Iconography of the Solanaceae from Antiquity to the XVIIth Century: a Rich Source of Information on Genetic Diversity and Uses

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Abstract

The systematic study of solanaceous plant iconography has been a neglected source of information although historical records (ceramics, painted and printed images in manuscripts, and printed documents) are numerous. Many wild and domesticated solanaceous species have been associated with human culture from antiquity, as medicinal, ritual or magical herbs and/or food crops in the Old World (alkekenge, belladonna, eggplant, henbane, mandrake) and New World (capsicum pepper, datura, husk tomato, potato, tobacco, tomato). Mandrake (*Mandragora* spp.) images can be found in Egyptian sources in the second millennium BCE, and along with alkekenge (*Physalis alkekengi*) and black nightshade (*Solanum nigrum* aff.) are found in the oldest extant copy of the *Materia Medica* of Dioscorides (*Codex Vindobonensis*, Aniciae Julianae, 512 CE), as well as in many later Medieval and Renaissance sources. Images of henbane (*Hyocyamus* spp.) appears in the VIIIth century while belladonna (*Atropa belladonna*) first appears in the Renaissance. Images of eggplant (*Solanum melongena*), an Asian crop, are found in Asian and European manuscripts from the XIVth century onwards. Images of New World species are present in pre-Columbian sources, attesting to their wide use by native populations. They appear in Renaissance herbals from the mid-XVIth century onwards, displaying an astonishing diversity in terms of species and morphology.

INTRODUCTION

Iconography in the form of ceramics, embroideries, manuscripts, printed woodcuts, and painted velum or paper, often completed by textual information, is an extraordinary source of information about the beliefs and uses by ancient societies of wild and cultivated plants. It is also a remarkable testimony about horticultural features of crops of the past, including genetic and taxonomic information.

Our investigation presented here focuses on Solanaceae and roughly covers the period from antiquity to the XVIIth century, the beginning of modern botanical science. During much of this time span, Solanaceae history in Europe is linked to medicinal and magical concerns. In the New World, many plants of the Solanaceae were a vital part of everyday life and used for food, spices, medicines and rituals. The European encounter with the plethora of new solanaceous species from the New World and other continents during the Age of Exploration raised as much fear as curiosity because of the very special status nightshades had in the Old World.

This paper is a preliminary survey of the information recently gathered from visits to several libraries and museums in France, Germany, the UK and the USA, from several library web sites, and from various books and papers. The paintings from Antiquity and Medieval manuscripts we have used are mainly those derived from Dioscorides (20–70 CE), Apuleius Platonicus (IVth century), Ibn Butlan (XIth century) and Matthaeus Platearius (XIIth century). We have also used paintings, printed woodcuts and associated texts from Renaissance herbals, in particular those of G. Oellinger (1487–1557), L. Fuchs

(1501–1566), P.A. Matthioli (1501–1577), J. Dalechamps (1513–1588), R. Dodoens (1517–1585), U. Aldrovandi (1522–1605), A. Lonicer (1528–1586), C. Durante (1529–1590), Ch. de l'Ecluse (1526–1609), M. de Lobel (1538–1616), G. Bauhin (1560–1624), J. Gerarde (1545–1612), B. Besler (1561–1619), J. Parkinson (1567–1629) and T. Zuingeri (1658–1724). We have also included some pre- and post-Columbian objects and drawings found in codices and books of the Americas.

This review will cover wild species as well as cultivated plants. We will first investigate the iconography from Old World Solanaceae (mandrake, henbane, belladonna and eggplant), turn to *Physalis* found in both the Old and New World, and lastly to New World species: datura, and then tobacco, capsicum pepper, tomato and potato, which developed rapidly worldwide as extremely important agricultural crops.

OLD WORLD SOLANACEAE

Mandrake (*Mandragora* spp.)

Very old iconographic documents are available for mandrake. A number of images from ancient Egypt have been assembled by Manniche (1989), in particular mandrake carved on an ivory casket of Tutankhamun from the eighteenth dynasty, about 1323 BCE (Fig. 1). Mandrake is present in two paintings of the frontispiece of the earliest surviving illustrated manuscript of Dioscorides' *De Materia Medica* completed in 512 CE known as the *Aniciae Julianae Codex* conserved at the National Library of Vienna. In the first image (Fig. 2A), Dioscorides, a Greek army physician of the Ist century CE, receives a mandrake in human form to which is attached a dead dog from the nymph Euresis (Discovery). In the second panel (Fig. 2B), the nymph Epinoia (an incarnation of thought and intelligence) holds up the mandrake to Dioscorides sitting at her left with a book, while to her right Krateus (rhizotomist, physician and famed herbal illustrator of Mithridates VI, Eupator, 120–63 BCE, King of Pontus), paints the portrait of the plant. Krateus and Dioscorides were not contemporaries, but their juxtaposition together with Euresis, Epinoia and mandrake has a strong symbolic value interweaving medicine, knowledge, botany and art.

These images testify to the early (and frequent) anthropomorphization of mandrake (the hairy bifurcate root suggests human legs and rosette leaves suggest a crowned head) as well as superstition about its harvest. During the Middle Ages male and female forms were distinguished (corresponding respectively to *Mandragora officinalis* and *M. autumnalis*), such as those represented in a XIXth-century herbal (Fig. 3). The frequent presence of a dog in mandrake illustrations is explained by the belief that the plant emitted a fatal shriek when ripped from the soil. Therefore, it was harvested by being tied to a starving dog, who when thrown some scraps, would rip it out, causing the demise of the dog but saving the attendant with muffled ears. This event is still illustrated in countless later Medieval illustrations, such as in a XVth-century *Tacuinum Sanitatis* (Fig. 4A) and can be found as late as 1685 in a Turkish manuscript, *Qazwînî (al)'adjâ'ibm khlûqât* (Fig. 4B). Renaissance illustrations of mandrake such as those of Fuchs (1543, folio 299; unpubl. *Codex 11 121*, 2(2) p.531, 533), Oellinger (1553, folio 595) and Besler (1613, Tafel 126) are less fanciful but often continue to suggest human figures.

Mandrake was widely used in the past for various medicinal properties (narcotic, anti-inflammatory, disinfectant, anesthetic and aphrodisiac) due to its content of alkaloids such as hyoscyamine, hyoscine (scopolamine) and atropine (Evans, 1979). Used in stronger dosages and blended with other plants, mandrake was also used for black magic, the dark side of botany and medicine. The round gold-colored berries of the plant, quite similar to those of the early introduced forms of eggplant and tomato, are the origin of the suspicions of Renaissance herbalists towards these foreign crop species.

Henbane (*Hyocyamus* spp.)

There are several species of henbane, including the so-called black (*Hyocyamus*

niger), white (*H. albus*) and yellow (*H. aureus*). Early illustrations are located in a Dioscoridean manuscript of the end of the VIIIth century (Grec. 2179, folio 100) representing three sketchy flowering plants. Later Medieval illustrations show plants with various stylized inflorescences of white, yellow or dark flowers, and with dentate leaves. One of the first botanically accurate paintings of henbane is found in Fuchs: *H. niger* (1543, folio 477; Fig. 5), *H. albus* (unpubl. *Codex 11 125* 3(3), p.181) and *H. aureus* (unpubl. *Codex 11 125*, 3(3) p.179). Shortly afterwards, the newly introduced *Nicotiana rustica* was confused with yellow henbane by several Renaissance botanists such as Dodoens (1553), Lobel (1576a) and Lonicer (1587).

According to Matthioli (1579 and 1605), one of the names of henbane, *Altercum*, derives from the talkative and aggressive behavior the plant induced. Black and yellow henbanes were considered quite dangerous. White henbane was preferred for medicinal use, based on its narcotic, anti-inflammatory and disinfectant effects due to the presence of hyoscyamine and hyoscine. As was mandrake, henbane was used for magical purposes, and dark legends are associated with this plant including Ulysses' crew being changed into swine after imbibing a henbane-laced beverage offered by Circe (Hansen, 1978) or Hamlet's father killed by a henbane-based poison dropped into his ear referred to in Shakespeare's most famous drama.

Belladonna (*Atropa belladonna*) and Other Old World Nightshades

The earliest image of belladonna found so far belongs to the precious *Horae ad Usum Romanum* (Grandes Heures d'Anne de Bretagne) dated ca. 1503–1508, which blends botanical accuracy and artistic licence (Fig. 6). Later colored images by Fuchs (1543, folio 395), Oellinger (1553, folio 346) and Aldrovandi (second half of the XVIth century, vol.5–2, folio 195) are more accurate botanically. Woodcuts are common in other printed herbals since the plant was commonly used in medicine for its anti-inflammatory and sedative effects. Among the many names for belladonna, *Solanum lethale* and *S. furiosum* attest to the plant's potentially strong effects, due to the presence of hyoscyamine, hyoscine, apotropine and belladonnine. Belladonna was also used in witchcraft.

The origin of the word *belladonna* is controversial. One explanation is based on the juice being used as eye drops provoking pupil enlargement, giving ladies a large, staring, dreamy and hypnotic gaze assumed to be attractive to men. The modern generic name, *Atropa*, refers to the Greek fate Atropos who severed the thread of life. Linnaeus captured both concepts in the name *Atropa belladonna*.

Images of several other Old World nightshades are found in the herbals, where they were often treated in a common section with a confusing nomenclature. Other noxious species are found in this group such as *Scopolia* spp. and *Withania* spp. as well as more harmless ones, such as *Solanum nigrum* (beautiful paintings of these two latter species are found in the *Aniciae Julianae Codex*, folios 386 and 292v), *Solanum dulcamara* and African eggplants (*S. aethiopicum* and *S. macrocarpon*). *Physalis* is treated together with all those nightshades species in the herbals, but we treat it separately here, given its wider geographical origin.

Eggplant (*Solanum melongena*)

Eggplant, indigenous to Indochina and early cultivated in India and China, migrated to the Mediterranean Basin along with Moslem conquests and probably reached Spain in the VIIIth century and the rest of Europe soon after. A XIVth-century drawing from China indicates roundish and possibly white fruits (Fig. 7). Eggplant images appear at about the same period in European Medieval herbals, generally with globose, medium-sized fruits of violet, brownish, or whitish colour. Eggplant is included in several illustrated XVth-century manuscripts with the text (in French or Latin) derived from the XIIth-century *De simplici medicina* of Mattheus Platearius. One shows globular purple fruit very similar to current types but the image suggests also putative aphrodisiac effects (Fig. 8); another is quite fanciful representing an eggplant tree (NAL 1673, folio 25v). In

Renaissance herbals, new fruit types appear including pyriform (Aldrovandi, second half of the XVIth century, vol.1–1 folio 53), egg-shaped (Fuchs, 1543, folio 300), or elongated (Dalechamps, 1653), but most of the woodcuts of this period are very sketchy and repetitive from one herbal to another. Eggplant is also found in late Renaissance and Baroque paintings. In the frescoes of the ceilings of the Loggia of Cupid and Psyche of the Villa Farnesina, painted by Giovanni da Udina, a member of the workshop of Raphael Sanzio between 1515 and 1518 (Caneva, 1992), there are 31 pyriform to globose fruits; immature ones range from light violet to purple, many showing a white ground color while mature ones are yellow. Eggplant is included in the portrait composed of fruits called "Summer" of G. Archimboldi (1573).

The Latin vocable *Mala insana* (or *Malum insanum*) was applied as soon as the XVth century for naming eggplant (probably because of the resemblance of its berries to those of mandrake and hence to the suspicion that ensued). This deprecating term was later on adapted in several European languages: *Mad apple* (English), *Doll öpffel* (German) and *Pommes de rage* (French). However, eggplant was also called *Poma amoris* or *Amoris Poma* (Latin), *Love apple* (English), *Pommes d'amour* (French) and *Pomi d'amore* (Italian)—a name that this species shared for a time with tomato. These opposite appellations, *Mad apple* and *Love apple*, well represent the contradictory opinions about this fruit.

As is true of almost all vegetables, eggplants had medicinal, culinary and even ornamental uses. In India eggplants were, and still are, widely used for medicinal purposes, but both Fuchs (1543) and Dalechamps (1653) concur about the poor use of this plant in European medicine. By the XVIIth century, eggplant was a favorite food of Mediterranean cuisines.

OLD AND NEW WORLD PHYSALIS

Alkekenge (*Physalis alkekengi*)

The Old World species *Physalis alkekengi*, with its bright orange-red calyx, is beautifully painted in color in the VIth-century *Julianae Aniciae Codex* (Fig. 9). Images in later Medieval herbals written in French or Latin, although diverse, are approximately faithful in morphology (e.g., leaf implantation varies from verticillate to alternate), and some show distortions such as transparent, yellow, spindle-shaped calices, each containing two small fruits in an VIIIth-century Dioscoridian herbal (Grec. 2179, folio 102) or fruits mistakenly placed at the end of each branch in an Arabic copy of Dioscorides dated XIIth–XIIIth centuries (Arabe 2850, folio 16v). In Renaissance herbals, *P. alkekengi* is often represented next to another species with inflated structures, the balloon vine (*Cardiospermum* sp.), which several herbalists took for a *Physalis* sp. (Dodoens, 1557; Fuchs unpubl. *Codex 11 124*, 3(2) p.395; Matthioli, 1579 and 1605; Lonicer, 1587; Aldrovandi, second half of the XVIth century, vol. 2, folio 173; and Besler, 1613, Tafel 304 left and middle drawings); this attests to the frequent confusion between species in those times. In Europe, *P. alkekengi* was used mostly for curing urinary disorders. According to Evans (1979) the plants contain a range of tropane alkaloids, but not the dangerous hyoscyamine or hyoscine. *Physalis alkekengi* did not suffer the dangerous reputation of other Old World nightshades, although it was given the name *Teufel Kirsen* or *devil's cherry*, possibly because of the bright red color of its calyx.

Husk tomato (*Physalis* spp.)

New World *Physalis* spp., used as food or medicine (in particular for curing urinary disorders) depending on the species, were part of Aztec culture as attested by their many local names (*Coztomatl*, *Xaltomatl*, *Tepetomatl*, *Miltomates*, *Tomates*, *Coyotomatl* and *Coyototomatl*). The same suffix *tomatl* or the words *Miltomates* or *Tomates* were also used for designating tomato, thus suggesting some confusion between these two juicy-berried species. The earliest New World illustration located so far is a post-Columbian drawing of *P. philadelphica* in Hernandez (1651). The first representations of husk

tomatoes in Europe appear during the second half of the XVIth century. A putative *P. philadelphica* (Fig. 10) is found in Aldrovandi (second half of the XVIth century, vol.2, folio 318) and another species, identified as *P. angulata* by Hedrick (1919) is located in Besler (1613, Tafel 304, right side drawing).

NEW WORLD SOLANACEAE

Datura (*Datura* spp.)

Daturas originated in Mesoamerica. There has been a long controversy about the geographical origin of some *Datura* species, in particular *D. metel* and *D. ferox*, which were believed to be of Asian origin, until Symon and Haegi (1991) demonstrated their New World origin. According to these authors, the misuse of ancient Hindu (*Datura*) and Arabic *(metel)* for naming these American plants perpetuated the uncertainty about their origin.

The scarcity of datura images in Medieval manuscripts of the Bibliothèque Nationale de France (BNF) is a side indication of the absence of this plant in Europe in those early times: we found only one painted plant in an VIIIth-century manuscript (Grec. 2179, folio 103) that does not look like a datura, and the other image is located in a XIVth-century manuscript (Arabe 2771, folio 264), which we have not seen.

The earliest iconographic traces of daturas are from the New World. Spindle whorls from Columbia, dated 500–1000 CE, reproduce geometrical features of datura flowers according to McMeekin (1992). In the *Codex Barberini*, also known as the Badianus manuscript (Aztec herbal, dated 1552) there are three colored plates. Plate 20 (plant on the left side) is identified as *Datura arborea* by Walcott Emmart (1940), but Symon and Haegi (1991) suggest it is a *Solanum* sp. Plate 41 (right side plant) is identified as *D. inoxia* or *D. stramonium* by Symon and Haegi. The two plants of Plate 49 (Fig. 11) are identified as *D. meteloides* by Walcott Emmart (left side drawing) and *D. ceratocaula* by Symon and Haegi (right side drawing). In another Aztec document, the *Florentine Codex* dated 1540–1585 (Dibble and Anderson, 1963; Estrada-Lugo, 1989), daturas are present in several illustrations: Fig. 12 shows a datura plant next to a person applying an ointment to the back of a prostrate patient.

Daturas are often represented in Renaissance herbals, although the botanical identification of the illustrations is speculative, given the insufficiency of details and the often cryptic texts. It is probably *Datura metel* that is found in Oellinger (1553, folio 335), Fuchs (1543, folio 396; and unpubl. *Codex 11 122*, 2(3) p.153), and Aldrovandi (second half of the XVIth century, vol.2, folio 171). *Datura inoxia* (also named *D. meteloides*) is possibly illustrated in Besler (1613, Tafel 342), while *D. stramonium* (the common name in the USA is Jimson weed) occurs in Fuchs (unpubl. *Codex 11 122*, 2(3) p.155), Aldrovandi (vol. 2, folio 311), Dodoens (1608), Besler (1613, Tafel 343) and Parkinson (1656, drawing 4).

The indigenous inhabitants from America used *Datura* species as hallucinogens for various rituals and as medicine. In European herbals, daturas were allocated several medicinal properties such as being an anti-inflammatory and for relief of asthma (atropine has a paralyzing action and thus relieves bronchial spasms).

Tobacco (*Nicotiana* spp.)

When Europeans reached the New World, tobacco was in common use by natives in most areas (North, Central and South America) and nearby islands by smoking, chewing, snuffing and for medicinal and possible hallucinogenic purposes in a complex system of rituals (Prescott, 1843; Hedrick, 1919; Heiser, 1969). Fig. 13, taken from book 11 of the *Florentine Codex* dated 1540–1585 (Dibble and Anderson, 1963) illustrates the plant and its preparation by grinding (drawing 512), as well as its use for attacking a snake called *tecutlacoçauhqui* with tobacco powder (drawing 247).

From the early tobacco images, it appears that coarse tobacco (*Nicotiana rustica*) and sweet tobacco (*N. tabacum*) were introduced at about the same time in Europe. In

Dodoens (1553), there is a drawing in the section allocated to *Hyoscyamus* entitled *Hyoscyamus luteus* that resembles *Nicotiana rustica* (tobacco was later still often confused with henbane) and that could be one of the first (if not the first) images of tobacco in Europe. In the unpublished Fuchs work, one finds two illustrations of *N. tabacum* [*Codex 11 123*, 3(1) p.257 and p.259 (Fig. 14A)] and three illustrations of *N. rustica* [*Codex 11 123*, 3(1) p.261, p.263 and p.265 (Fig. 14B)]. Tobacco images are found under various names in many later documents such as in Lobel, 1576 a, b; Gerarde (1597), Dodoens (1608), Besler (1613), Neandrum (1626) and Parkinson (1635 and 1656, 1640).

The name *Nicotiana* honors Jean Nicot de Villemain, France's ambassador to Portugal, who sent *N. rustica* plants and snuff to Queen Catherine de Medicis for use at the French Court in 1560 and 1561. The monk A. Thevet who, according to Heiser (1969) and Vigié and Vigié (1989), was responsible for the introduction of *N. tabacum* from Brazil in 1557, was not to be remembered for posterity for this plant. The term *tobacco is* derived from *tabaco*, a Spanish word that, according to B. de Las Casas (1552) has its origin in the Arawakan language, particularly in the Taino language of the Caribbean, and referred to the rolling of the leaves. *Tabaco* could also have designated a Y-shaped tube used for inhaling smoke (G.F. de Oviedo y Valdès, quoted by Ernst, 1889).

In Europe, tobacco was taken at once as a panacea, cleaning away all secretions and healing inner and outer ailments (Parkinson, 1640; Vigié and Vigié, 1989). The Indian fumitory and snuffing uses were quickly picked up by the Europeans and tobacco was soon to become a nasty habit worldwide.

Capsicum Peppers (*Capsicum* spp.)

There is archeological evidence for consumption of capsicum peppers 9000 years ago with cultivation by 2500 BCE in northern Peru (Roberts, 2001). They were very common in Mexico at the time of the conquest, as attested by reports from several European travellers and by the many local names specifying the various pepper types. Capsicum peppers were the principle, perhaps the only spice in pre-Columbian America, and were also used for rituals and medicinal purposes. Fig. 15, from the *Codex Mendoza* (1542), represents a child exposed to the smoke of burning peppers either in an initiation rite or as a therapeutic practice.

The first European illustration found of pepper (Fig. 16) is located in the *Codex Amphibiorum* dated ca. 1540, which shows a plant with conical and pendant fruits, either green (immature) or dark colored (mature). A detached, longitudinally cut fruit shows the inner structure with whitish seeds, and an adjacent sketch of a man bringing the fruit to his mouth carries the message of edibility.

In the latter half of the XVIth century, a great variety of peppers were illustrated in the herbals, mostly *Capsicum annuum* with elongated, oblong, or roundish smooth or shrivelled fruits, either green, brown, yellow or red. This fruit diversity was represented by the artists either on separate plants as in Oellinger (1553, folios 289 and 454) or, to save space, various types of fruits were shown on a single plant (Aldrovandi, second half of the XVIth century, folio 48). In Besler (1613), 16 different pepper types with small fruits are displayed. The largest fruits found in Lobel (1576b) and on the doors of the Pisa cathedral (dated 1601) are still much smaller than some of the modern bell pepper types.

Other *Capsicum* species found in the Renaissance herbals include putative *C. chinense* with the typical calyx constriction (Fuchs, 1543, plate 420; Oellinger, 1553, folio 64); *C. baccatum* with yellow-spotted flowers (Besler, 1613, Tafel 327 right side), and possibly *C. pubescens* (Lobel 1576b) with small erect dehiscent fruits and clearly veined leaves—although stronger diagnostic traits of this species such as black seeds and violet flowers are not specified on the woodcut or in the attached text. Although the frequent inaccuracies of the illustrations require conservatism in regard to definitive identifications, it is clear that many images do not represent *C. annuum*.

Because of their fiery taste (mentioned in most herbals) capsicum peppers were immediately associated by herbalists with Asian black peppers (*Piper indicum* and

P. nigrum) and were given the same vernacular name of pepper by Columbus. They were later referred to as "red" pepper to distinguish them from the black pepper of India. Thanks to this safe botanical association, they escaped suspicious comments from herbalists. Capsicum peppers had some early medicinal uses in the West but rapidly became a popular condiment as attested by Dodoens (1557) who noted their use for giving taste and color to meats.

Renaissance iconography indicates that the first pepper introductions to Europe had small to medium-sized, pendant or semi-erect fruit, mostly red at maturity (a few brown or yellow), and the texts suggest that they were all pungent. The non-pungent (sweet), large-fruited types were not introduced at this time from Mexico, and perhaps these types did not exist and were created by later selection.

Tomato (*Solanum lycopersicum = Lycopersicon esculentum*)

The earliest objects linked to tomato could be decorated spindle whorls from Columbia (Fig. 17), dated 500–1000 CE, which suggest tomato flower morphology according to McMeekin (1992); however this interpretation is controversial. Although tomato was common in Mexico at the time of the conquest, New World images were not found. Because the conquest of the Aztec empire occurred in 1521, the first European images of tomato appear later than other New World plants such as *Cucurbita pepo* depicted as early as 1503–1508 (Paris et al., 2006) or maize in 1515–1518 (Janick and Caneva, 2005). The first mention of tomato (unfortunately without any drawing) in European herbals is found in a chapter on mandrake by P.A. Matthioli (1544). Shortly after, there was a sudden spurt of contemporary images (the chronology of which is difficult to unravel) from Dodoens (1553) and from three unpublished herbals (*De Stirpium Historia Commentarii illustres*, etc. of Fuchs - *Codex 11 122*, 2(3) p.161 dated between 1549 and 1556; *Magnarum medicine partium herbariae* of Oellinger, 1553, folios 541, 543 and 545, and *Historia Plantarum* of Gessner, folio 42r, dated 1553). Fig. 18 displays the images of Dodoens and Fuchs. These illustrations, as later ones (Dodoens, 1574; Durante, 1585; Matthioli, 1586; Zuingeri, 1696; Besler, 1613), testify to the great diversity of fruits types when tomato was introduced in Europe: whitish, yellowish, orange, and red, sometimes small and round, but more frequently large and ribbed.

The names *tomate* (Spanish, French) and *tomato* (English) derive from the suffix *tomatl* or the words *tomates* or *miltomates* in the Nahuatl language, which were also used by ancient Mexicans for designating *Physalis* species (see *Physalis* section above), which, as does the tomato, produce globose juicy berries. In XVIth century Europe, there were many names for tomato such as *Solanum pomiferum*, *Pomum amoris* and *Lycopersicum* (Latin), *Golden Apples* (this name indicates that many of the early tomatoes introduced were yellow) and *Love apples*, both translated in other European languages. According to Miller (1731), the genus name kept by the botanists, *Lycopersicon* (also spelled *Lycopersicum)*, which means wolf (*lykos)* peach (*persikon*), was first used by the Greek physician Galen (131–200) for designating a plant from Egypt whose sap was malodorous (tomato also has a malodorous sap). Current modern taxonomy is bringing tomato back to the genus *Solanum* (Spooner et al., 1993), but there is resistance to this change among tomato investigators largely because the binomial *Lycopersicon esculentum* is so well ingrained in the literature. Though tomato was looked on with some suspicion in view of the European antipathy toward nightshades, it was consumed from the beginning of its presence in Europe.

Potato (*Solanum tuberosum*)

The ultimate home of potato and its domestication would be southern Peru or possibly also northern Bolivia. The crop was certainly throughout the Andes long before the Inca Empire. According to Humboldt (Hedrick, 1919), potato was cultivated in all temperate regions of Chile to Columbia ("New Granada") at the time of the conquest, but not in Mexico. Many ceramic vessels (Fig. 19) and images from pre-Columbian

civilizations located in Peru, dated first to VIth century CE, are based on the potato tuber, which was associated with the worship of *Axomama*, mother of potato, one of the deities of their pantheon (Rousselle-Bourgeois and Spire, 2003).

The Flemish botanist, Charles de l'Ecluse (his name was latinized to Clusius), was a pivotal figure in the diffusion of the potato to the gardens of various European botanists. In 1588, he received two potato tubers as well as a fruit from Philippe de Sivry, governor of Mons (Belgium), who had received them from an acquaintance of the Pope's local representative. The next year he received a watercolor supposedly brought from South America but labelled with the Italian names *Taratoufli* and *Papas peruänum Petri circae*. This painting is the oldest known European image of potato, now located in the Plantin-Moretus Museum in Antwerp, Belgium. Clusius published a description of potato in Latin as well as a drawing of its aerial parts, roots and tubers in his 1601 *Rariorum plantarum Historia* (Fig. 20). However, the Englishman John Gerarde was earlier, and published a description and a drawing in his *Herball* of 1597. He is the one who named potato "Battata Virginiana" and "Potatoes of Virginia," thus producing the first confusion between potato (Indian name *Papas*) and sweet potato (Indian *Battatas*, *Ipomea batatas* in Latin). Bauhin allocated the name *Solanum tuberosum* to potato in his *Phytopinax* (1596). A painted image of potato is found in Besler (1613, Tafel 345); later drawings in printed herbals do not provide new information.

Because the conquest of the Inca Empire by Francisco Pizzaro occurred in 1531–1536, potato entered the medico-botanical manuals later than tomato and pepper and thus its early iconography is rather scarce. With the exception of Gerarde's mention of the fear of leprosy by some people, and the comparison of potato fruits to those of mandrake by Clusius (1601), little suspicion is noted towards potato in the early herbals and in fact Gerarde (1597) mentioned its culinary uses in 1597.

DISCUSSION AND CONCLUSIONS

Solanaceous plants are present in Old World iconographic sources dating back to pharaonic Egypt (Fig. 1) and early Byzantine times (Figs. 2 and 3) attesting to the long involvement of mandrake, alkekengi, *Withania* spp. and *Solanum nigrum* with humankind. Henbane, although referred to in ancient texts, was first found illustrated only in the VIIIth century, while the first illustration found for belladonna dates to the beginning of the XVIth century (Fig. 6). European images of eggplant, an Asian food and medicinal species, appear in Europe only during the XIVth century (Fig. 8), revealing globose, medium or large, violet or whitish fruits, while one Chinese drawing of this period shows roundish and possibly white fruits (Fig. 7). In the New World, pre-Columbian iconography begins in the first millennium CE and includes datura (Figs. 11 and 12), tobacco (Fig. 13), pepper (Fig. 15), perhaps tomato (Fig. 17) and potato (Fig. 19), indicating the presence of these species in the native people's life as food as well as medicinal and ritual plants. However, little information can be taken from those sources in regard to genetic diversity. Several other and less known Old and New World solanaceous plants are found in the iconography of the period, but are not included here.

Scientific interest in plants was renewed suddenly at the time of discoveries in the Age of Exploration attested by the high number of European herbalists during the Renaissance. The invention of printing in the late XVth century facilitated the transmission of this new information on plants via commercially viable herbals, essential for physicians. The herbalists compiled ancient knowledge fused with new observations and new plants. These events contributed to the re-emergence of the science of botany. The Old World and New World Solanaceae played an important role in these events. The beautiful painted drawings by Fuchs (1542, 1543, and unpubl. codex dated 1542–1565), Oellinger (1553), Gessner (before 1565), Aldrovandi (second half of the XVIth century), B. Besler (1613), or the more modest black and white woodcuts of P. Matthioli, J. Dalechamps, R. Dodoens, A. Lonicer, C. Durante, Ch. de l'Ecluse, M. de Lobel, G. Bauhin, J. Gerarde, J. Parkinson, T. Zuingeri and other herbalists, are a rich source of botanical and horticultural information, even if botanical accuracy of the illustrations does

not always allow the identification of the plants at the species level. Renaissance iconography indicates the arrival about mid-XVIth century of three species of daturas (*Datura. metel*, *D. inoxia* and *D. stramonium*), of two tobacco species (*N. rustica* and *N. tabacum*), of several species of capsicum peppers (*Capsicum annuum, C. chinense, C. baccatum, C. pubescens*) and of tomato. Husk tomatoes appear a bit later in herbals during the second half of the XVIth century. Potato, originating from later conquered places, entered the herbals only at the very end of the XVIth century. Herbalists encountered great difficulties for identifying and classifying properly the new species (for example tomato was at first taken for a kind of mandrake, tobacco was often confused with henbane, and potato confused with sweet potato). Their problems were exacerbated by the absence of any reliable plant identification and nomenclature system, which awaited the innovative developments of Linnaeus in 1735. However, the images transmit a tremendous amount of horticultural information such as the dominant globose, violet, and mid-sized eggplant type in Middle Age and Renaissance times; the small size of capsicum peppers whose shapes and colors were astonishingly diverse at the time of their introduction in Europe; and the various tomato types, including yellow colors (explaining the name *gold apple* or its various synonyms) and variability in fruit size and fruit shape including ribbing but excluding elongated shapes.

The powerful physiological and psychic effects of many Solanaceae species are due to their content of tropane alkaloids such as hyoscyamine, hyoscine and atropine. Thus their uses in the past varied from benevolent (medicinal) to malevolent (hallucinogens, paralytics and even lethal poisons) depending on species, plant parts used, dose, recipe and mixtures. These properties were known since Antiquity for Old World Solanaceae (mandrake, henbane, belladonna, alkekengi and other less known species) as evidenced by the term "nightshades" (*Nachtschatten* in German), which also can be assigned appropriately to a number of New World plants, particularly datura and tobacco. However, these malevolent properties were also attributed, first and in various degrees, to eggplant, tomato and potato, although these species were commonly consumed in their countries of origin. Capsicum peppers escaped suspicion because of their fiery taste, which was immediately compared to that of black pepper, the precious spice. The amazing paradox is that tobacco, which was widely cultivated in various parts of the Americas, was first attributed as a panacea in Europe, although it is truly a malevolent species whose disastrous effects have only recently been appreciated fully.

This preliminary investigation on the iconography of solanaceous plants needs to be continued and expanded, notably by a more detailed analysis of pre-Columbian documents and by the input of specialists of the various solanaceous genera involved. Furthermore, herbals that we have not investigated need to be explored such as those by H. Bock (1498–1554), V. Cordus (1515–1544), A. Cesalpino (1519–1603), J. Camerarius (1545–1607) and J. Theodorus (1520–1590). Another rich field worthy of further study is the world of Renaissance paintings. The images gathered so far have been assembled into a database (http://www.hort.purdue.edu/newcrop/iconography/default.html) that Solanaceae scientists, historians and art specialists are invited to consult (see Janick et al., 2007, in this volume). We hope that this database will be enlarged progressively by contributions from workers in these fields.

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Figures

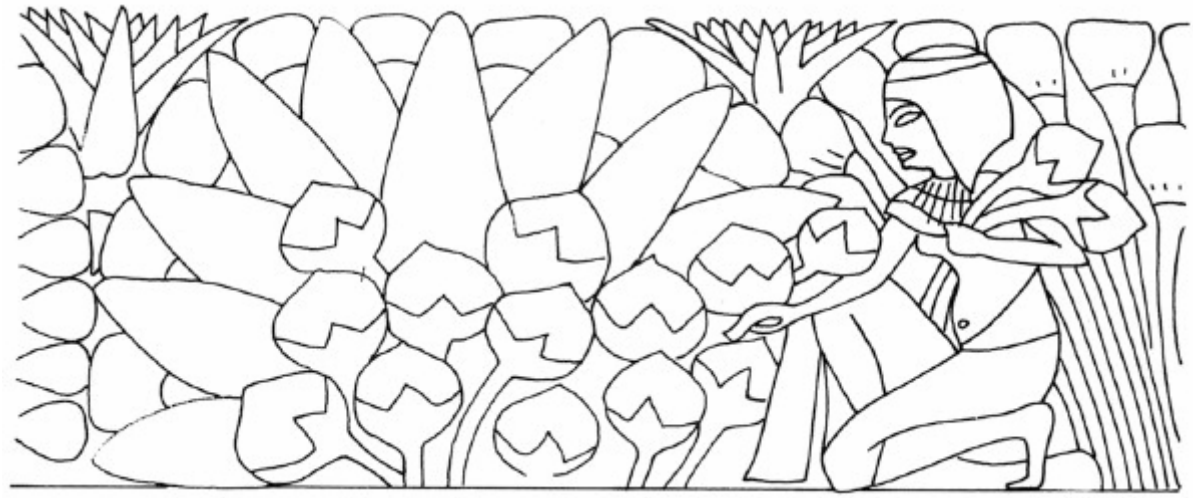

Fig. 1. Harvesting mandrake fruits from ivory casket of Tutankhamun, eighteenth dynasty (Manniche, 1989).

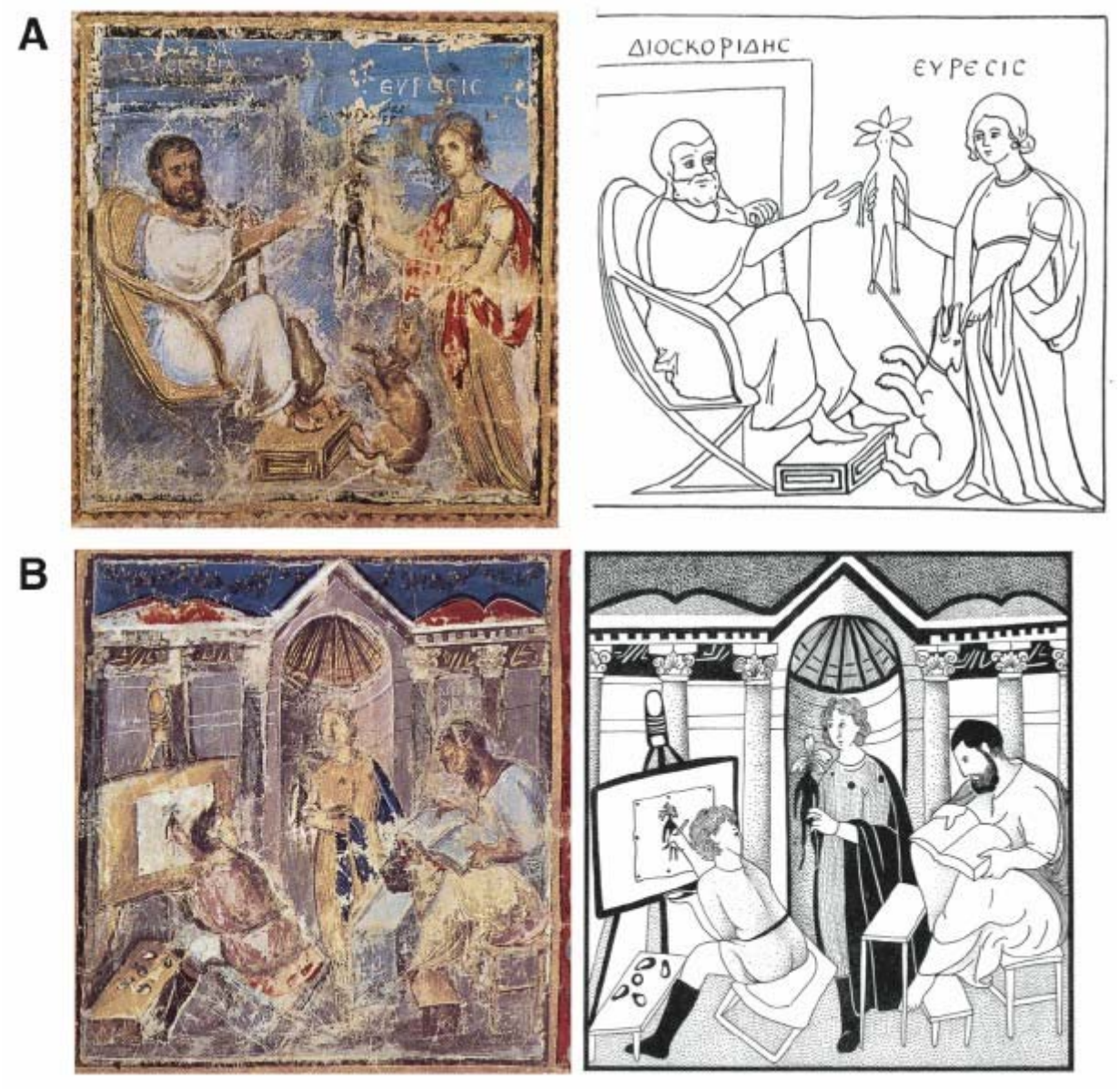

Fig. 2. Mandrake in *Aniciae Julianae Codex.* (A) Dioscorides receiving mandrake from Euresis (discovery). Sketch on right by Singer (1927). (B) Krateuas painting mandrake held by Epinoia. Sketch on right by M. Breen (Bredemeyer), from D'Andrea, (1982).

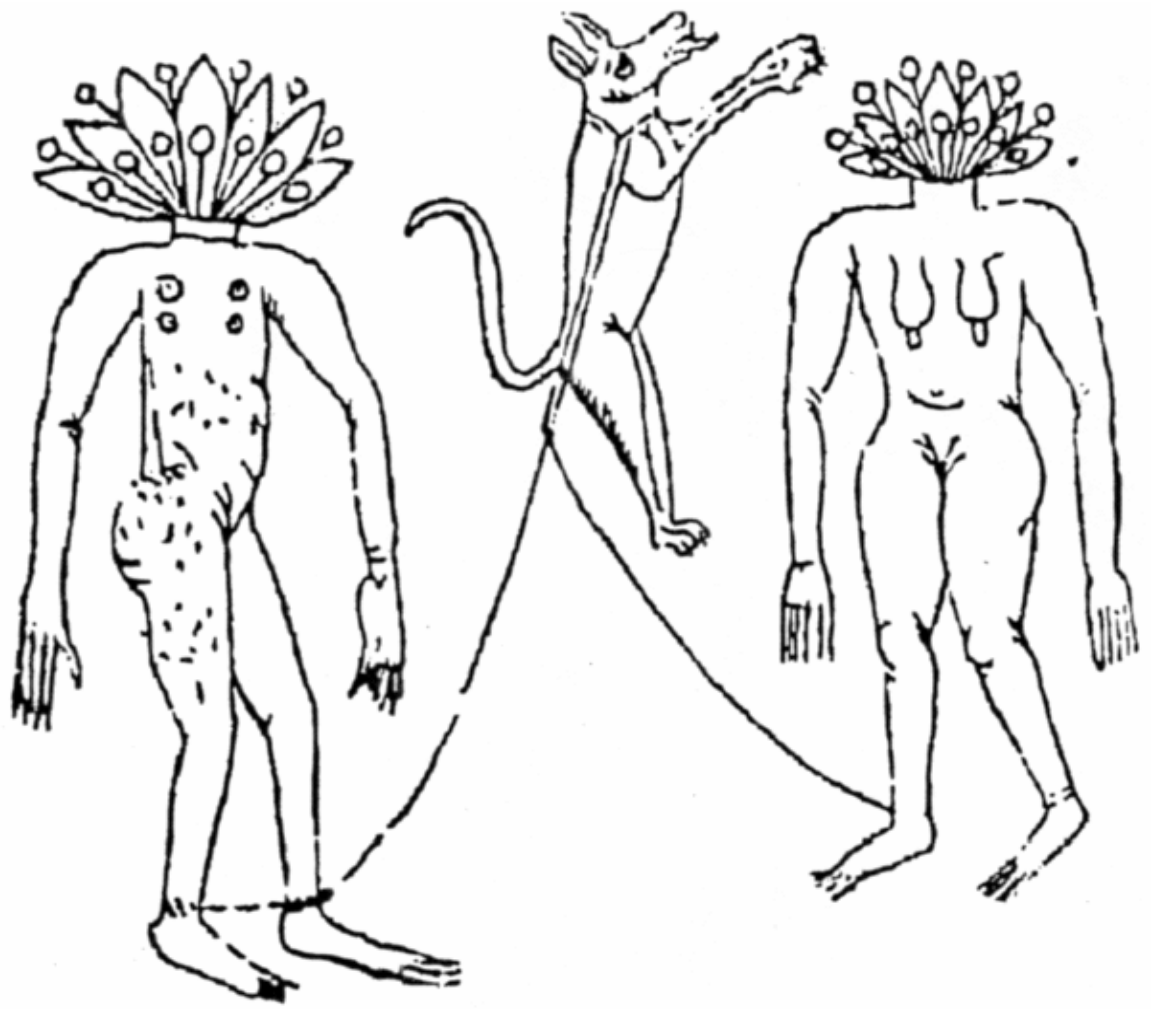

Fig. 3. “Male” and “female” mandrakes and dead dog, Hertensis, IXth century. (Singer,1927).

Fig. 4. Harvesting mandrake with the help of a dog (http://mandragore.bnf.fr). (A) Latin 9333, folio 37; XVth century. (B) Suppl. Turc 1063, fol. 17v, 1685.

Fig. 5. Henbane in Fuchs, *New Kreüterbuch*, 1543, folio 477 (L. Fuchs, *The New Herbal*, ed. Taschen, 2001).

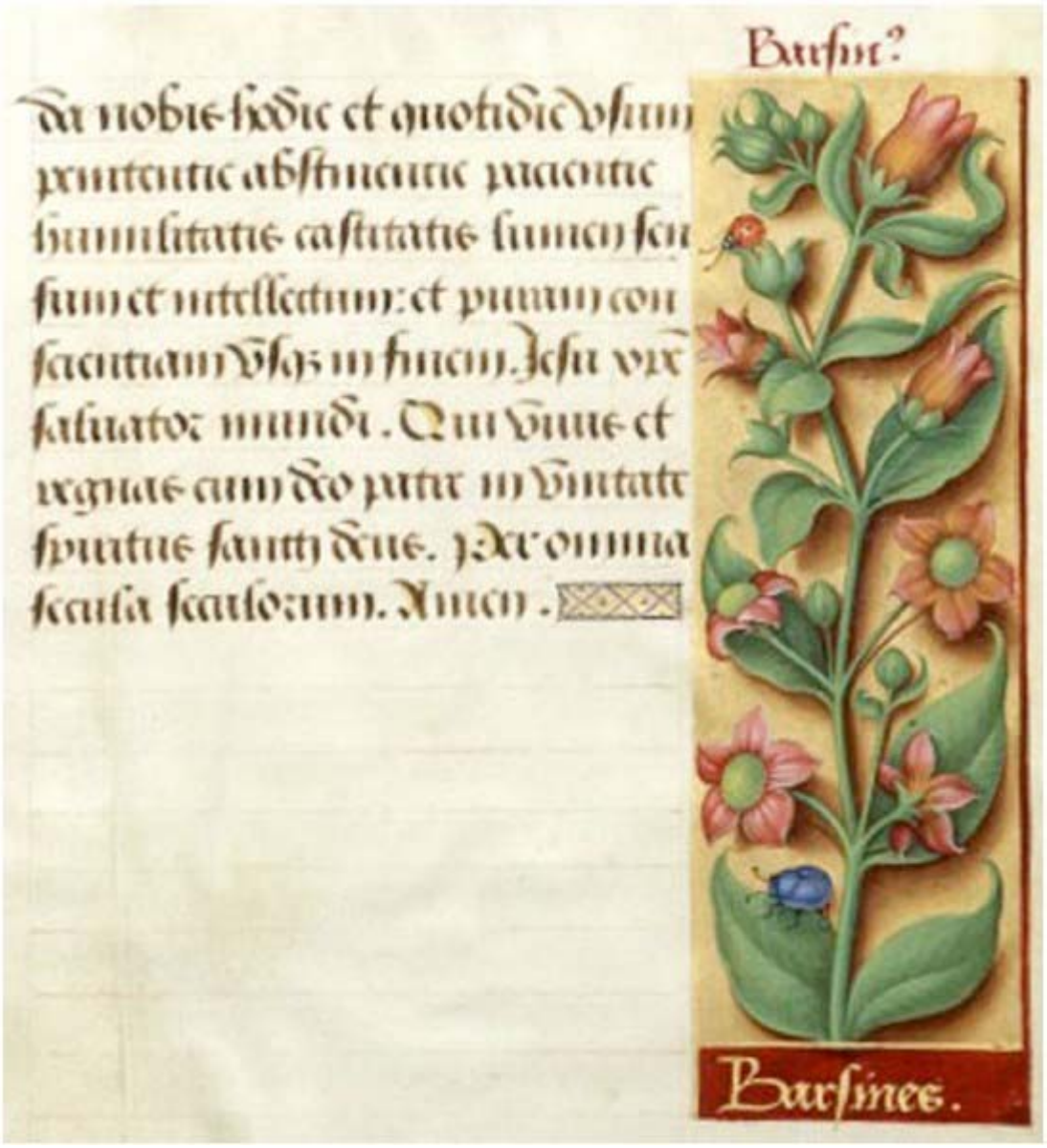

Fig. 6. Belladonna in *Horae ad Usum Romanum* (Grandes Heures d'Anne de Bretagne), folio 237, 1503–1508. (http://mandragore.bnf.fr).

Fig. 7. Chinese eggplant drawing. From Hu Sihui, Yinshan Zhengyao, 1330 (Buell and Anderson, 2000).

Fig. 8. Eggplants and their aphrodisiacal effects, *Tacuinum Sanitatis*, SN2644, folio 31v; 1385–1390. (Pitrat and Foury, 2003).

Fig. 9. *Physalis alkekengi* in *Aniciae Julianae Codex* ca. 512.

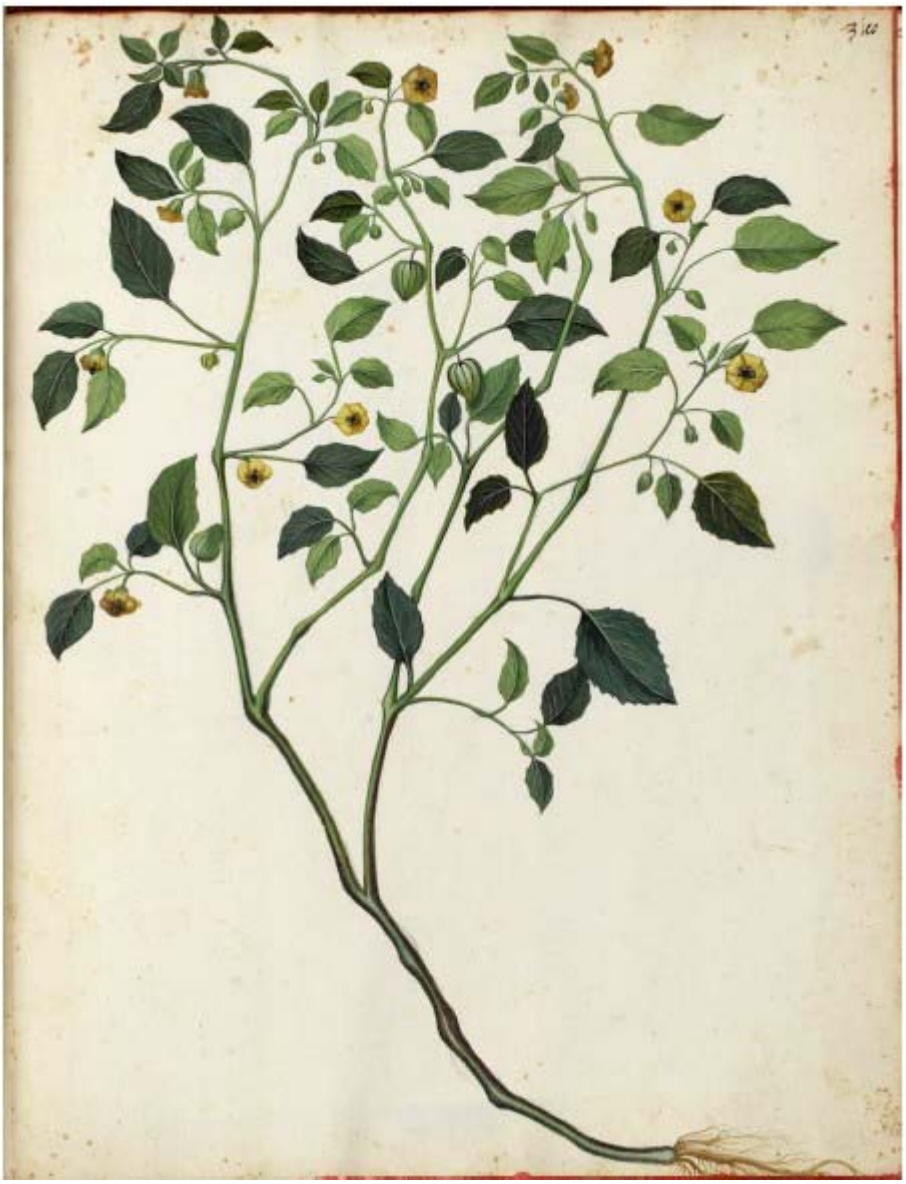

Fig. 10. Husk tomato (possibly *Physalis philadelphica*), Aldrovandi, second half of the XVIth century, vol.2, folio 318. (http://www.filosofia.unibo.it/aldrovandi/).

Fig. 11. Putative *Datura meteloides* (left) and *D. ceratocaula* (right). Plate 49, from *Codex Barberini* Latin 241, 1552 (Walcott Emmart, 1940).

Fig. 12. Plant of *Datura* sp. and person being anointed with a datura-based preparation. In: *Florentine Codex*, vol. 3 book 2 p.294, 1540–1585 (Estrada-Lugo, 1989).

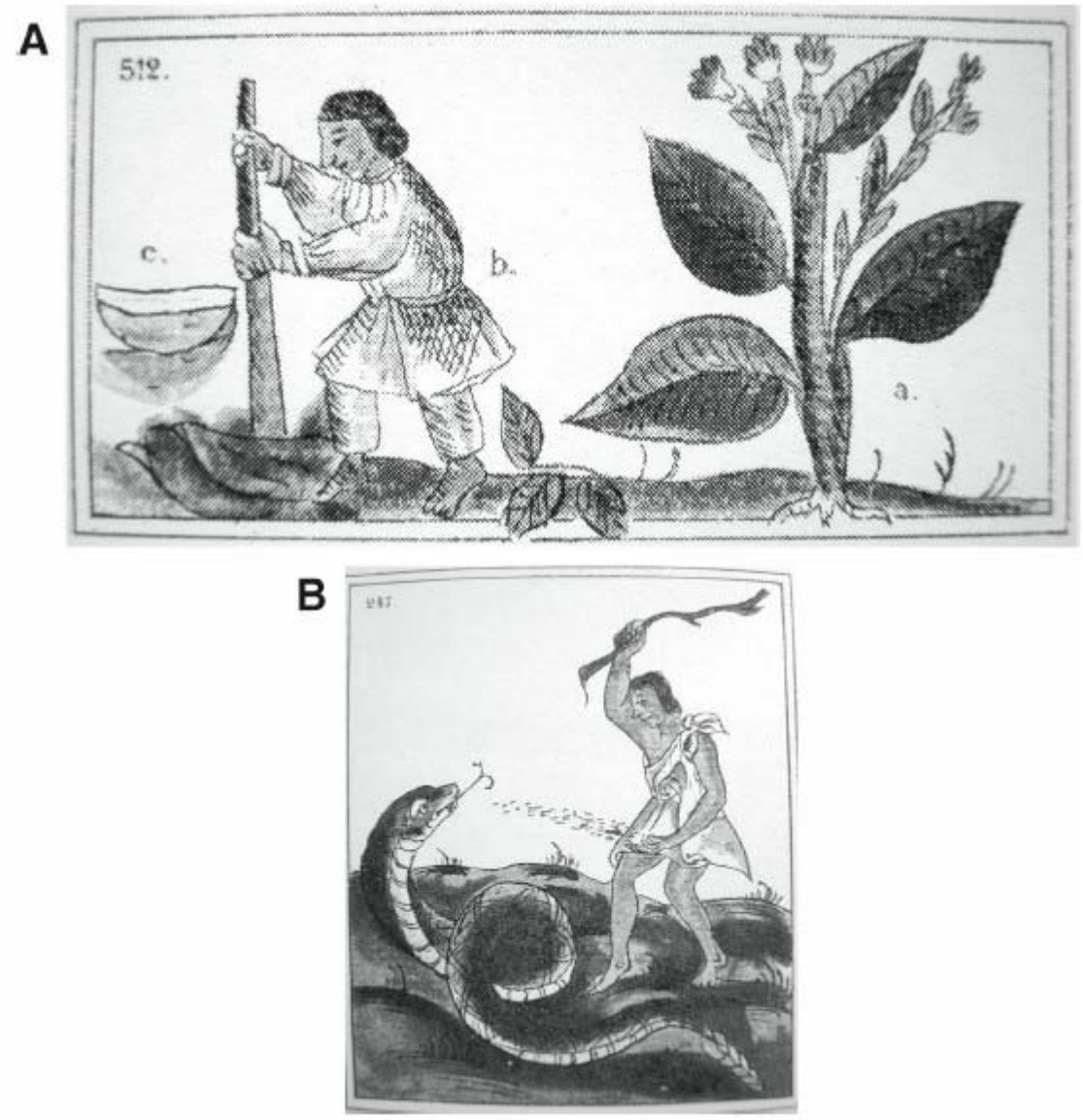

Fig. 13. Tobacco in the *Florentine Codex* (Mexico), book 11, 1540–1585 (Dibble and Anderson, 1963). (A) Man grinding leaves of tobacco plant (drawing 512), (B) Capturing the Tecutlacoçauhqui (serpent) with club and powdered tobacco (drawing 247).

Fig. 14. Tobacco in Fuchs, unpublished codex (*Codex vindobonensis Palatinus*). (A) *Nicotiana tabacum*, codex 11 123, 3(1), p.259, dated 1566–1604 (Meyer et al., 1999). (B). *N. rustica*, codex 11 123, 3 (1), p.265, illustration by Albrecht Meyer, dated 1549–1556 (Baumann et al., 2001).

Fig. 15. Mexican ritual with burning peppers in *Codex Mendoza*, 1542 (A. Palloix, pers. commun.).

Fig. 16. *Capsicum annuum* in *Codex Amphibiorum*, folio 11r, 1540 (Lack, 2001).

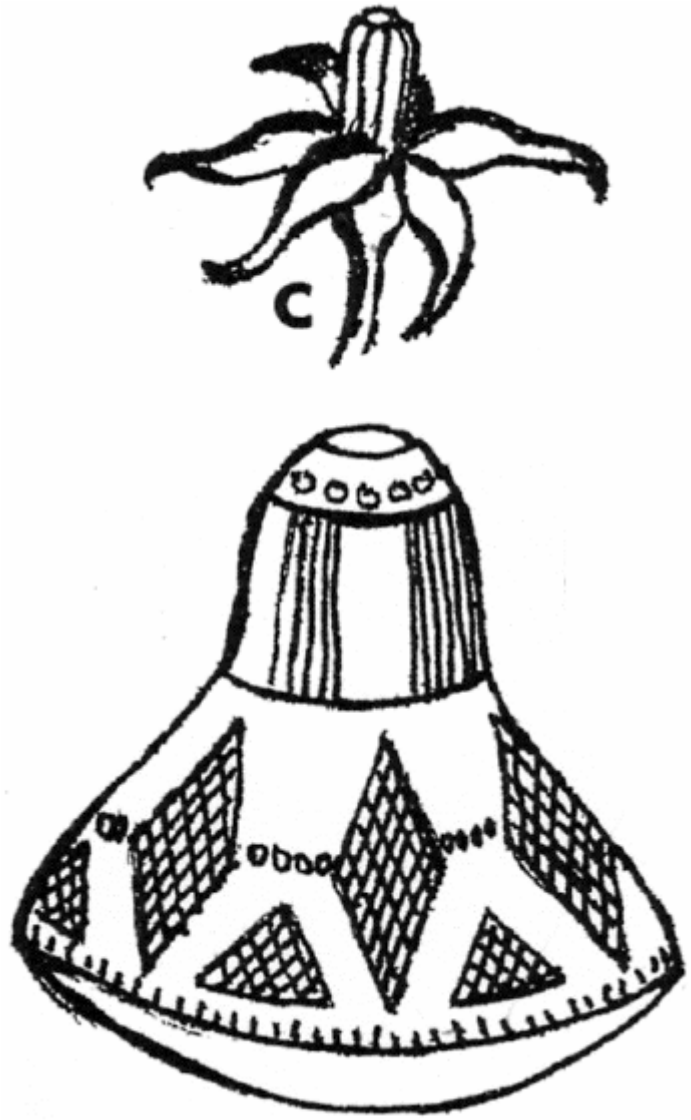

Fig. 17. Spindle whorl presumed to reproduce tomato flower geometry, Columbia, 500–1000 CE (McMeekin, 1992).

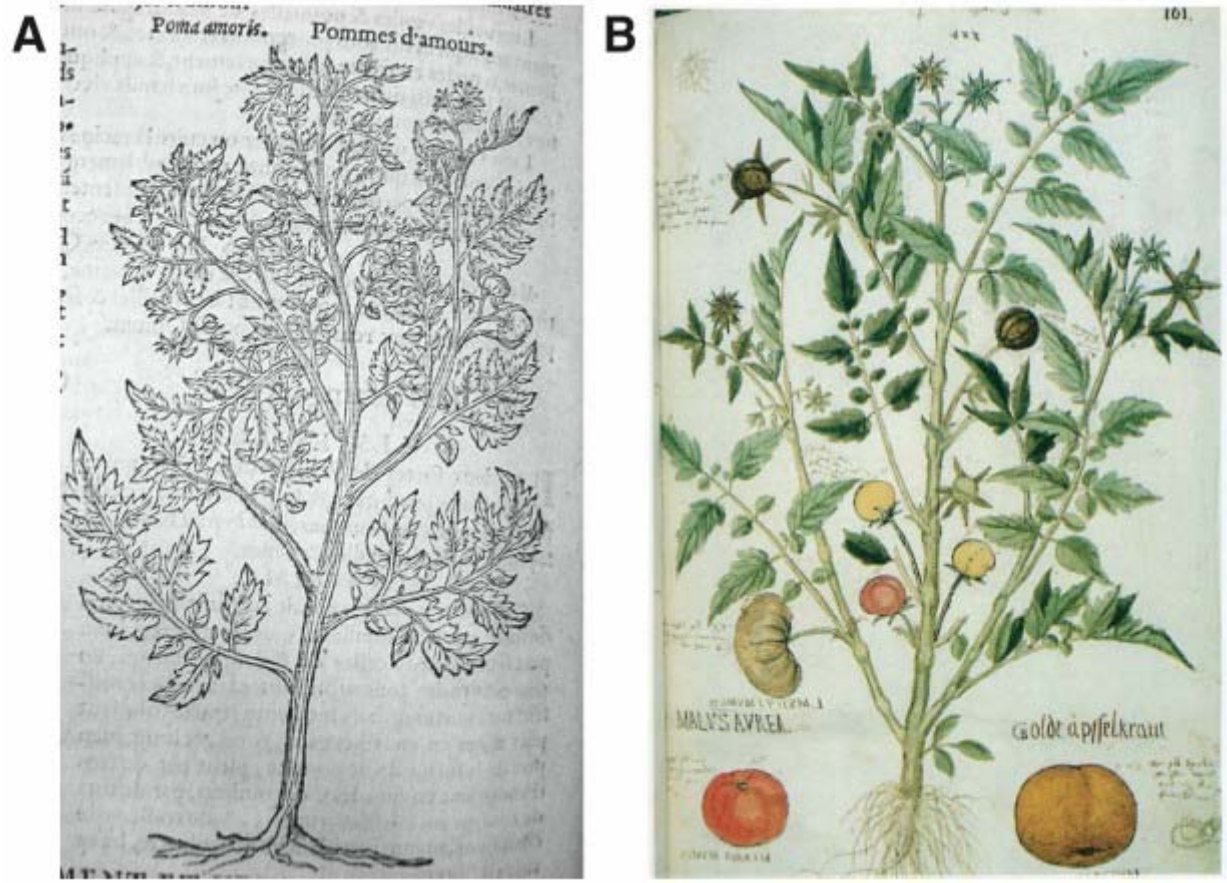

Fig. 18. Two of the first European illustrations of tomato. (A) Dodoens, p.428, 1553. (B) Fuchs, unpublished, codex 11 122, 2 (3), p.161, illustration by Albrecht Meyer, dated 1549–1556 (Baumann et al., 2001).

Fig. 19. Pre-Columbian ceramic of anthropomorphized potato tuber. Proto-Chimu period 200 CE (Leonard, 1973).

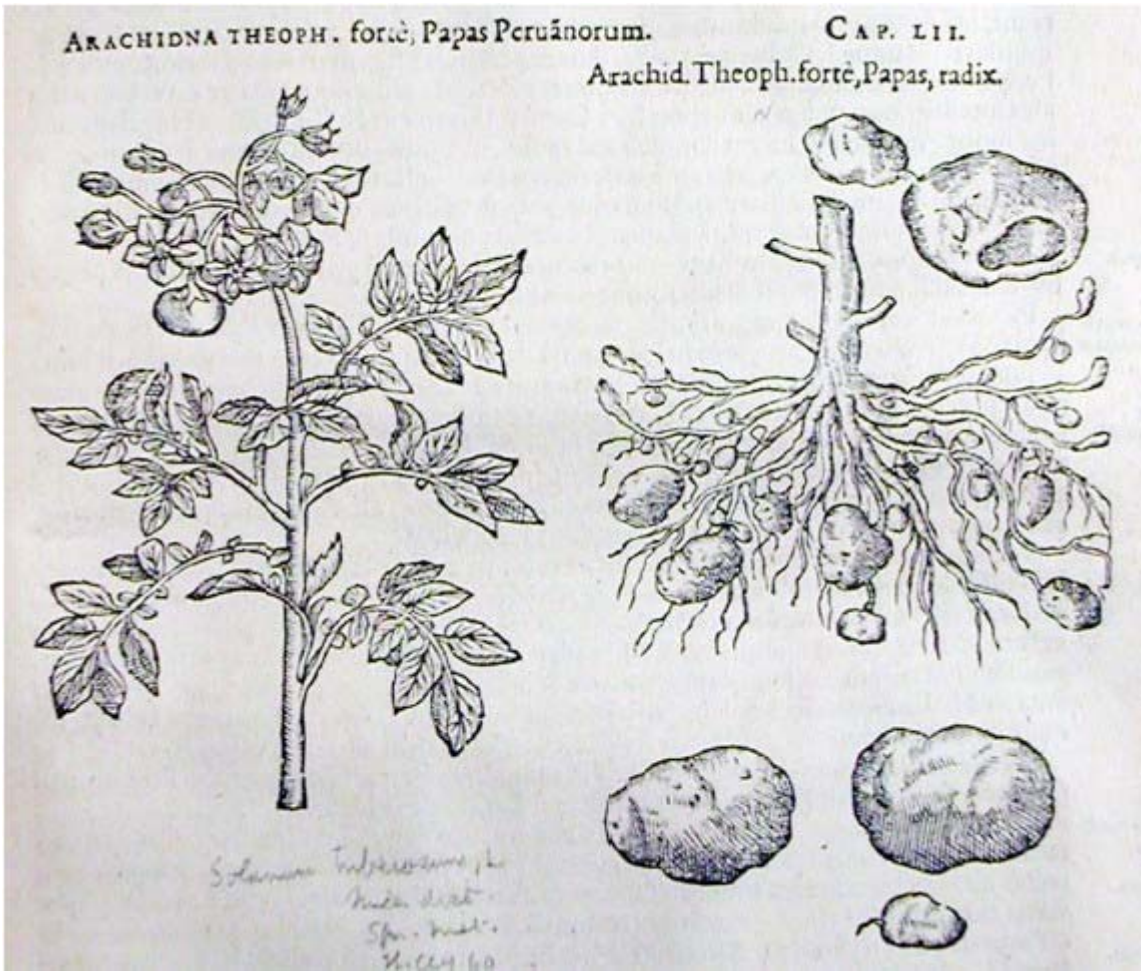

Fig. 20. Potato, from Clusius, *Rariorum plantarum historia*, L.IIII, p.lxxix, 1601.