Summary

In this paper, we would like to contribute to the controversed question of the origin of thorn apple (*Datura stramonium* L.): is it native of the Old or of the New World? In the second hypothesis, it would have been imported from America after the discovery of the continent in 1492. We propose a renewed lecture of ancient Greek and Latin texts supposed to deal with the plant. In doing so, we reach the conclusion that *Datura stramonium* seems to have been described by classical authors like Theophrastus, Pliny, Dioscorides and Galen, even though in Dioscorides' text it has been confused with *Atropa belladona* further to an alteration of the text. Consequently, the plant was known in the Old World and is thus not native only from the New one. Notwithstanding, it could very well have been re-discovered after the arrival of Spanish people in the New World. But the conclusions of the study go far beyond as they allow to state that plants taxonomically related to *D. stramonium* were considered as species of its genre and were credited of similar, if not identical properties. This fact suggests that the principle of the interrelation between taxonomical proximity and similarity of pharmacological activity was if not discovered explicitly, at least well known empirically.

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