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Iconography and History of Solanaceae: Antiquity to the 17th Century

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I. INTRODUCTION

Species of the Solanaceae, commonly referred to as nightshades, have strong and complex relationships with human societies, as evidenced by the wealth of archeological remains, medicinal and agricultural texts, Medieval and Renaissance herbals, codices, historical documents, folklore, and art. Two and three dimensional images in the form of terra-cottas, carvings, embroideries, manuscripts, woodcuts, painted illustrations on velum or paper, often associated with textual information, are an extraordinary source of information about the beliefs and plant uses by ancient societies in both the Old and the New World. Nightshades include mandrake, henbane, belladonna, datura, alkekenge, datura, as well as cultivated crops such as eggplant (aubergine, brinjal), husk tomato, tobacco, capsicum pepper, tomato, and potato. Iconography is also a remarkable testimony for horticultural features of the cultivated Solanaceae including genetic and taxonomic information.

Our investigation roughly covers the period from antiquity to the 17^{th} century, the beginning of modern botanical science. During much of this time span, the history of the Solanaceae in the West is linked to medicinal and magical concerns. However, 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 survey, admittedly incomplete, of information gathered: (1) from visits to several libraries and museums including the Bibliothèque nationale de France (BNF) and Museum National d'Histoire Naturelle (Paris, France); Musée Requien and Bibliothèque Ceccano (Avignon, France); Missouri Botanical Garden (St. Louis, USA); Natural History Museum (London, UK); and Botanischer Garten & Botanischer Museum (Berlin, Germany); (2) from several library web sites; and (3) from various books and papers. Most of the documentation is derived from ancient, Medieval, and Renaissance herbals. A typical herbal chapter named the plant with a list of

synonyms; described its characteristics, distribution, and habitats; reported information from earlier authors; provided medical properties and instructions on harvest and preparation; listed recipes for medicines and cures; and included an illustration of the plant (Arber 1986; Collins 2000; Daunay et al. 2007).

Many of these treatises were originally conceived as books of ''simples,'' a medicine concocted of only one constituent, especially a plant. In ancient medicine as defined by Hippocrates, just as there were four cardinal points (north, east, south, and west) and four elements (earth, water, fire, and air), the body was considered inhabited by four humours [blood, phlem, choler (yellow bile), and melancholy (black bile)], which corresponded to four qualities (humid, cold, dry, and hot), each measurable to four degrees determining the good or bad influence on humans (Mane 2006). Disease was considered to be a disequilibrium of one or several of the humours, and the physician had to interfere by prescribing compensatory preparations; thus a hot and wet patient was prescribed a cold and dry medication. When ''simple'' medicines did not work, a medicine composed of a combination of contraries was necessary.

This review will start with species confined to the Old World including mandrake, henbane, belladonna, eggplant and some lesser known species. On the basis of their strong pharmaceutical and psychotropic effects, due to various alkaloids, mandrake, henbane, and belladonna developed a disquieting reputation and were widely used in medicine and as an essential ingredient in magical rituals and spells. We will continue with the genus *Physalis,* alkekenge in the Old World and husk tomatoes in the New World. Finally, species confined to the New World will be covered: first the wild daturas and then crops that were to become tremendously important throughout the world: tobacco, capsicum peppers, tomato, and potato.

II. OLD WORLD SOLANACEAE

A. Mandrake (*Mandragora* spp.)

Mandrake species are indigenous to the countries around the Mediterranean (Jackson and Berry 1979) and farther east to Himalayas (D'Arcy 1979, 1991). Mandrake is the classical example of a plant having both medicinal and magical properties, in which human imagination and superstition have wrestled with logic and good sense for millennia. The hairy bifurcate root suggesting human legs and the rosette leaves suggesting a crowned head, together with the strong

somatic and psychic effects, are at the origin of the very special status of this species and of anthropomorphized illustrations into a crowned human figure. However, skepticism concerning these magical characteristics is almost as old as the legend (Thompson 1934). Columella (first century CE), the Latin author of a farming treatise, believed that the mandrake was half man and half plant. From early times, a ''male'' form (*Mandragora officinalis*) and a female form (*M. autumnalis*) were distinguished. The ''male'' was characterized by a whitish root, large, smooth, broad whitish smooth leaves, and globular yellow to saffron colored berries with a pleasant, heady, fragrance. The less common ''female'' had externally blackish and smaller roots, narrow, dark green leaves, and smaller pale berries ripening later than those of the ''male'' form and having a strong and unpleasant odor. The designation of the foul-smelling species as ''female'' tells volumes about the status of women throughout this period. The mystical aura of the plant extended to a common superstition regarding the plant harvest. 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; it was harvested by being tied to a starving dog, which, when thrown some scraps, would rip it out, causing the demise of the dog but sparing the attendant who had muffled ears. A variant of this tale occurs in the first century *Wars of the Jews* by Josephus Flavius (Feliks 1968).Voluminous references to this species appear from antiquity to the Renaissance, but our discussion here stresses iconographic information to understand the very special relations between this species and humankind.

1. First Records. Mandrake is found in very old documents. It is included in the *Ebers Papyrus* (ca. 1530 BCE), an Egyptian medical treatise and the earliest known book of any kind (Dawson 1933). A carving of a mandrake being harvested by an Egyptian lady on an ivory casket of Tutankhamun (Fig. 1.1A) from the 18th dynasty, about 1323 BCE, and a painting illustrating mandrake along with cornflower and poppy is found in Theban Tomb no. 1, 19th Dynasty (Fig. 1.1B). Mandrake, called *Duda'im* in Hebrew, the name for lovers, is referred to twice in the Hebrew Bible. In *Genesis 30:14*, Rachel asks for mandrake to help her conceive, and in *Song of Solomon 7:13*, the fragrance of mandrake is referenced. Medicinal properties of mandrake are also referred to by Theophrastus (372–287 BCE), Dioscorides (20–70 CE), and Pliny (23–79 CE). An image of mandrake is found in two paintings of the frontispiece of the earliest surviving illustrated manuscript of Dioscorides' *De*

Fig. 1.1. Mandrake in pharaonic Egypt: (top) harvesting mandrake fruits on an ivory casket of Tutankhamun, 18th Dynasty; (bottom) painting illustrating mandrake along with cornflower and poppy, Theban Tomb no. 1, 19th Dynasty. Source: Manniche 1989.

Materia Medica completed in 512 CE, known as the *Codex Aniciae Julianae,* which is conserved at the Austrian National Library of Vienna. In the first (Plate 1.1 top), Dioscorides receives a mandrake (in human form with a rosette crown and to which is attached a dead dog) from the nymph Euresis (Discovery). In the second painting (Plate 1.1 bottom), 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 an illustration 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 anthropomorphization of mandrake as well as superstition about its harvest, which continued unabated in later manuscripts, such as in *Hertensis*, a 9th century herbal (Fig. 1.2); *Theatrum sanitatis MS 4182* folio 73 (14th century), *Latin 9333* folio 37 (15th century) (Plate 1.2); *Français 12322* folio 180v, ca. 1520–1530 (Plate 1.3); and up to the 17th century, for example, in a Turkish manuscript, *Supplément turc 1063,* dated 1685, folio 17v (Plate 1.4). A miniature of *Nouvelle Acquisition Latine 1673* folio 85 (Plate 1.5) suggests the aphrodisiac effects of mandrake. These illustrations reflect the coexistence of botany, magic, and whimsy combined with imaginative flights of fancy by herbal illustrators.

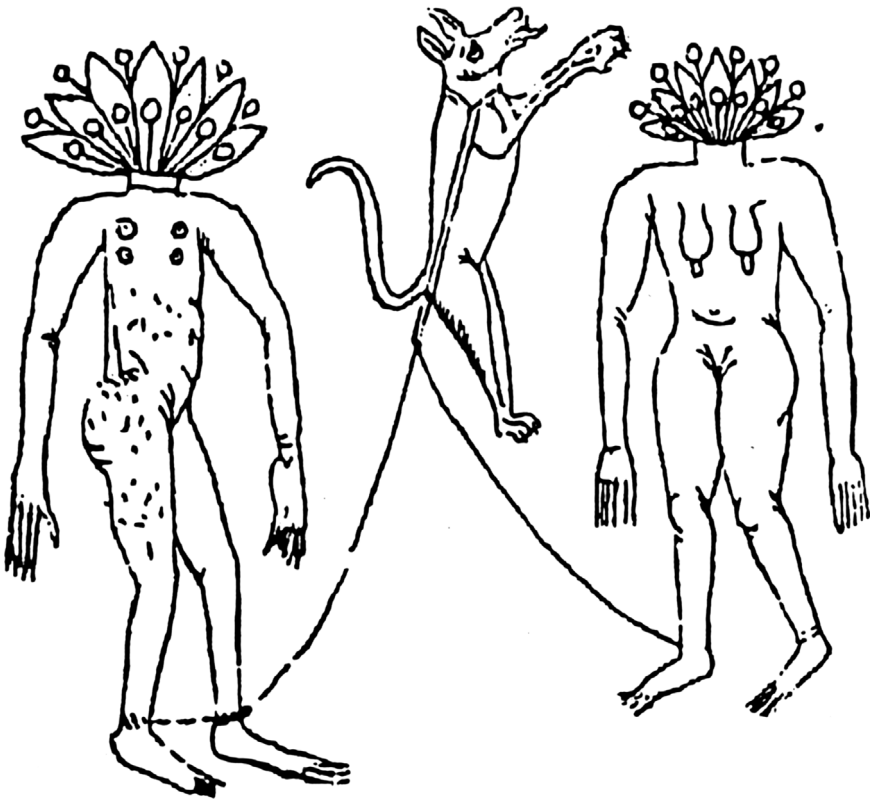

Fig. 1.2. ''Male'' and ''female'' mandrakes and dead dog, Manuscript *Hertensis*, 9th century. Source: Singer 1927.

Normal images of mandrake are also found in herbals such as the *Codex Aniciae Julianae* (folio 367v), as well as in later Dioscoridean manuscripts such as *Grec 2179* (folio 104), dated 8th century; *Arabe 4947* (folio 92), dated 12th century; and *Français 12322* (folio 161), ca. 1520–1530. Renaissance illustrations of mandrake such as those of Fuchs' *New Kreüterbůch* (1543), folio 299 and *Vienna Codex 11 121*, 2(2) folio 533 (which is, according to Baumann et al. [2001] a copy of V. Cordus [1561] folio 204 verso, itself a copy from Gesner's manuscript [MS 2386, dated before 1565]), illustrations of Oellinger (*MS 2362*, dated before 1553, folio 595) and of Besler (1613, Tafel 126) are less fanciful but often continue to suggest human figures. The globular gold-colored berries of mandrake, beautifully illustrated by Aldrovandi in his *Il Teatro della Natura* realized during the second half of the 16th century (Plate 1.6), are similar to early introduced forms of eggplant and tomato This resemblance fuelled the suspicions of Renaissance herbalists toward these foreign crop species.

2. Names. Pythagoras in the 6th century BCE called it *Anthromorphos* (i.e. human form). Both the Greek and Latin word for the plant is *Mandragora*. In the first century CE, the plant was also named *Circaea* (Circe, the enchantress, was supposed to use it as a love potion). According to Parkinson (1640, 1656), Dioscorides said the female was called *Tridacias* (which relates to its narrow lettuce-like leaves) as well as *Niger*; the male was called *Candidus*; and both were called *Antimelum*. The confusing term *Morion* designated the male mandrake as well or another species (possibly *Atropa belladonna*). Latin names were *Mala canina*, *Mala terrestria*, *Mandragora canina, Terrestris malus*, *Mandragora mas*, and *Mandragora foemina*. Mandrake was to be known in common languages as *Mandrake*/*Mandrage* (English); *Alraun menlin*, *Alraun weiblin* (German); *Mandragora manneken*, *Witte mandragora*, *Alruyn Manneken* (old German, i.e. Dutch); *Morion*, *Mandegloire*/*Mandegloyre*, *Mandragore male*, *Mandragore femelle, Pomme terrestre, Pomme de chien* (French); *Mandragula*/*Mandracula* (Spanish); and *Mandragola* (Italian).

3. Uses. Since antiquity, mandrake has been used in various ways and for curing various ailments. Dioscorides refers to a myriad of medicinal uses and mentions that the fruit is soporific when eaten or smelled, and when consumed in excess renders people speechless (Beck 2005). An aphrodisiac effect is suggested in the reference to mandrake in the biblical account of *Genesis 30:14* (Feliks 1968). In a late copy (ca. 1520–1530) of the *De simplici Medicina* (or *Circa instans*) of Matthaeus

Platearius (*Français 12322*), mandrake is reported to be cold and dry. Dodoens (1557) and Matthioli (1605; his name was latinized to Matthiolus) offer examples of cures that can be found in the literature. Desiccated fresh root juice, taken in small quantity, was used as a purgative; as an ingredient in an eye lotion for its disinfectant effect; and when taken as a suppository induced sleep (the simple scent of the fruits or their consumption supposedly had the same effect, although not as efficiently). The juice, mixed with wine and honey, had a strong emetic effect. A decoction made out of wine and mandrake root was a strong narcotic and sedative, used in different quantities depending on the effect expected: simple painkiller or ''sleeping pill,'' or anesthesia agent in cases of severe wounds or surgery such as cauterization of wounds or amputation. It was known, however, that the root juice could be dangerous, even provoking death, if taken in too high a quantity. The leaves, ground with roasted barley flour, were used for removing all kinds of inflammations, ulcerations, and tumors. The root also calmed inflammations and adding it to honey and oil produced a medicine that cured venomous bites.

The various tropane alkaloids contained in the mandrake, such as hyoscyamine, hyoscine (scopolamine), and atropine (Evans 1979), are responsible for the various pharmaceutical and psychotropic effects (disinfectant, anti-inflammatory, anesthetic, sedative, paralytic, narcotic, hallucinogenic,) that were empirically found in the past. However, there is a thin line between beneficial medicinal effects, malevolent effects, and superstition, and this line can be crossed by changing the dosage plus the addition of special ceremonies. Used in stronger dosages than for medicinal use, and blended with other plants, mandrake was also indeed employed for black magic, the dark side of botany and medicine (although black magic is not referred to in the herbals). Recitations of these magical effects (witches' brews, flying ointments, and aphrodisiac philters) flourished in countless folktales.

4. Conclusion. Mandrake has been the subject of countless illustrations. In the medico-botanical treatises, superstitious beliefs as well as simple botanical observations are incorporated in the illustrations of mandrake. However, in the associated texts, authors either avoid mentioning the superstitions surrounding the plant or condemn them. The magical uses of the plant are not mentioned in the medicinal treatises. Mandrake, by combining physiological effects with a humanlike appearance, has focused, since remote times, irrational fears and beliefs in Mediterranean and European societies. This special status was shared, to

a lesser extent, by other Old World nightshades, such as henbane and belladonna, which have similar physiological effects. These fears no doubt are the origin of the initial distrust of other solanaceous species, such as eggplant and later tomato, since some early introduced forms had golden fruits as did mandrake and hence induced confusion between species.

B. Henbane (*Hyoscyamus* spp.)

The genus *Hyoscyamus* is distributed in the Mediterranean area and in Asia (D'Arcy 1979, 1991). Although there are about 15 henbane species, only the black (*H. niger*), white (*H. albus*), and yellow henbane (*H. aureus*) were important medical and magical herbs (Hansen 1978). *Hyoscyamus albus* and *H. aureus* are found around the Mediterranean, but the common henbane, *H. niger,* is indigenous farther east in regions around the Caspian Sea. These species were well known to writers of antiquity probably because of their strong pharmaceutical and psychotropic properties, due to the presence of the alkaloids hyoscyamine and hyoscine.

1. First Records. Henbane was included in the *Ebers Papyrus* of ancient Egypt (1530 BCE) as a useful but dangerous plant (Hansen 1978). It is is mentioned in Dioscorides' *De Materia Medica* (first century CE), and illustrations are contained in a Dioscoridean manuscript of the end of the 8th century (*Grec 2179* folios 100 and 101) representing three crudely drawn plants (Fig. 1.3) with entire leaves, reddish or yellowish flowers (folio 100) or white flowers (folio 101), and fruits. Later Medieval illustrations represent plants with or without flowers, fruits, or roots and with variously stylized inflorescences (e.g. *Latin 6862* folio 27v, *Français 12320* folio 99v; *Français 1310* folio 3). The plant is represented as a rosette in the manuscript *NAF 6593* (folio 112v), but in all cases with clearly dentate leaves (e.g. *Français 1310* folio 3). In one copy of Platearius's *Livre des Simples Médecines* (*Français 12322* folio 159, dated 1520 to 1530) (Plate 1.7), a careful painting represents abaxial and adaxial leaves surfaces as well as white flowers and fruits in long racemes.

The first botanically accurate paintings of the three types of henbane are found in Fuchs: *Hyoscyamus niger* (New Kreůterbůch, 1543, folio 477) (Plate 1. 8) with very dentate leaves, and two less dentate types, *H. aureus* (*Vienna Codex 11 125*, 3(3) folio 179 (painted, between 1555 and 1560) and *H. albus* (*Vienna Codex 11 125*, 3(3), folio 181 painted 1549–1556). The newly introduced *Nicotiana rustica* from America was confused by several herbalists with true henbane (*H. niger* and *H. albus*)

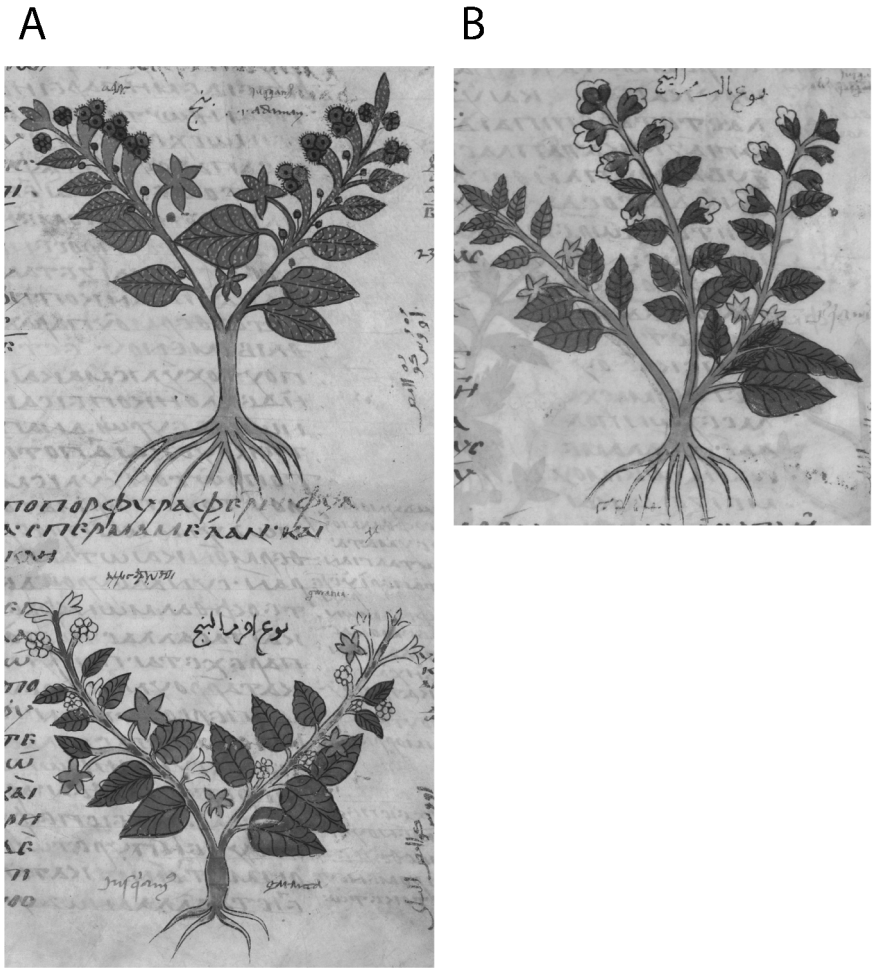

Fig. 1.3. Henbane, manuscript *Grec 2179*, 8th century: (A) folio 100; (B) folio 101. Source: Bibliothèque nationale de France. Source: Bibliothèque nationale de France. Copyright: Bibliothèque nationale de France

and was named *H. luteus* (Dodoens 1553, 1557); *dubius hyoscyamus luteolus solanifolius* (Lobel 1576b), and *gelb Bilsen* (i.e. yellow henbane) (Lonicer 1587, tinted edition).

Clusius (1601) displays a woodcut of *Hyoscyamus albus vulgaris* as well as two new morphological types that he names *H. albus creticus* and *H. aegyptius*, but the attribution is uncertain. Besler (1613) displays paintings of *H. albus* (with white flowers and moderately dentate

leaves) and of *H. vulgaris* (with yellowish flowers and quite dentate leaves). Gaspard (Caspar) Bauhin (1560–1624) is the most confusing herbalist. In a 1707 edition of his *Histoire des Plantes de l'Europe et des plus usitées qui viennent d'Asie et d'Amérique, one* woodcut is entitled *Hyoscyamus vulgaris vel. niger* and *jusquiame jaune* as a common name (i.e. yellow henbane); the text affirms that the flowers are yellow, and the drawing suggests the plant to be a black henbane, with very dentate leaves. Another drawing, with much less dentate leaves, is entitled *H. albus major* (common name *jusquiame blanc*, i.e. white henbane) and the image appropriately confirms that the flowers are white. A third drawing resembles a tobacco plant and is named *Nicotiana minor*, common name *jusquiame noir* (i.e. black henbane); the associated text describes a quite complex flower color pattern involving purple and yellow. Therefore, it is probable that Bauhin got mixed up between henbane types as well as between henbane and tobacco. This latter confusion, more than 50 years after Dodoens's first misidentification, demonstrates how difficult it was for herbalists of those times to reconcile the knowledge and nomenclature of plants.

2. Names. A great diversity of names is given by successive herbals authors. Latin names (not exhaustively quoted) from Fuchs (1543), Dodoens (1557), Lobel (1576a, 1581), Matthioli (1579), Lonicer (1587), and Clusius (1601) include: *Hyoscyamus* (*niger, albus*, *luteus* or *luteolus*), *Appollinaris*/*Appollinaris herba*/*Appolinarem*, *Jusquiamum*, *Fabulum*, *Fabam suillam*/*Faba suilla*, *Faba lupine*, *Herba pinula*, *Herba canicularis*, *Calicularis*/*Canicularis*, *Caniculata*, *Caßilago*, *Deus caballinus*, *Dioscyamos* (*Louis faba*, *Fabulonia*), *Arabibus*, *Palladio symphoniaca*, *Symphoniaca*, *Mania,* and *Altercum*. According to Matthioli (1579), the name *Altercum* comes from the loquacious and aggressive behavior of people who have drunk a henbane-based beverage.

In other languages, one finds *Henbane, Hennequale* (English), *Bilsenkraut/Bilsamkraut, Sawbonen/Sewbon, Bilsomen Sewbon, Schlaafkraut, Dollkraut* (high German); *Bilsen, Bilsencruyt/Bilsencruydt, Bilsensamen* (Low German); *Jusquiame* (Spanish); *Hanebane* (French); *and Velenno, Meimendro Jusquiamo, Dente cavallino (Italian);* . The Greek name *Hyoscyamos* means pig bean (*feue de pourceau* in French), which according to Matthioli (1579) is because wild pigs after consuming it became paralyzed and convulsive. Dodoens (1608) includes many other names.

3. Uses. Dodoens (1557) reports that seeds and leaves of the white henbane are cold at the third degree. The yellow and black henbane are

still colder, almost to the fourth grade, and are noxious to human health. Henbane was used for treating many ailments, inflammations, pains, and insomnia. According to Fuchs (1543) and Dodoens (1557), the diluted juice taken from stems and leaves was used for preparing lotions for treating eye inflammation and infection. The juice or the seeds' oil instilled into the ears appeased ear pains. The root boiled in vinegar and taken by mouth soothed toothaches. Crushed leaves mixed together with malt calmed gout. The juice mixed with roasted wheat or barley flour was an excellent plaster against warm ''*phlegmons and apostem*s'' [abscesses, tumors, and ulcers] of eyes, feet, and other body parts. The seed, taken with water and honey, was good for all kinds of coughs or thorax infection, or women's bleeding disorders. Drinking sweetened water of henbane, washing the feet with a henbane decoction, or using seed oil as forehead ointment induced sleep. Fuchs (1543) concluded that leaves, seeds, and juice can make fools of people, and therefore, they must not be taken internally but only externally for calming pains and bringing on sleep.

We now know that the properties of henbane are linked to the presence of hyoscine and hyoscyamine-type alkaloids (Evans 1979), which in addition to useful pharmacological properties used in medicine, are responsible for psychotropic effects through transmission blockage in the parasympathetic nervous system by an anticholinergic action (Roddick 1991). As in the case of mandrake, these alkaloids were used in the service of good as well as of evil. Hansen (1978) reports that Circe is supposed to have turned Ulysses' crew into swine with a drink of henbane, and in other Greek texts (Apollonius Rhodius, Ovid, and Homer), there are stories of magical drinks which indicate that hyoscyamine was the most active ingredient. In the Middle Ages, henbane was included in ''flying ointments'' and other witches' preparations. William Shakespeare suggests that the poison put in the ear of Hamlet's father was henbane. The ghost of Hamlet's father explains:

> Sleeping within mine orchard,
> My custom always in the afternoon,
> Upon my secure hour thy uncle stole,
> With juice of cursed hebenon in a vial,
> And in the porches of mine ears did pour
> The leperous distilment; whose effect
> Holds such an enmity with blood of man
> That swift as quicksilver it courses through
> The natural gates and alleys of the body,

> And with a sudden vigour it doth posset
> And curd, like eager droppings into milk,
> The thin and wholesome blood. So did it mine,
> And a most instant tetter bark'd about,
> Most lazar-like, with vile and loathsome crust,
> All my smooth body.
>
> *Hamlet,* Act 1 Scene 5

4. Conclusion. Henbane (as mandrake) long remained in the pharmacopoeia of Europe, and its importance is attested by its frequent inclusion in illustrated herbals. Its strong psychotropic effects are responsible for its use also as one of the components of magical potions and spells. The images together with the names allocated by herbalists show that the three types of henbane were sometimes confused with each other and that one of them in particular, the yellow henbane, was confused with the first introduction of tobacco (*see* Section IV.B.).

C. Belladonna (*Atropa belladonna*)

The genus *Atropa* is found from Mediterranean areas to Himalayas (D'Arcy 1979, 1991). The extremely toxic species *Atropa belladonna* is often referred to as ''deadly nightshade''. It is a hardy perennial, herbaceous shrub, and a rich source of alkaloids. Roots, leaves, and seeds are poisonous to humans.

1. First Records. Theophrastus described a plant named *Morion* that could have been *Atropa belladonna*, and the question was long debated among later herbalists. According to Heiser (1969), the description of the appearance and behavior of the maenads (nymphs' attendants) of the Dionysian orgies suggests that belladonna was mixed in the wine at the Bacchanalia.

The earliest image of belladonna found (Plate 1.9) is from the *Horae ad Usum Romanum,* also known as *Grandes Heures d'Anne de Bretagne* (*Latin 9474*), dated ca. 1503 to 1508 (folio 237). Though artistic license produced reddish calyces (instead of green) and only flat globose unripe green fruits (instead of the characteristically globular black ripe fruits), the painted branch is easily recognized as belladonna (named *Barsines* in the old French of the time) with its entire leaves, bell-shaped reddish flowers, and the large stellate calyx framing the fruit.

More botanically accurate is the image dated 1536–1541 in Fuchs' *Vienna Codex 11 121*, 2(2) folio 535, which displays a plant named

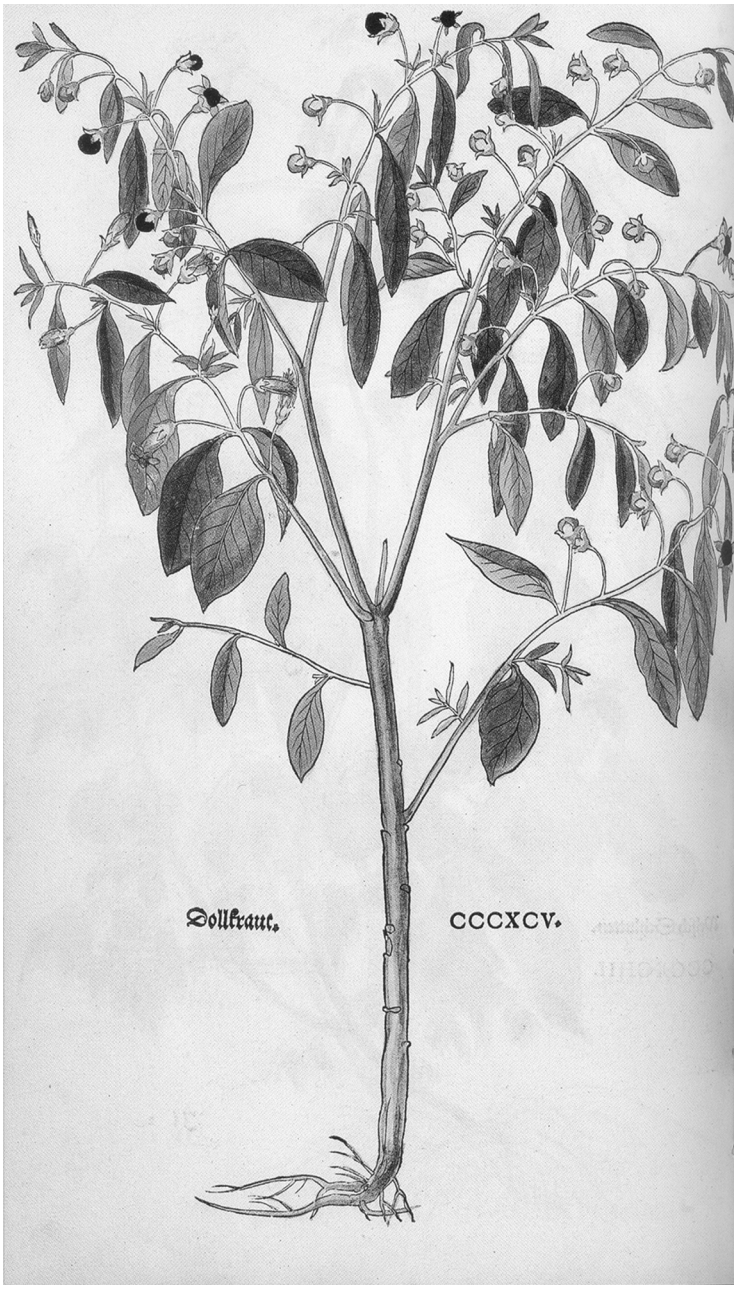

Fig. 1.4. Belladonna, Fuchs 1543, folio 395. Source: Fuchs, *The New Herbal*, Taschen, 2001. Copyright: Ulm Municipal Library.

Fig. 1.5. Belladonna, Aldrovandi, *Il Teatro della Natura*, vol. 5-2, folio 195, 16th century (2d half). Source: www.filosofia.unibo.it/aldrovandi. Copyright: Bologna, University Library.

Fig. 1.6. Belladonna. Source: Parkinson, 1640. Courtesy: Library of Missouri Botanical Garden.

Mandragora Morion Dollkraut with one large leaf at the basis with, quite long internodes, solitary and reddish bell-shaped flowers, and numerous green or black fruits attached to long pedicels and framed by a large calyx. Fuchs' 1543 woodcut (folio 395), named *Dollkraut*, is the same but reversed and without the large leaf (Fig. 1.4)—it was used by Dodoens (1553), again reversed.

Plants of the same type are present in the herbals of Oellinger (1553, folio 346) with the name of *Solanum somniferum et lethale* and Aldrovandi (second half of the 16th century, vol. 5-2, folio 195) (Fig. 1.5) with several names including *Mandragora Theo*, *Solatron lethale*, and *Solanum manicum*. Dodoens (1553, 1557) repeats the 1543 image of Fuchs (reversed), Lonicer (1587) displays a very crude drawing, and Matthioli (1579) illustrates a quite stiff plant bearing the characteristics of belladonna. This woodcut was used again by Bauhin (ed. 1707). Lobel (1576b), Clusius (1601), Dodoens (1608), Gerard (1633), and Parkinson (1640) used another woodcut (Fig. 1.6) displaying the characteristic flowers and fruits with their large star-shaped calyx.

2. Names. The names identifying the drawings of belladonna in the 16th and 17th centuries are extremely diverse. They include *Solanum lethale*, *S. hypnoticon*, *S. soporiferum*, *S. furiosum*, *Solatrum mortale*, *Solatrum lethale*, *Mandragoras Theophrasti*, *Morion* (Latin); *Seukraut*, *Dollwurtz*, *Dollkraut*, *Schlafbeeren* (High German); *Groote nascaye*, *Dulcruyd*, *Dulle besien*, *Schlaaffkraut*, *Dollkraut* (Low German); *Dwale*, *deadly nightshade*, *Greate Morelle* (English); *Solanum dormitif*, *Solanŭ mortel, Morelle marine* (French); *Acarreadora de sueño*, *Yerva mora mayor* (Spanish); and *Belladona italorum*, *Solatro marino* (Italian).

The origin of the word *belladonna*, now used as epithet, is controversial. An interesting explanation was the belief that the juice, when used as drops placed into ladies' eyes, provoked pupil enlargement, giving them a dreamy and hypnotic gaze thought to be very attractive to men. The modern generic name, *Atropa*, refers to the Greek fate Atropos who cut the thread of life. By naming the plant *Atropa belladonna*, Linnaeus captured the essentials of the plant.

3. Uses. Fuchs (1543) warns about the poisonous nature of the plant. According to Dodoens (1557), the leaves and fruits of the plant are cold to the fourth grade and were used as external applications against any kind of inflammation. But internal use was contraindicated, because deep

sleep, rage (fury), and even death were induced, and Dodoens warns against planting it in any garden given its attractive fruits (particularly to children) and its dangerous effects. The uses of belladonna in witchcraft is not evoked in the Renaissance herbals, but according to Hansen (1978), this species was part of the witches' preparations. Hyoscyamine, the principal alkaloid present in the plant, together with some others such as hyoscine, atropine, and belladonnine, are responsible for the plant's pharmaceutical and psychotropic properties (Evans 1979).

4. Conclusion. Belladonna images are found in the herbals much later than mandrake and henbane, and this can possibly be explained by its confusion with other sleep inducing nightshades (*see* Section D, which follows). This truly malevolent member of the Solanaceae is especially dangerous to children because of its attractive shiny black and sweet fruits, which are deadly. Belladonna is also fatal to many domestic animals and livestock although rabbits, birds, and deer appear to be unaffected. Atropine is still used by ophthalmologists to dilate eyes and is used as an antidote for organo-phosphate and carbamate poisonings.

D. Other Old World Species

Several other Old World species are found in herbals, where they were often treated in a common section entitled ''Nightshades'' (or the Dutch or English or French equivalent) with a confusing nomenclature. *Physalis* spp. belongs to this large group, but we treat it separately (*see* Section III.A and B) given its wider geographical origin. We include here *Withania* and *Scopolia* species as well as more harmless species such as *Solanum nigrum*, *S. dulcamara*, and even edible plants such as the African eggplants (*S. aethiopicum* [scarlet eggplant] and *S. macrocarpon* [Gboma eggplant]). Several of these species were described as sleep-inducing.

***1. Withania* spp.** *Withania* is an Old World genus (D'Arcy 1979; 1991) distributed along north western and north eastern Africa, south of Saudi Arabia and farther east to northern India (Hepper 1991). In the *Codex Aniciae Julianae* (folio 386), a plant with entire and verticillate leaves, groups of almost sessile, accrescent, and very small calyces located at the leaf axis resembles a *Withania somnifera* (Plate 1.10). We did not locate *Withania* in the later Middle Age manuscripts examined. Fuchs (1543) does not mention *Withania* in the *Nachtschatten* section of his *New Kreüterbůch*, but an illustration of it, labeled *Halicacabum*

peregrinum primum, is present in his *Vienna Codex 11 124*, 3(2), folio 393 (dated 1564): according to Baumann et al. (2001), this illustration is a copy from Matthioli (1554). Other woodcuts are found in Matthioli (1579) and Bauhin (ed. 1707)—a reversed copy of Matthioli (1579), but reversed, and Zwinger (1744) under the names of *Halicacabon*—as well as *Solanum somniferum verticilliatum*, *Solanum soporiferum*, *Thrychnos hypnoticos* (Latin), *Solanum dormitif* (French), *Orvale* (Spanish), and *Solano somnifero* (Italian). From the texts of Matthioli (1579) Bauhin (ed. 1707), Zwinger (1744), the flower is described as red, the fruit as yellow, and the root skin as reddish. A woodcut of a plant named *Alkekengi mexicanum* that resembled *Withania somnifera* was found in a 1651 book describing Mexican plants by Franscisco Hernandez, a Spanish physician, but since *Withania* is an Old World genus, this attribution must be incorrect (though possibly it could have been introduced in the New World).

Aldrovandi (vol. 2, folio 174) represents a similar plant also with almost sessile, accrescent, and very small calyces grouped by two at the leaf axis, but with alternate leaves. He entitles this painted drawing *S. somniferum* (Fig. 1.7). Lobel (1576b), Clusius (1601), Dodoens (1608), Gerard (1633), and Parkinson (1640) all provide the same woodcut of a plant with seemingly alternate leaves and calyces grouped by 3 or 4 instead of 2 and much larger than those in the Aldrovandi painting. From the accompanying texts at our disposal, we cannot interpret the flower and fruit colors. This plant resembling a *Withania* species, has various names: *Solanum somniferum Clusijfoliis*, *Hyoscyami lutei*, *Somniferum verticilliatum* Matth., *Strychnos hypnoticos*, *Strychnos hypnodes* (Latin); *sleepy nightshade* (English); *Slaepmakende Nascane* (Low German); *Solanum dormitif* (French); and *Yerua mora que acarrea locura* (Spanish).

The properties of these plants that we identify as possibly *Withania* spp. are described as soporific (root and skin consumed with wine), analgesic (juice), diuretical and good against hydropisy (seeds), and causing frenzy and loss of self-control at high doses (Matthioli 1579; Bauhin ed. 1707). According to Bauhin, the quality of the root is dry at the second degree and cold at the third degree.

2. *Scopolia* spp. Scopolia is an Old World genus found from Mediterranean area to Himalayas (D'Arcy 1979, 1991). Illustrations of putative *Scopolia carniolica* are present in the 16th century herbals together with images of the plants identified as *Withania* spp. Fuchs (1543) does not illustrate *Scopolia* in the *Nachtschatten* section of his *New Kreüterbůch*. The woodcuts in Matthioli (1579) and Bauhin (ed. 1707), similar to each

Fig. 1.7. Putative *Withania* sp. Aldrovandi, *Il Teatro della Natura*, vol. 2 folio 174, 16th century (2d half) Source: www.filosofia.unibo.it/aldrovandi. Copyright: Bologna, University Library.

other, display a plant with long narrow entire leaves, kinds of tubular flowers and globular berries tightely enclosed into a large calyx. Those of Parkinson (1640) (Fig. 1.8) and Zwinger (1744) are similar to each other but slightly different from those of Matthioli and Bauhin. Compared to *Withania*, the plant displays a much fleshier root, longer and narrower leaves covered with a dense network of veins, long flower and fruit peduncles that are born at the leaf axils, much shorter calyces,

Fig. 1.8. Putative *Scopolia carniolica*. Source: Parkinson 1640. Courtesy: Library of Missouri Botanical Garden.

bell-shaped flowers, and globular berries with a pointed tip. The authors describe it as having purplish flowers and deep red to blackish fruits. Bauhin specifies that it grows spontaneously in the mountains in Italy. The illustrations are named *Solanum somniferum*, *Solanum somniferum bacciferum*, *Solanum somniferum alterum* (Latin); *Sleepy nightshade* (English); *Schlaf beere* (Low German); and *Solanum dormitif* (French). It is credited with properties similar to plants we identified as *Withania* spp. Evans (1979) details the various alkaloids found in *Withania* and *Scopolia*.

3. *Lycium* spp. The genus *Lycium* is widespread in warm temperate areas (D'Arcy 1979, 1991). A plant with entire leaves, black and sessile fruits in manuscript *Latin 6823* (dated 1330–1340) folio 67v, though referenced as ''morelle'' by BNF, could be a *Lycium* sp. Many more crude images of plants without flowers and fruits are referenced as ''lyciet'' (Solanaceae) by BNF in these sources: *Latin 6823* folio 86 and 152v, ca 1330–1340; *Français 1312* folio 38, *Français 12320* folio 200v and *Français 12321* folio 215, all dated middle of the 15th century; *NAF 6593* folio 192, dated 1452; *Français 12319* folio 303v, and *Latin 6822* folio 66 and 126, both dated second half of the 15th century. Fuchs (1543) does not provide an illustration of *Lycium* in the *Nachtschatten* section of his *New Kreüterbůch*, but there is one in his *Vienna Codex 11 120*, 2(1) folio 425 painted 1555–1560, labeled *Clematis altera minor tertia indicave* and identified by Baumann et al. (2001) as *L. barbarum.*

4. *Solanum nigrum* (black nightshade). *Solanum nigrum* is native in Europe, much of Asia and northern Africa (M. Nee, pers. commun.). It is listed in the *Codex Aniciae Julianae* of 512 CE (folio 292v) (Plate 1.11), where the plant is represented with entire leaves, flowers, clustered, immature and ripe fruits. Various drawings of Medieval manuscripts (*Grec 2179* folio 101v, end of 8th century; *Latin 6823* folio 137, ca. 1330–1340; *Français 1312* folio 22v, *Français 12320* folio 173, *Français 12321* folio 198v, all of the middle of 15th century; and *Français 12319* folio 278, end of 15th century) display painted plants that look like *S. nigrum*. They display clustered green and black fruits; however, the leaf indentation is very variable. In the manuscripts *Français 12322,* folio 185v (ca. 1520–1530) and *Latin 9474* folio 232 (ca. 1503–1508), the plant is represented with white flowers. An inaccurate painted drawing displaying white flowers located at the tip of the green fruits is found in a book that, according to Wickert (1993), is the second printed herbal, that is, the *Herbarius* of Peter Schöffer (1485).

Many other crude paintings of black nightshade, also identified as *morelle* (black nightshade) by BNF, are present in Medieval manuscripts, and display a diversity of features: globular or oblong fruits, single or grouped by two, yellow (*Français 1311* folio 39, middle 15th century; *Français 12322*, folio 182, ca. 1520–1530), red (*Latin 6822*, folio 50v, second half of the 15th century; NAF 6593, folio 176, 1452), or brownish (*Français* 12320, folio 85, and *Français 12321*, folio 107v, both dated middle 15th century; *Français 12319*, folio 156, third quarter of the 15th century). This morphological diversity is probably a combination of both artistic fancy and illustrations of different *Solanum* species. For example the plant with entire leaves, solitary small, oblong and brown berries of *Français 12319*, folio 156 could be an eggplant.

Many drawings and paintings of *S. nigrum* are found in Renaissance herbals, some unique to a single herbal (Brunfels 1530–1532; Aldrovandi second half of the 16th century, vol. 5-2, folio 189; Matthioli 1579; Lonicer 1587; Zwinger 1744); while others have been recopied, such as the woodcut of Fuchs (1543 folio 392), which has been used by Dodoens (1553, image reversed). The woodcut present in Lobel (1576b) has been copied by Dodoens (1608) and Parkinson (1640). The drawing present in Bauhin (ed. 1707) is a copy of Matthioli (1579) but simplified and reversed.

Various names are attributed to these images, such as *Solatrum, Solanus, Solanu, Solaria, Solanum hortense, Strychnos, Maurella, Maurella a macro, Morella, Vua lupina, Vua vulpis, Vua canina, Hortensium* (Latin); *nightshade, Morel, Petye morel, bowndes berri* (English); *Nachtschatt/Nachtschadt* (high German); *Nachtschade, Nascaye, Nascane* (Low German); *Morelle* (French); *Morella, Yerva mora* (Spanish); *Solatro/Solatro hortolano* (Italian); and *Trychnos* (Greek).

Fuchs (1543) refers to the cold and wet properties of the leaves, although he comments that the efficacy for ''cooling'' and ''drying'' is moderate. Matthioli (1579) say that leaves have a cooling effect on inflammatory disorders such as ulcers, headaches, stomach burning, and that it restrains immoderate menstrual flow and can be used for eye lotions and ear aches. Bauhin (ed. 1707) indicates that the leaves as well as the fruits can be used in medicine. According to Matthioli, the leaves are also edible.

5. Other *Solanum* spp. Matthioli (1579) refers, unfortunately without any drawing, to a *Solanum furieux*, also named *Persion* and *Thryo*, with black flowers and infructescences of 10 to 12 small black fruits, the root of which, when prepared in a diluted beverage, induces pleasant visions but when more concentrated induces loss of self-control and even death. Dodoens (1608), also without any drawing, refers seemingly to the same

species, also with black flowers, that he names *Solanum manicum*, *Strychnon manicum*, *Furiosum solanum*, *Thryon*, *Thryoron*, *Bryoron*, *Persion,* and *Dulmakende nascaye* (in Low German). We could not identify this species, which the authors claim to have properties similar to those of *Withania* spp. and *Scopolia carniolica*.

Solanum dulcamara. This species, native to northern Eurasia (M. Nee, pers. commun.), is more rarely represented in herbals than *S. nigrum*, although beautiful paintings of it are found in a manuscript dated ca. 1503 to 1508 (*Latin 9474*, folio 59) (Plate 1.12), in Fuchs' *Vienna Codex 11 120,* 2(1) folio 423 (folio painted between 1543 and 1548), and Oellinger's manuscript (1553). Lobel (1576b), Dodoens (1608), Gerard (1633), and Parkinson (1640) use all the same woodcut. Included mong the names designating the plant are *Amara dulcis, Dulcamara*, *Solanum lignosum*, and *Solanum fruticosum*, but there are others as well. Parkinson (1640) says that both leaves and fruits are hot and dry, and are used for curing disorders such as bruises and fevers.

Scarlet (Solanum aethiopicum) *and Gboma* (S. macrocarpon) *eggplants from Africa.* These two species are native from tropical Africa (Daunay et al., 2001). A plant resembling *S. aethiopicum* Kumba Group, with large fasciated fruits and lobate leaves, is found in Besler (1613, Tafel 322) (Plate 1.13) under the name of *Solanum pomiferum*. Similar fruits but less lobed leaves are displayed on the painting by Aldrovandi (vol. 2 folio 172) labeled *Solanum pomiferum quod Mandragoras* (relating at once the plant to the nightshade family): This plant is either a *S. aethiopicum* Kumba or Gilo Group. Another drawing present in Lobel (1576b) and Parkinson (1640, same woodcut), which is entitled *Solanum pomiferum herbariorum* by both authors (Lobel adds the name of *Piper de Guynee vulgo*; notice that the name *Piper de Guinea* was used in 1640 by Parkinson for designating a capsicum pepper), was identified by Lester and Niakan (1986) as a *S. aethiopicum* Shum Group. Another woodcut named *Mala aethiopia* is found in Dalechamps (1587 p. 1730), and, reversed, in Gerard (1597), Dodoens (1608), Gerard (1633), and Parkinson (1640): this image was identified by Lester and Niakan (1986) as *S. aethiopicum* Aculeatum or Gilo Group. Much later drawings by Zanonii (1742) closely resemble *S. aethiopicum* Aculeatum Group (p.157) and *S. macrocarpon* (p. 158). According to Gerard (1597), *Mala aethiopia* was not used for medicinal purposes, but only as food for wealthy people (boiled in the broth of fatty meat with pepper and salt) and had less harmful juice than either mad apples (i.e. eggplant) or golden apples (i.e. tomato).

Other Species. A few other Solananeae are present in the Medieval and Renaissance manuscripts, such as the beautiful *S. villosum* with globular red fruits in Oellinger (1553), but they are not discussed here because of the paucity of information.

6. Conclusion. There are many miscellaneous solanaceous species referred to in herbals, but definitive identification of all of them is difficult, given the way the plants are treated in Renaissance documents (often in the same chapter, sometimes without drawings). Positive identification requires the combined expertise of linguists who understand old European languages and botanical experts of the Solanaceae. Some species are described as powerful plants with a strong influence on human behavior, others with quieter medicinal or alimentary properties. Medieval and Renaissance works use a variety of names for them, a number of which are sources of confusion because they were common to several species, e.g., *S. somniferum* is a name for *Atropa belladonna* and species of *Withania* and *Scopolia*.

E. Eggplant/Aubergine (*Solanum melongena*)

The center of origin of eggplants is located from North East India and Burma to northern Thailand, Laos, Vietnam, and Southwest China, and wild plants can still be found in these locations (Lester and Hasan 1991). The earliest information on eggplants dates from Sanskrit documents, written about 2,000 years ago, suggesting that eggplant had been popular in ancient India. Botanical and agricultural sources of the same period suggest that it was also cultivated in China as early as the 5th century CE. From China, eggplant migrated eastward to Japan, probably during the 8th century, and was carried westward along with Muslim conquests. It was well known in the Middle East during the early Arabic period (Amar 2000). Eggplant probably reached Spain in the 8th century and the rest of Europe soon after, and about this time reached Africa by Arab and Persian travellers. Greek and Roman authors do not mention eggplant. During the Mamelouk period (1250–1517), eggplant is mentioned among the crops grown in the land of Israel as an annual, though in the lower Jordan valley semi-perennial eggplant type (possibly the spiny eggplant's close wild relative, *Solanum incanum*) was cultivated. This difference fueled a Jewish legal controversy as to whether eggplant was a vegetable or the fruit of a tree (Amar 2000).

1. First Records. The earliest image found is a black-and-white drawing of a small plant bearing two globular fruits and possibly white fruits

(Fig. 1.9), part of the *Yinshan Zhengyao* by Hu Sihui (1330), a treatise about the principles of safe food written by the dietician of the Mongol emperor (Buell and Anderson 2000). A European painting of about the same time (ca. 1330–1340), from an Italian manuscript referenced as *Latin 6823*, folio 106v (Plate 1.14), accompanied by some text, displays two leafy branches bearing several large globular light violet fruits.

Eggplants are also found in at least five of the some 10 extant illustrated copies of *Tacuinum sanitatis* or *Tables of Health*, which were miniature books for aristocratic families of the 14th and 15th centuries derived from the medical treatise *Taqwim al-sihha bi al-ashab al-sitta* (''straightening up health by six causes'') authored by the 11th century Baghdad physician known as Ibn Butlan (Mane 2006). In the copy (*Ms 4182*) held by the

Fig. 1.9. Eggplant, Hu Sihui, *Yinshan Zhengyao* (1330). Source: Buell and Anderson 2000. Courtesy: Paul Kegan and A. Jacobsohn.

Casanatense library (Rome, Italy) as well as in the one held in the town Library of Rouen (France) (referenced as Leber 1088, *Ms 3054*) a field of adult plants bearing globose purplish fruits is represented (respectively folios 41 and 21). In *NAL 1673* folio 25v (held by BNF) an astonishing image of an eggplant tree (!) bearing abundant oblong violet fruits (Plate 1.15) is one example of the artistic license used by some Medieval painters, often clearly unaware of the plant being illustrated. In *Latin 9333* folio 21 (held by BNF), and in the copy held in the national Austrian Library of Vienna, *SN 2644* folio 31v (Plate 1.16), large plants with typical leaves and dark purple, obovate fruits constitute the background of a scene where an amorous couple is admonished by a punctilious lady, thus suggesting an aphrodisiacal effect of eggplant.

Beautiful, realistic potted eggplants are illustrated in a miniature of *Ms 2396* held in Vienna (folio 6v) dated ca. 1480 (Plate 1.17). Other 15th century manuscripts (*Français 1310* folio 33v; *Français 12319* folio 226; *Français 12320* folio 135v; *Français 12321* folio 160v; *NAF 6593* folio 144; *Latin 6822* folio 85), derived from the 12th century *De simplici medicina* of Matthaeus Platearius, display quite monotonous and simplified paintings of entire plants with oblong to globose, whitish or brownish fruits.

In the 16th century manuscripts of Oellinger and Aldrovandi (Plate 1.18), as well as in Besler (1613) (Plate 1.19), eggplants are represented with violet flowers and purple or yellow or white, pyriform or oblong fruits. Compared to these careful illustrations, other contemporary as well as later printed illustrations are disappointing because all those examined, such as Bock (1546); Dodoens (1553, 1557, and 1608); Lobel (1576b and 1581); Lonicer (1587); Gerard (1633); Parkinson (1640); and Zwinger (1696), as well as some of the 18th century (Bauhin ed. 1707; Zwinger 1744) are very crude and quite monomorphic. Most of them are closely related to the woodcut published by Fuchs in 1543 (Fig. 1.10), which represents a whole plant with roots, leaves, buds, flowers, and 3 to 6 (depending on the copies) small, egg-shaped and somewhat deformed fruits. Curiously, eggplant is absent from the Gesner's manuscript, dated before 1565. Durante (1585) displays a stylized drawing of a potted plant with small egg-shaped fruits. Gerard (1597) published the 1590 woodcut of Jacobus Theodorus better known as Tabernaemontanus, that shows differently stylized plant and fruit features. Dalechamps in 1586–1587 includes three images of plants: one with egg-shaped fruits (Fig. 1.11A), one with two fruits types—obovate, and ovate with a very sping calyx (Fig. 1.11B); the last image displays, for the first time, very elongated fruits (Fig. 1.11C).

The texts describe the flowers as brown (which should probably be understood as purplish), reddish, purplish, or white, the fruits as

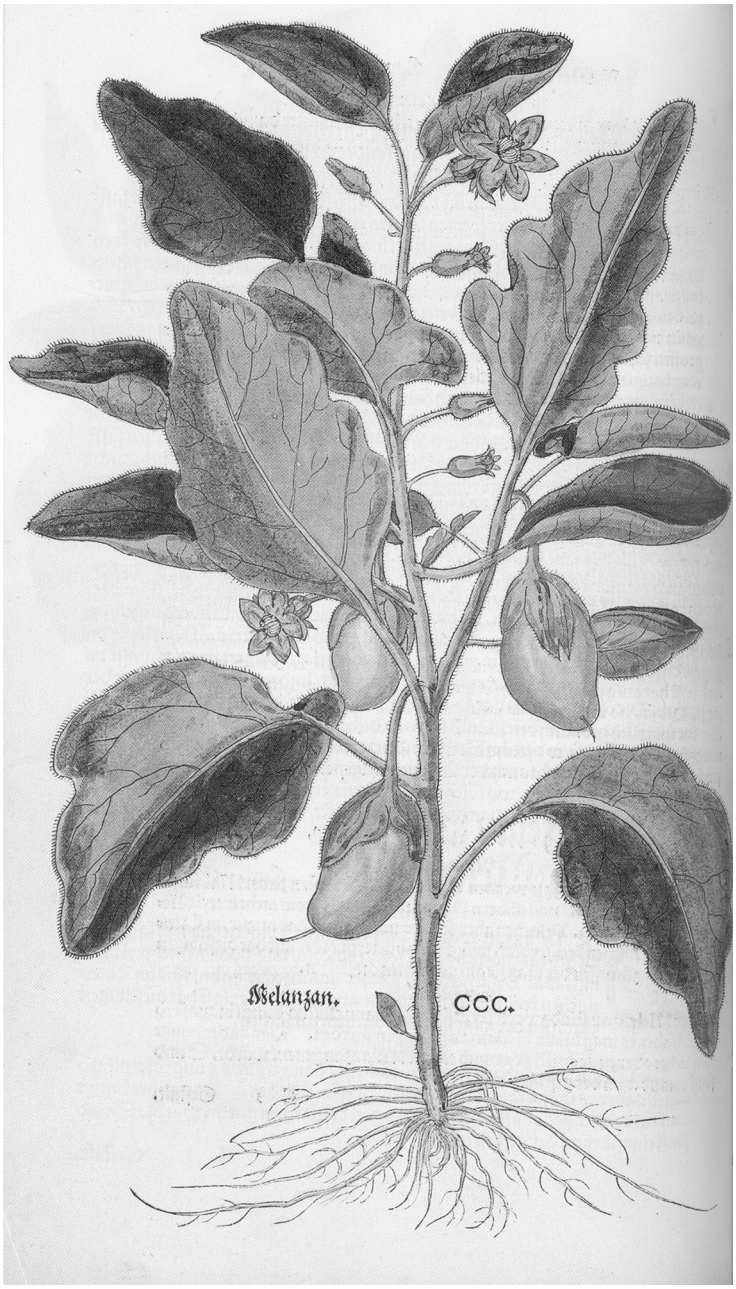

Fig. 1.10. Eggplant, Fuchs 1543, folio 300. Source: Fuchs, The New Herbal, Taschen 2001. Copyright: Ulm Municipal Library.

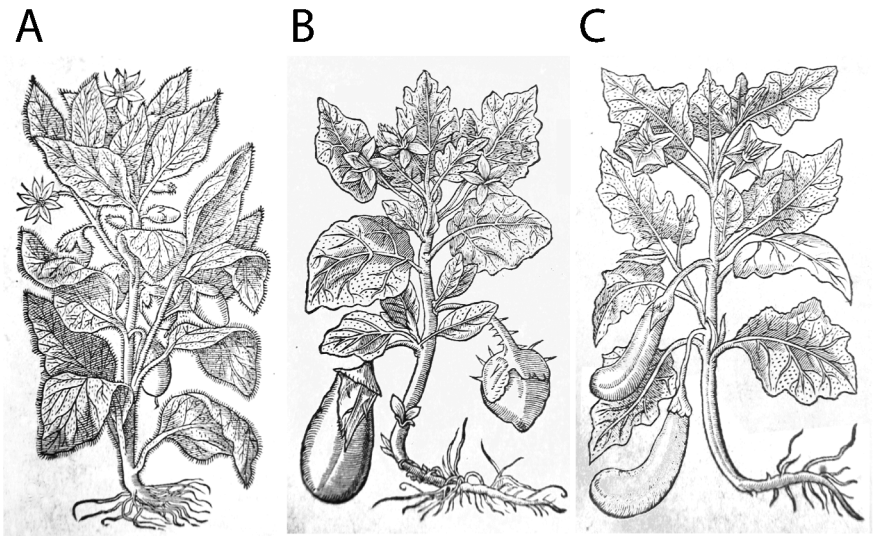

Fig. 1.11. Three eggplant types: (A) egg shaped (B) obovate left, and, ovate with a very spiny calyx, right (C) elongate. Source: Dalechamps 1586–1587. Courtesy: Musée Requien, Avignon, France.

globular or long; they are compared to a plum, an egg, an apple or a cucumber, with a purplish, whitish, or greenish color (immature fruits), or brown or yellow (mature fruits). Also recorded are hairs on the leaves, spines on the calyx (called a ''small cup''), and many small flat yellowish seeds within the fruit pulp. The first analytical drawing of eggplant found was published by Pitton de Tournefort in 1694, with a fruit section and flower dissection.

In hand-tinted versions of these Renaissance herbals, one notices some artistic license. For example, fruits of the same woodcut are either yellow or purple in two hand colored copies (Taschen 1999; Barker, 1994) of the first edition of *Hortus Eystettensis* of Besler (1613); in Fuchs' *New Kreüterbůch* (1543) fruits are green whereas in the similar drawing by Bock (1546) they are bright pink or white, and this while their respective related texts describe them as brown, white, or yellow (Fuchs), or purple-brown or white (Bock).

Eggplants are also found in late Renaissance and Baroque paintings. In the frescoes of the ceilings of the Loggia of Cupid and Psyche in the Villa Farnesina painted by Giovanni da Udina, a member of the workshop of Raphael, dated 1515 to 1518 (Caneva 1992), there are 31 pyriform or globose eggplant fruits; immature ones range from light violet to purple, many showing a white ground color, and mature

ones are yellow. Eggplant fruits are also present in the portrait composed of fruits called *Summer* of G. Arcimboldi, 1573; the *Fruttivendola* (Fruit Seller) of V. Campi, ca.1580; the *Ritratto composito* of F. Zucchi, ca. 1600; the *Wedding of Thetis and Pélée* by H. van Balen, ca.1618; the *Still Leben mit Kürbissen* by J.A. van der Baren, ca. 1650 (Plate 1.20); and in *Scena di mercato* of G.F. Cipper, known as Todeschini, ca. 1700. In all these paintings, the small to medium-size globose fruits are violet or yellowish. Similarly shaped fruits were carved on the bronze doors of the Pisa cathedral in 1601 (Fig. 1.12). Eggplant is also found in Asian iconography contemporary with the European Renaissance. A folding screen painted by Sin Saimdang (1504–1551), mother of Lee Yul Gok, the illustrious Confucian scholar in the Joseon dynasty in Korea (International Horticultural Congress Abstracts 2006) shows two plants with oblong fruits, one with a spineless calyx and white fruit, and the other with prickly calyx and violet fruits in which the color lightens toward the calyx and is clearly white under the calyx, indicating homozygosity for the recessive allele of the *Puc* gene (Tatebe 1939; Janick and Topoleski 1963), which stops anthocyanin synthesis when light is absent. Globose violet fruits are also found in a Indian manuscript dated 17th to 18th century (*Supplément persan 1568*, folio 81 (Fig. 1.13).

2. Names. The literature contains many names for eggplant, due to the many appellations in its home country (India), the number of countries where grown, together with the transliteration difficulties from one

Fig. 1.12. Eggplant on bronze door of Pisa cathedral, Italy, 1601. Source: J. Janick.

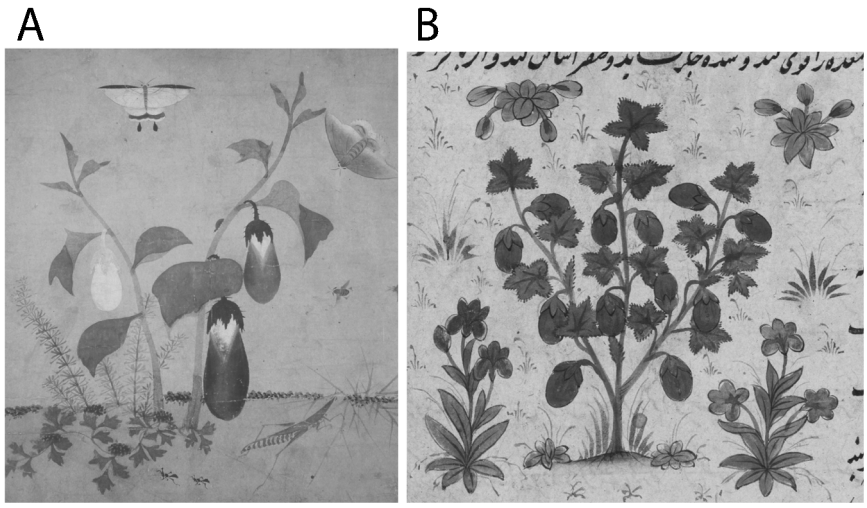

Fig. 1.13. Images of eggplant from Asia: (A) Korean screen painted by mother of Lee Yul Gok, 16th century. Source: International Horticultural Congress, Abstracts book, 2006; (B) Persian image from Manuscript S*upplément persan 1568,* folio 81, 17th–18th century. Source: Bibliothèque nationale de France. *Copyright: Bibliothèque nationale de France.*

language to another; hence the linguistic relationships between these names need to be cautiously handled. From De Candolle (1890), Hedrick (1919), Bhaduri (1951), and Khan (1979), we cite here a number of these apparently related names: *vartta*, *varttaka*, *vaatinga* or *bhantaaki* in Sanskrit, and *badanjan* or *bungan* in Hindustani are possibly at the origin of *baadangan*, *baatangaan*, *badenjan* in Persian; which could have led to *bedengiam*, *bedengaim*, *badindjan*, *baadanjaan*, *melongena* in Arabic; *patlidjan* in Turkish; *badnjan* in Georgian; *tabendjalts* in Berber (North Africa); *beringela* in Portuguese; *berengena* in Spanish; and *bérengène* and *aubergine* in French. *Brinjal*, one of the common eggplant names in India, derives from the Portuguese *beringela* coined when the Portuguese were the masters of the trade between India and Europe during the 16th and 17th centuries. *Brinjal* is possibly the source of the French *bringelle* used in La Réunion (Island), where people of Indian origin long reside. The word *eggplant* in English (the name used in the United States, although in the UK eggplant is now commonly referred to as aubergine) dates to the British occupation of India, where white egg-shaped fruits were, and still are, very popular in some areas. This name also suggests that a number of early introductions into Europe had small ovoid white fruit, and this is partially confirmed by study of the iconography.

Middle Age Persian writers on medicine and botany often urged caution about the use of eggplant (Encyclopedia Iranica 1988), though Moorish authors such as Ibn al Awam who lived in Spain in the 12th century considered it positively (Cubero Salmerón 1999). European herbalists associated it negatively with poisonous solanaceous herbs connected to witchcraft, in particular mandrake, and eggplant is often found in Renaissance herbals either within the mandrake chapter (e.g. Matthioli, 1544), just after it (e.g. Fuchs 1543), or placed between the mandrake and the henbane chapters (e.g. Lobel 1581). The origin of the confusion between eggplant and mandrake is unclear. From clues provided by Dodoens (1553), Lobel (1576b), and Gerard (1633), it may have originated from misinterpretation of names given by Dioscorides and Theophrastus such as *Morion.* Some Persian and Arabic words designate the two species (Encyclopedia Iranica 1988) and this may have also contributed to the confusion at a time Greek documents were translated into Arabic. Matthioli (1544) suggests the confusion to be the result of a misinterpretation of H. Barbarus's writings (1454–1493) by A.M. Brasavola (1500–1555) and L. Fuchs (1501–1566). But the relative similarity of the fruit of eggplant and mandrake has also certainly contributed to the confusion at some stage. This confusion is at the origin of the Latin vocable given to eggplant, *Mala insana*, which was the source of the Italian name *Melanzana,* and thus, the name *mad apple* and perhaps the derogatory term *Jew's apple* in English, although this may refer more specifically to the African eggplant (*Solanum aethiopicum*).

In Medieval manuscripts, eggplant is found under the names *Melongiane* or *Melongiana* or *Melonge*. According to Dalechamps (1653), Hermolaus Barbarus (1454–1493) was the first to use the Latin vocable *Mala insana* (or *Malum insanum* in singular). Although Dalechamps thought the name inappropriate, it was variously inflected as, for instance, *Mala insana vel melazana citrina* and *Mala insana purpurea* (Oellinger 1553), *Mala insana lutea*, *Mala insana purpurea* (Aldrovandi, late 16th century), *Mala insana Europea,* or *Mala insana Syriaca* (Parkinson 1640). There were vernacular counterparts of the name *Mala insana*, such as *Mad apple* or *Raging apple* (English); *Doll öpffel*/*Dollöpffel*/*Dollopffel*/*Dulle Appelen* (German); and *Pommes de rage*, *Pommes de fureur*, *Pommes furieuses* (French).

Eggplant was also called *Poma amoris* or *Amoris Poma* (i.e. *Love apple*) in English; *Pommes d'amour* in French; and *Pomi d'amore* in Italian, a name that this species shared for a time with tomato. Ruel (1474–1537), quoted by Dalechamps (1653), suggested that eggplant

fruits were called *Love apple* because of their beauty. These contrasting names, *Mad apple* and *Love apple*, well represent the contradictory opinions about this plant.

Many other names flourished in the herbals, a diversity that continued to evolve in later centuries, such as *Verangenes/Verangenas/Verágenes/Verágenas* (French, Low German, and Spanish); *Melantzan/Melanzan/Melanzana* (High and Low German, Italian); and *Melongena* (Arabic). According to Lobel (1576, 1581), the Persian physician Abu Ibn Sina, 980–1037 (latinized as Avicenna) and the Andalusian-Arab physician Abu al Walid Ibn Rushd, 1126–1198 (known in the West as Averroes) were the first to use the name *Melongena*, which became *Solanum melongena* in the 1753 *Species Plantarum* of Linnaeus (vol. 1 p. 186). In Italy, the multiplication of names (*Melongena*/*Melogena* in Lombardy, *Petranciani* in Toscany, *Merenzana* in Genova) is an indicator of the popularity of eggplant there in the Renaissance.

3. Uses. As is true of almost all vegetables, eggplants had medicinal, culinary, and even ornamental uses. In India, eggplants were used for medicinal purposes (Khan 1979); they are also described in Medieval Arabic texts such as the *Taqwim al-sihha bi al-ashab al-sitta*, already mentioned (Section II.E.1). In Europe, the medicinal properties of eggplant seem to have been controversial. In a copy (*Français 12322*, ca. 1520–1530) of the *Circa instans* of Matthaeus Platearius (12th century), also known as *Le livre des simples medicines*, eggplants are said hot and dry, which is confirmed by Dalechamps (1653), but Fuchs (1543) and Durante (1585) claim that they are cold and wet. Whatever its properties, Fuchs (1543), Dodoens (1557) as well as Dalechamps (1653) all mention the poor use of eggplant in European medicine. Durante's woodcut (1585) suggests that eggplants were sometimes grown for decorative purposes, and in a 1605 French edition of Matthioli, readers are reminded of eggplant's aphrodisiac properties: *Il y a de nos gens qui mangent les pommes d'amour, pour se rendre plus disposts au ieu des dames* (some people eat love apples in order to become more receptive to flirtation).

Eggplant is present in Medieval cuisine (Weiss Adamson, 2004). According to the *Book of Agriculture* of Ibn El Awam (12th century), and to Italian Herbalists of the Renaissance such as Matthioli (1579) and Durante (1585), eggplant was a favorite food in Southern Spain as soon as the 12th century, and in Italy by the 16th century. Fuchs (1543), Durante (1585), and Dalechamps (1653) indicate various ways of eating them, such as (1) cooking the fruit like mushrooms

with oil, salt, and (black) pepper; (2) boiling and peeling them, then powdering the slices with flour, and frying them in oil or butter and serving them with salt and pepper; or (3) boiled, and arranged in a salad with salt, pepper, and vinegar. However, these authors as well as others (e.g. Matthioli, 1579; Lonicer, 1587), comment that eggplant fruits are unhealthy food that provoke all kinds of ailments, such as melancholia, sadness, cankers, leprosies, hemorrhoids, headache, hardening of liver, fever, and malodorous breath, yellow and black color (bilious) to the body, and several other maladies. Still, Lonicer comments also that the plant is grown in gardens more for enjoyment than for food or medicinal uses. Fuchs (1543) summarizes the general opinion about eggplant used as food by saying that this food is loved only by the Epicurians who do not mind the health impact of what they eat so long it tastes good, but sensible people concerned for their health should keep away from them. However, Durante (1585) affirms that when prepared properly, the fruits are less harmful, and Dalechamps (1653) cannot refrain from commenting that such fruits have a nice taste.

4. Conclusion. There are numerous images of eggplant in Medieval and Renaissance documents. There should be extensive iconography from Indian and Far-East (China, Korea, Japan) sources, but we have been able to locate only very few. In Europe, it was well understood that eggplant was of foreign origin. The plant was common in gardens where it flowered in summer and autumn, set fruits in autumn, and perished with the first frosts. It was known that it did not grow well in cold climates such as in Germany but was particularly prosperous in Italy.

The dominant type had globose or oblong fruits, of a generally medium size, purplish or white. From the various drawings, paintings, and texts, it is clear that people of these times did not establish a clear difference between physiologically unripe (purple or white or green) and ripe (brown or yellow) fruits. As eggplant was early associated with mandrake, and hence allocated its disturbing properties, a negative prejudice was endlessly repeated by successive authors, though it is clear from their texts that their feelings about the plant were ambiguous.

III. OLD AND NEW WORLD SOLANACEAE

The genus *Physalis* is present in both the Old and New World. The Old World species, alkekenge, was used as medicinal plant, and New World

species (husk tomatoes) were used as medicinal, ceremonial, and food crops.

A. Alkekenge (*Physalis alkekengi*)

This species from Eurasia, is the only species of *Physalis* definitely native in the Old World (M. Nee, pers. commun.). It is now known by a bewildering number of names including *Winter cherry* and *Chinese lantern*, is an ancient medicinal herb, which has a special status within the Solanaceae since it it is a non-noxious species (in contrast to mandrake, henbane, belladonna, and various other herbs), and was used exclusively for medicinal purposes.

1. First Records. *Physalis alkekengi*, with its bright orange-red calyx (husk), is painted in color in the 6th century *Codex Aniciae Julianae* folio 359v (Plate 1.21). The plant is complete (roots and aerial part with leaves and fruits hidden within or exerted from the ripe orange calyces), but it has no flowers. A similar drawing, of a much lesser quality, is found in a 7th century Dioscoridean manuscript (*Codex neapolitanus*, folio 148), but it is unclear if this is a copy or a sister image based on a lost archeotypic manuscript. Images in later Medieval herbals written in Latin or French, such as *Latin 6823* folio 84v (dated ca. 1330–1340); *Herbarius* of Peter Schöffer (1485); *Latin 9474* folio 108 (dated 1503–1508); as well as a copy of the *Livre des simples médecines* of M. Platearius (*Français 12322* folio 186, dated ca. 1520–1530) are common and approximately faithful for plant morphology, except for some details such as leaf arrangement which varies from verticillate to alternate. The illustration in *Codex bellunensis*, folio 70 (Fig. 1.14), dated 15th century, is remarkable for the presence of details such as the white flowers, unripe and ripe fruits visible through transparent calyces, and an opened calyx revealing the berry inside.

Many Medieval illustrations show morphological distortions of *P. alkekengi,* such as a quite imaginary (but beautiful) plant bearing transparent yellow spindle-shaped structures, each containing two small fruits (or seeds) in an 8th century Dioscoridean herbal (*Grec 2179* folio 102) (Fig. 1.15). Another example is a plant bearing several red-orange fruits mistakenly placed at the end of each branch in an Arabic copy of Dioscorides dated 12th to 13th century (*Arabe 2850* folio 16v). A third example is a plant in rosette with a cluster of three central stems, each bearing a single terminal red-orange fruit, frequently represented in 15th century (*Français 1309* folio 42; *Français* ais 12319 folio 67v; *Français 12320* folio 21; *Français 12321* folio 44;

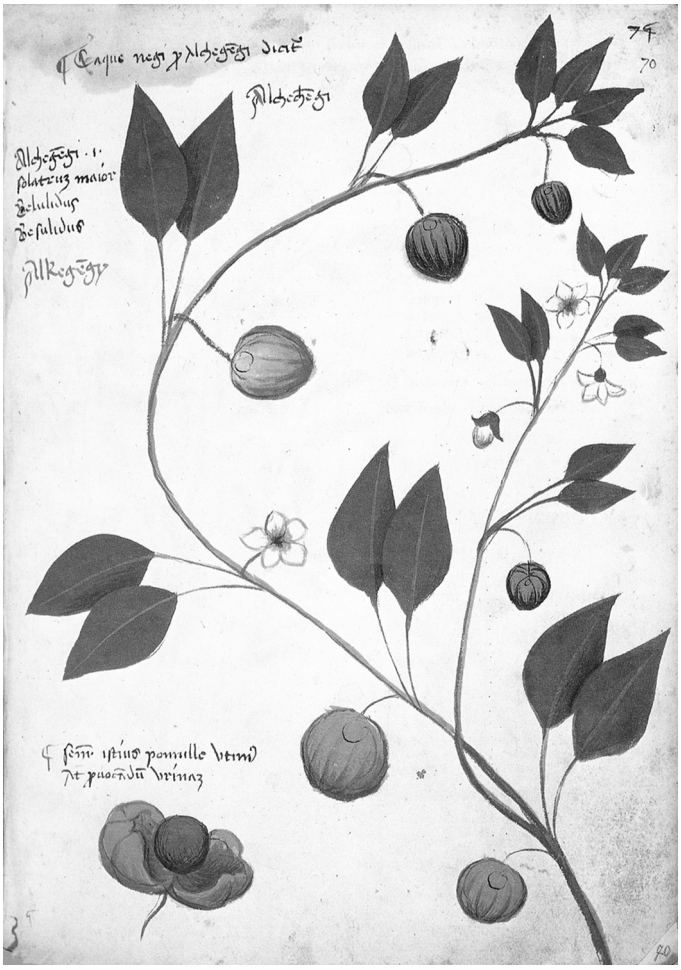

Fig. 1.14. *Physalis alkekengi. Codex bellunensis,* Manuscript Add 41623, folio 70r, 15th century. Source: Blunt and Raphael 1979. Copyright: British Library Board. All rights reserved.

Latin 6822 folio 4; *NAF 6593* folio 42) as well as 16th century herbals (*Français 12322* folio 148v). However, we have some doubts about the correct botanical identification (as given by BNF Web site) of the drawings of this third type, since the plant is really different from alkekenge, and also because of the noun *Appollinaris*, written next to most of these drawings, which was never found again in later documents for designating alkekenge. A fourth example consists of plants bearing fruits that are not inserted at the leaf axis as they should be,

Fig. 1.15. *Physalis alkekengi.* Dioscoridean herbal, Manuscript *Grec 2179*, folio 102, 8th century. Source: Bibliothèque nationale de France. *Copyright: Bibliothèque nationale de France.*

but are connected along the internodes instead (*Français 12319* folio 278v, and *Français 12321* folio 198v, both dated 15th century). Orange calyces of *Physalis alkekengi* were widely used by miniature painters as part, together with other painted plants, of frames adorning various texts and sceneries (e.g. *Français 51* folio 43).

Three 15th century illustrations show careful representations of translucid orange calyces, each containing a globular berry, one with pendant fruits (*Latin 6822* folio 114v), and the two others with semi-erect fruits (*Français 1312* folio 23; *Français 12320* folio 173v). In the *Vienna Codex 11124, 3(2)* folio 391 (painted 1536–1541), Fuchs represents an entire plant, obviously drawn with precise care from a live specimen (white flowers, unripe and ripe fruits, one calyx open to show the berry inside), a woodcut of which has been used by

Dodoens (1553, 1557). In his 1543 New Kreüterbůch folio 393 (Plate 1.22) the same plant is given, but reversed.The other woodcuts of Lobel (1576b), Dodoens (1608), and Gerard (1633) are identical to each other; the one of Parkinson (1640) is very close to them; and the one of Bauhin (ed. 1707) is an exact copy of Matthioli (1579). Alkekenge is also present in Aldrovandi (vol.4, folio 67; vol. 5–2, folio 191). During the Renaissance, alkekenge is often drawn or painted next to the balloon vine (*Cardiospermum* sp., Sapindaceae), another species with inflated floral structures, that Fuchs (1543, folio 393), Dodoens (1557), Matthioli (1579), Lonicer (1587), Aldrovandi, (second half of the 16th century, vol. 2 folio 173), and Besler (1613, Tafel 304 middle drawing) took mistakenly for another type of alkekenge. This is an example of the frequent confusion between species in those times.

2. Names. *Physalis alkekengi* is named *Physalis* in the *Codex Aniciae Julianae*. Similar names were used in 15th and 16th century manuscripts, such as *Alkegengy*/*Alkekengi*/*Alkecangi*/*Alkequange*. The Latin names were many, such as *Cerasa ultramarina*, *Vesicaria, Solanum vesicarium* (or *Vesicula* or *Callion*), *Solanum halicacabum,* and *Halicacabus.* Common names include *Alquequanges/Alquequenges* or *Baguenauldes*, *Cerises d'Outre mer*, *morelle* (French); *Schlutten*, *Boberellen*, *Juden hütlin*, *Juden döcklin*, *Judenkirsen*, *Teufel Kirsen*, *Schlutten*, *roter Nachtschatt* (High German); *Rot Nachtschatt* and *Iuden hutlin* (Low German); *Vexiga de Perro* and *Carreador de sueňo* (Spanish); *Halicacabo* (Italian); and *Strychnos Halicacabos* (Greek). Fuchs (1543) names his drawing *Halicacabum vulgare* and *Judendocken*; Dodoens (1557) uses *Halicacabon* and *Vesicaria vulgaris*; and Aldrovandi uses *Solanum Halicacabu*, *Vesicaria*, *Cerasus Judeor*, *Kekengi*, *Alkekengi sive Kekenegi*, *Halicacabo Italis*, and *Herba coca Bononie*.

3. Uses. In Europe, Dodoens (1557) considered *P. alkekengi* as having cold medicinal properties and the same virtues as those of the common nightshade (*Solanum nigrum*). The fruits were considered excellent for liver and for curing urinary disorders caused by kidney stones. Parkinson (1640) provides additional details: As the leaves had ''cold'' properties, they could be used for curing ''hot'' troubles such as inflammations of kidney and bladder by dissolving the stones, and jaundice by facilitating liquid elimination from the liver. This medicine was to be taken as ''distilled water'' of the fruit or the leaves with milk and sugar, but he also describes other methods of preparation.

According to Evans (1979), the plant contains a range of tropane alkaloids, but not the dangerous hyoscyamine or hyoscine. Alkekengi did not suffer the dangerous reputation of other Old World solanaceous species, but the name *Teufel Kirsen* or *Devil's cherry*, a reflection of the bright red color of the calyx, is suggestive of a trace of fear for this nightshade.

4. Conclusion. In the Old World, alkekenge was long known and used for curing urinary disorders. Although one of the most ancient medicinal plants, this species is now most known as an ornamental for its beautiful calyx, which changes from green to orange and red at maturity. Specimens are beautifully and generally faithfully illustrated in herbal manuscripts. Shoots with fruits are often used as winter bouquets, hence their common name *Winter cherry* or *Chinese lantern*.

B. Husk Tomato (*Physalis* spp.)

The great majority of *Physalis* species are native to the Central America, especially Mexico (D'Arcy 1979, 1991). They were widely and diversely used by the Aztecs and others. Their wide calyx enveloping a globular juicy and often edible berry is at the origin of their common name, *husk tomatoes*. Their iconography is rather scarce. The suffix *tomatl* present in several Aztec names designating these plants as well as tomatoes suggests that both tomato and physalis were considered the same or very closely related plants.

1. First Records. A botanical list of the plants contained in the *Florentine Codex,* also known as *General History of the Things of New Spain,* was set up by Estrada Lugo (1989). This Codex, written in Nahuatl (Aztec language) with partial translations in Spanish, comprises 12 books of text and images, created between 1540 and 1585 by Aztec students from the recollections of Nahuatl scribes, under the supervision of the Franciscan missionary Bernardino de Sahagun. It is the major source of Aztec life in the years before the conquest of Mexico by the Spaniards in 1521. According to Estrada Lugo (1989) the Codex contains many references to *Physalis* species, but the texts and putative images of the codex itself were not accessed. The earliest New World illustration located so far is a post-Columbian drawing of *P. philadelphica* (Fig. 1.16) published in the book on Mexican plants, animals, and minerals published in 1651 by the Spanish physician and naturalist F. Hernandez (1515–1587). In Europe, the first representations of husk tomatoes appear during the second half of the 16th

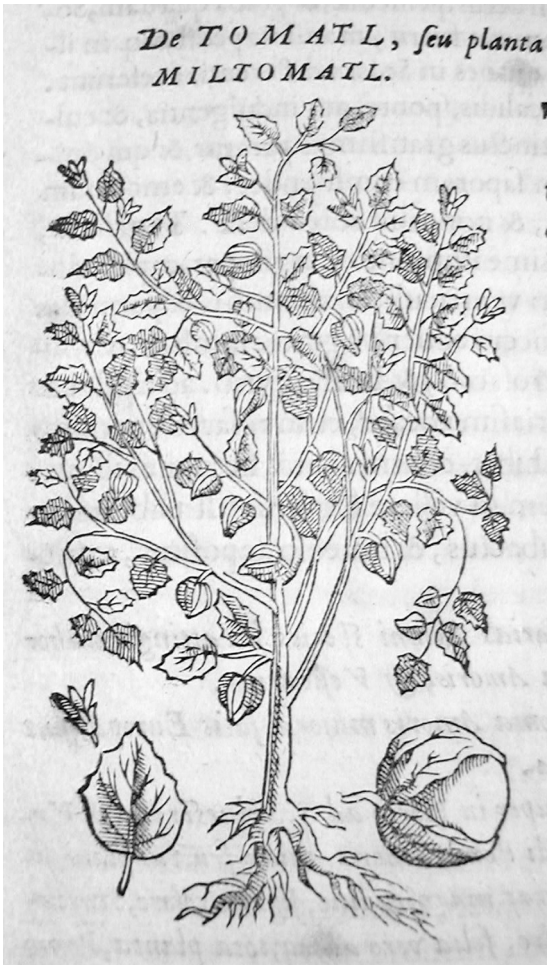

Fig. 1.16. Physalis philadelphica. Source: Hernandez 1651. Courtesy Musée Requien, Avignon, France.

century. Aldrovandi (vol. 2, folio 318) represents a plant remarkably unnamed (he usually provides a wealth of names to his illustrations, and this sudden silence suggests he did not know what the plant was) with small leaves, yellow and large flowers, and small green calyces (Fig. 1.17), one of the first representations of possibly *P. philadelphica*. Another species with a large accrescent calyx was displayed by Camerarius (1588) with the name *Halicacabum sive Solanum indicum*, and later by Besler (1613 Tafel 304 right side drawing) as

Fig. 1.17. *Physalis philadelphica*. Aldrovandi, *Il Teatro della Natura*, vol. 2 folio 318, 16th century (2d half). Source: www.filosofia.unibo.it/aldrovandi. *Copyright: Bologna, University Library*.

Halicacabum seu Solanum Indicum Camerary: the plant has large yellowish flowers with purplish macules and light greenish calyx fully enclosing the berry. This illustration was identified as *P. angulata* by Hedrick (1919). Bauhin (1596) also referred to it in his *Phytopinax*. Two American *Physalis* species are described (without illustrations) by Parkinson (1640): one (*Halicacabum indicum rectum*) which probably, according to his comment, is the one described

by Camerarius, and another with a larger berry filling in the calyx (bladder), which he obtained from Virginia and named *Halicacabum Sive Alkekengi Virginense*. Zwinger (1744) displays a woodcut of a *Solanum vesicarium Indicum*.

2. Names. The Aztec names of the husk tomatoes species mentioned in the *Florentine Codex* (T.III book 11) are *Coztomatl (Physalis costomatl), Xaltomatl* (*P. mollis*), and possibly *Tepetomatl* (*Physalis* spp.), but according to the botanical list of the plants contained in the entire codex (Estrada Lugo 1989), there are further references to *Physalis* species in other books, identified as *Miltomates* (*P. aequata*, *P. peruviana*, *P. philadelphica*), *Tomates (P. angulata, P. costomatl, P. pubescens)*, and *Coyotomatl*, or *Coyototomatl* (*Physalis* sp.). The same suffix *tomatl* or the words *Miltomates* or *Tomates* were also used for designating tomato, and the husk tomato drawing published by Hernandez (1651) is indeed entitled *De Tomatl Miltomatl* (Fig. 1.16). This suggests some confusion between these two juicy-berried species by the Aztecs (or the Spaniards). Indeed, later on, *tomatl* was to be used and deformed by the Spaniards for designating tomato (*see* Section IV.D.2).

3. Uses. According to the T.III book 11 of the *Florentine codex* of B. de Sahagun (Dibble and Anderson 1963), the Aztec used *Coztomatl* as food (fruits sweet, edible, becoming yellow when cooked) as well as for helping digestion and driving away the heat that makes ''*one's flesh burn''*. They used *Xaltomatl* also as food (fruit sweet and edible) and for treating urinary disorders. *Tepotomatl*, inedible, was used when urine was stopped, against constipation, when one had harmed his ''manhood,'' and when the abdomen was swollen. Estrada Lugo (1989), indexing the uses of ''tomates'' as described in the entire codex, mentions the edibility of *P. angulata*, the ceremonial use of *P. pubescen*s, and the medicinal use of *P. peruviana*, *P. coztomatl*, and other undetermined *Physalis* species.

C. Conclusion

New World husk tomatoes (*Physalis* spp.), well known by the Aztecs for various uses, were introduced in Europe toward the end of the 16th century only, but their iconography is rather scarce over the period studied here. The Aztec codices should be investigated in depth for locating *Physalis* spp. illustrations, which could help unravelling their possible confusion with tomato (*see* Section IV.D). None of the *Physalis* species suffered the dangerous reputation of Old World nightshades.

Although producing quite pleasant berries, especially when cooked, the edible American species were not to become as successful in Europe as other American nightshades, such as capsicum pepper, tomato, and potato. Husk tomatoes, now widely used to make salsa in Mexico (a spiced sauce similar to ketchup made from tomatoes) still remain an underutilized crop.

IV. NEW WORLD SPECIES

A. Datura (*Datura* spp.)

Daturas originate from the central area of America (D'Arcy 1991). 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. In accordance with the American origin of daturas, there are very scarce illustrations in the European Medieval herbals: BNF indicates under this name (1) a painted plant in an 8th-century manuscript (*Grec 2179*, folio 103), which does not look at all like a datura; and (2) another intriguing plant in a 14th century manuscript (*Arabe 2771*, folio 264), with trilobate leaves, erect trumpet like whitish flowers and globular whitish fruits.

1. First Records. The earliest iconographic traces of daturas are from the New World. Spindle whorls from Colombia, dated 500 to 1000 CE, could 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 illustrations. This codex is the oldest known book of the medicinal herbs of the Indians; it is the translation into Latin by Juan Badiano of a no longer extant Nahuatl (Mexican) original composed in Tlatelolco (district of Mexico city) in 1552 by Martín de la Cruz; and possessed in the early 17th century by Cardinal Francesco Barberini. Both Juan Badiano and Martín de la Cruz were Aztecs educated at the College of Santa Cruz, Tlatelcoco. One of the datura figures located in this codex (Fig. 1.18) is identified as *D. arborea* by Walcott Emmart (1940), but that species is native only in the Andes, and Symon and Haegi (1991) suggest it to be a *Solanum* species. Another one (Fig. 1.19) is identified respectively as *D. inoxia* (Walcott Emmart 1940) or *D. stramonium* by Symon and Haegi (1991). Two other plants (Fig. 1.20) are

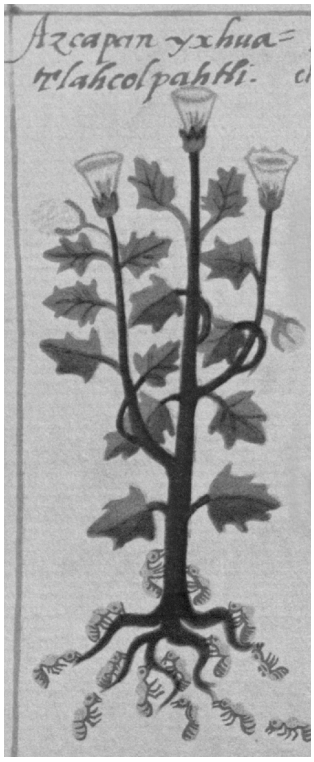

Fig. 1.18. Doubtful species in *Codex Barberini* (*Badianus* ms), 1552. Identified as *Datura arborea* by Walcott Emmart (1940) and as *Solanum* species by Symon and Haegi (1991). Source: Walcott Emmart 1940, plate 20. Courtesy Library of Missouri Botanical Garden-Copyright: Vatican Apostolic Library.

identified as *D. meteloides* by Walcott Emmart (left side drawing) and as *D. ceratocaula* by Symon and Haegi (right side drawing). In another Aztec document, the *Florentine Codex* of B. de Sahagun, beautifully painted daturas are present in several illustrations (Fig. 1.21A), and set up together with one of their medicinal use (Fig. 1.21B). Two other drawings identified in this codex as daturas (*tlapatl*, see Section IV.A.2) suggest that confusions between plants were not restricted to Europeans, since one is recognizable as a datura (no. 450) but the other is not (no. 451).

Daturas are present in Renaissance herbals starting from the middle of the 16th century, but the species identification of the illustrations is speculative, given the insufficiency of morphological details and the difficulty to understand the texts. It is probably *D. metel* that is found in Oellinger (1553, folio 335), Fuchs (1543, folio 396, Figure 1.22),

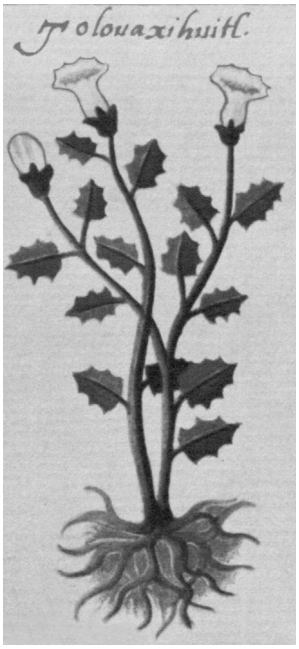

Fig. 1.19. Datura in *Codex Barberini* (*Badianus* ms), 1552. Identified as *Datura inoxia*, by Walcott Emmart (1940) and as *D. stramonium* (Symon and Haegi 1991). Source: Walcott Emmart 1940, plate 41. *Courtesy Library of Missouri Botanical Garden.* Copyright: *Vatican Apostolic Library.*

Fuchs' *Vienna Codex 11 122*, 2(3) (folio 153 painted in 1536 to 1541), and Aldrovandi (second half of the 16th century, vol. 2 folio 171). The woodcut of Fuchs (1543, folio 396) has been used, reversed, by Dodoens (1553 and 1557). The woodcuts displayed by Lobel (1576b), Dodoens (1608), and Gerard (1633) are identical to each other and very close to that of Fuchs (1543), and the one used by Parkinson (1640) is also identical except that the left part of the plant has not been printed to provide space for a close up of a flower. All these woodcuts have in common broad slightly lobate leaves, pendant globose fruits with short spines and an adherent calyx, and flower calyces inflated at their base. *Datura metel* is also beautifully painted in the painting *Still Leben mit Kürbissen* (Plate 1.20) by van der Baren (ca. 1650). Lonicer (1587) displays a very rough illustration of the same species.

Datura stramonium (U.S. common name ''Jimson weed'' derived from Jamestown) occurs in Fuchs' *Vienna Codex 11 122*, 2(3), folio 155 painted 1566 to 1604, i.e. after the death of Fuchs), Aldrovandi

Fig. 1.20. Datura, *Codex Barberini* (*Badianus* ms), 1552: (Left) identified as *Datura meteloides* by Walcott Emmart (1940); (Right) identified as *D. ceratocaula* by Symon and Haegi (1991). Source: Walcott Emmart 1940, plate 49. Courtesy: Library of Missouri Botanical Garden. Copyright: Vatican Apostolic Library.

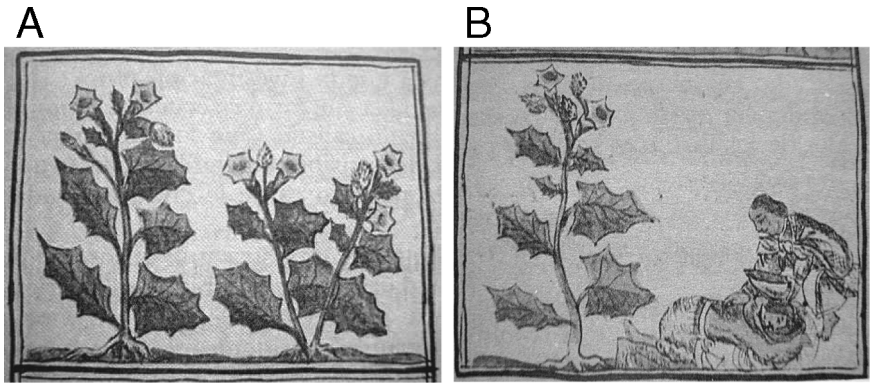

Fig. 1.21. Putative *Datura stramonium* in *Florentine Codex,* T.III, L.11, p. 294, 1540–1585: (A) plants with flowers and fruits; (B) plant next to person applying ointment to prostrate patient. Source: Estrada-Lugo 1989. Courtesy: Library of Missouri Botanical Garden. Copyright: Florence, national Central Library.

(vol. 2, folio 311) (Fig. 1.23), Besler (1613, Tafel 343), and Parkinson (1656, drawing 4). Dodoens (1608) and Gerard (1633) use both another woodcut. All these illustrations display dentate leaves, oblong and very spiny and erect fruits with a roundish deflexed calyx. A putative *Datura inoxia* (= *D. meteloides*) is illustrated in Besler (1613, Tafel 342) (Plate 1.23).

2. Names. In the T.III book 11 of the *Florentine Codex* (Dibble and Anderson 1963), *Datura stramonium* is found under the names *Tlapatl*,

Fig. 1.22. Putative *Datura metel*, Fuchs, 1543, folio 396. Source: Fuchs, *The New Herbal*, Taschen, 2001. Copyright: Ulm Municipal Library.

Fig. 1.23. Putative *Datura stramonium*, Aldrovandi, *Il Teatro della Natura*, vol. 2 folio 311, 16th century (2d half). Source: www.filosofia.unibo.it/aldrovandi. Copyright: Bologna, University Library.

Mixitl, and *Toloatzin*. *Toloa*, and another datura species is also mentioned. According to Estrada Lugo (1989), the whole codex refers also to some other daturas, namely *Coatlxoxouhqui*, *Ololiuhqui* (*D. ceratocaula*, *D. meteloides)*, *Xoxouhcapatli*, and *Tecomaxochitl* (*Datura* sp.).

In Fuchs (1543), Oellinger (1553), Dodoens (1557, 1608), Aldrovandi (late 16th century), and Besler (1613), datura species are referred to under many names, such as *Stramonia*, *Stramonia malus prima*, *Stramonium peregrinum*, *Stramonium spinosum*, *Pomum spinosum*, *Melospinus*, *Malum spinosum*, *Hyoscyamus peruvianus*, *Solanum spinosum fructu rotondo*, *Datura turcarum*, *Nux metela seu stramonia*,

Nux methel (Latin); *Rauch öppfelkraut, Rauhen öpffel* (High German); *Dorn appel*, *Stechopffel* (Low German); *Pomme de Pérou*, *Pomme épineuse* (French); *Vulgo paracoculi*, (Italian); *Noce metella* (Spanish); *Datura* or *Burladora* (Portuguese); *Paracoccalon*, *Baryococcalon* (Greek); and *Datula*/*Tatula* (Turkish). These names show that daturas were known in all European countries by the late Renaissance; some of the names (*peregrinum, peruvianus*, *turcarum*) show that their foreign origin was known. Zwinger (1744) labels *Stramonia foetida* a drawing that possibly represents *D. stramonium*, thus referring to the unpleasant odor of this species. The use or reference to the Arabic name *Nux methel* as well as to the name *Nux vomica* (nowadays *Strychnos nux-vomica*) in the chapters allocated to daturas by several Renaissance herbalists indicates that there was probably some confusion between daturas and other poisonous plants. According to Mansfeld (2001), *Nux methel* is one of the common names in Latin of *Datura metel*.

3. Uses. Indians from both North and South America used datura species as hallucinogens for various rituals and in medicine, for instance, as anesthetic for trepanation by ancient Peruvians (Heiser, 1969). B. de Sahagun, in book 11 (T.III) of the *Florentine Codex* (Dibble and Anderson 1963), refers to the use of a datura ointment as a cure for gout, and indicate the appetite suppressant effect, and, more dangerous, a maddening effect caused by *Tlapatl*. Generalized paralysis of eyes, throat, tongue, and muscles is inferred to the use of *Mixitl*. *Toloa* is credited as a fever medicine (infusion) and a painkiller, and is also said efficient against gout. The strong pharmaceutical and psychotropic effects of daturas are due to the presence of diverse alkaloids including hyoscyamine, hyoscine, and atropine (Evans 1979).

In Europe, it is possible that the German vernacular name of datura, *Rauch öppfelkraut,* which means ''smoke appleherb,'' was used because the smoke relieved asthma (atropine, which has a paralyzing action, relieves bronchial spasms). Parkinson (1640) indicates that datura seeds taken in water were good for expelling bladder and kidney stones by breaking them and provoking urine. In 1656, he adds that in the East Indies, women used datura seeds for preparing an aphrodisiac drink; however Heiser (1969) states that datura could be also used for lessening sexual arousal. Perhaps the opposite effects are due to a question of dosage! According to Parkinson (1656), *the whole plant, but especially the seed, is of a very cold and soporiferous quality, procuring sleep and distraction of the senses* giving for some hours the feeling of being drunk. He explains that the plant is excellent for calming any inflammation or burning and speculates that it could be

used as an anesthetic, but he recommends very cautious use. Hansen (1978) provides only little information regarding use in black magic.

4. Conclusion. The writings in Aztec codices and associated illustrations demonstrate that datura species, under several names, were very well known and used by the Indians. *Datura metel*, *D. stramonium*, and *D. inoxia* appear in European herbals toward the middle of the 16th century, though the illustrations, which stress the exceptional aesthetic quality of the big trumpet-shaped flowers, often lack details for ascertaining species identifications. Daturas were well associated with other Solanaceae by Renaissance herbalists, who pointed out that in addition to the similarity of the leaf shape and softness, there were common traits, such as seeds, which Fuchs (1543) compared to those of the *Chalecutischen Pfeffers* (i.e. *Capsicum* species); Dodoens (1557) compared daturas seeds to those of *verangenes* (eggplant).

B. Tobacco (*Nicotiana* spp.)

The genus *Nicotiana* is native from America and Australia (D'Arcy 1991). When Europeans reached the New World, tobacco was in common use by indigenous population in North, Central, and South America and nearby islands by smoking, chewing, snuffing, and for medicinal and possibly hallucinogenic purposes in a complex system of rituals (Prescott 1843; Hedrick 1919; Heiser 1969; Robicsek et al. 1978). *Nicotiana rustica*, which originates from Mexico, was widespread over the entire continent (Brücher 1989). This species had its origin as an allotetraploid in the (Peruvian) regions as a hybrid of *N. undulata* and *N. paniculata*. It has a higher nicotine content than *N. tabacum*, and is supposed to be the kind originally introduced into Europe (Hedrick 1919), and indeed the earliest illustrations found represent this species. However, *N. tabacum* (originating in Bolivian or northwestern Argentina) and other tobacco species were rapidly introduced shortly afterward. B. de Sahagun (1499–1590), in his famous *Florentine Codex* written between 1540 and 1585, distinguished the coarse tobacco (*N. rusticum*) from the sweet tobacco (*N. tabacum*).

1. First Records. There are pre-Columbian remains attesting to ancient uses of tobacco, such as a wealth of decorated pipes discovered in the tombs of the Aztecs in Mexico and in mounds of the United States (de Candolle, 1890), and a 10th century Mayan pottery vessel discovered at Uazactun (Guatemala) that shows the figure of a Maya smoking a string tied roll of tobacco leaves (Encyclopedia Britannica online). For

a review on tobacco and smoking by the Mayas, see Robicsec et al. (1978). The botanical study of the *Florentine Codex* by Estrada Lugo (1989) indicates many references to *Nicotiana* species (T.I books 1, 2, T.III books 10, 11) as a soothing substance (*Nicotiana tabacum*), medicinal (*N. rustica*), and ceremonial material (*N. mexicana*). An illustration from the *Florentine Codex* illustrates the grinding of tobacco leaves in preparation of a product, used for attacking a snake called *tecutlacoçauhqui* (Fig. 1.24).

An entry dated October 1492 in the diaries of Columbus includes the statement that *''the native brought fruit, wooden spears and certain dried leaves which gave off a distinct fragrance''* and he commented that these gifts seemed very prized by the natives. The 6th November 1492, in Cuba, he described men and women carrying burning herbs and

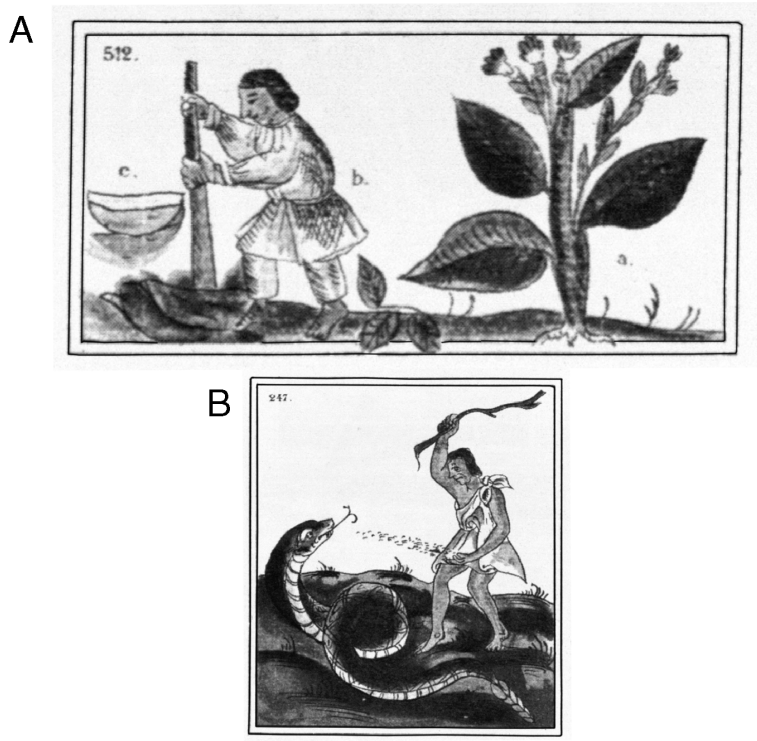

Fig. 1.24. Tobacco. *Florentine Codex*, book 11, 1540–1585: (A) grinding leaves of tobacco (p. 294) attacking Tecutlacoçauhqui (serpent) with club and powdered tobacco (p. 230v). Source: Dibble and Anderson 1963. Courtesy Library of Missouri Botanical Garden. Copyright: Florence, National Central Library.

inhaling the smoke (Lack 1992). Rodrigo de Xerex and Luis de Torre were sent by Columbus inland on the Island of Cuba and observed ''*certain herbs the smoke of which they inhale*'' (Thomas 2005). Smoking tobacco was a common practice, and many early European engravings of the New World show Indians puffing on rolls of tobacco that resemble modern cigars. Tobacco was seen by Cortez in 1519, but the first plants that arrived in Spain seem to be from Portugal, where it was brought from America about 1559; from there the general diffusion over Europe and the East commenced (Hedrick 1919). However, Heiser (1969) and Vigié and Vigié (1989) credit the French monk A. Thevet as the introducer of *N. tabacum* from Brazil to France in 1557, as described in his 1558 publication.

The first published European illustration of tobacco (Fig. 1.25) is the *N. rustica* found in Dodoens (1553), although it was misidentified as

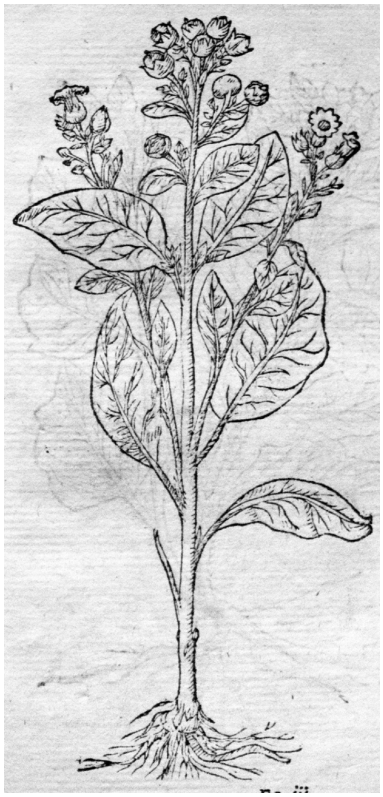

Fig. 1.25. Putative *Nicotiana rustica*, first European image. Source: Dodoens 1553. Courtesy: Library of Missouri Botanical Garden.

Hyoscyamus luteus (yellow henbane) and included in the henbane section. *N. rustica* is also present in Oellinger's *Ms 1553*, folio 629, under the name of *Solanum somniferum et lethale*. It is also found in Gesner's *Ms 2386* folio 13 dated before 1565, year of his premature death due to plague. Facsimiles of the 8 volumes of Gesner's manuscript were published between 1972 and 1980. Gesner deserves a special mention because at a time when leaves were largely used as distinctive criteria among species, he insisted on the relevancy of flower, fruit, and seed features for discriminating species, and he added these details to his folio 13. In the Fuchs' *Vienna codex*, there are three illustrations of *N. rustica*: *Vienna Codex 11 123*, 3(1) folio 265 dated 1549 to 1556 (Fig. 1.26), and folios 261, 263 dated 1566 to 1604, with small and large

Fig. 1.26. *Nicotiana rustica*. Fuchs' *Vienna Codex 11 123*, 3(1), folio 265, painted by A. Meyer between 1549 and 1556. Source: Baumann et al. 2001. Copyright: Austrian National Library, picture archive, Vienna.

leaves and inflorescences of short flowers. Folio 261 is, according to Baumann et al. (2001), a copy from Matthioli (1563 p. 460v), and folios 261 and 263, according to the dates they were painted, were made after Fuchs death (1566). A related but reversed drawing of Fuchs folio 261 is illustrated in Matthioli (1579) though misidentified as a henbane and laid out just next to a woodcut of the white henbane. Another *N. rustica* (still misidentified as *Hyocyamus luteus*) is found in Gerard (1597, 1633) and in Besler (1613, Tafel 341 left side drawing). Neandrum (1626 p. 13) displays a drawing that possibly is *N. rustica*.

Lobel (1576a) represents a plant of the *N. tabacum* type, close to a head of a figure smoking a long conic pipe or tobacco roll (Fig. 1.27). The same drawing, but reversed and tinted, is found in Lonicer (1587), but the figure next to the plant is slightly altered. This drawing, but without the figure, is also present in Gerard (1597). *N. tabacum* is illustrated in Fuchs' *Vienna Codex 11 123*, 3(1) folio 257, dated 1583 to 1604, and folio 259, dated 1566 to 1604 (Fig. 1.28) with large sessile leaves, and a

Fig. 1.27. *Nicotiana tabacum*, note head smoking tobacco on right. Source: Lobel 1576a. Courtesy: Musée Requien, Avignon, France.

Fig. 1.28. *Nicotiana tabacum*, Fuchs' *Vienna Codex 11 123*, 3(1), folio 259, painted between 1566, and 1604. Source: Meyer et al. 1999. Copyright: Austrian National Library, picture archive, Vienna.

terminal inflorescence with many and long flowers. According to Baumann et al. (2001), folio 257 is a copy from Dodoens (1583, p. 449 right side). Both folios 257 and 259 were painted and added to Fuchs' Vienna codex after his death. Many other woodcuts of *N. tabacum,* still with sessile leaves and loose inflorescences of elongated flowers, are displayed by the Renaissance herbalists: Dodoens (1608, p. 805 left side drawing); Besler (1613, Tafels 340 and 341 right side drawing);

Neandrum (1626, p. 7); Gerard (1633 p. 57, left side drawing), copied from Dodoens (1608); Parkinson (1656, drawing 8); and Bauhin (ed. 1707, p. 183). The Spanish physician and botanist Nicolás Monardes (1493–1588) also displays a *N. tabacum* woodcut (1619, p. 43)

Other drawings of the same period are probably also *N. tabacum*, but the leaves are petiolate. Lobel (1576b, p. 316 left woodcut) (Fig. 1.29), represents a plant with very acute leaf tips and terminal multiflowered inflorescences, which was copied by Gerard (1597),

Fig. 1.29. Putative *Nicotiana tabacum*. Source: Lobel 1576b. Courtesy Musée Requien, Avignon, France.

and in the second edition (1633), and also by Dodoens (1608). Neandrum's drawing (1626, p. 9) is different from these woodcuts but represents a similar morpho-type.

Another plant that could possibly be *Nicotiana bigelovii* var. *bigelovii* or *N. obtusifolium* displays long petioles, long internodes, biflorate terminal inflorescences, and non-acute leaves. The woodcut by Lobel (1576b, p. 316 right woodcut) (Fig. 1.30) is copied by Monardes (1619, p. 45, image reversed), Gerard (1633, p. 358) as well as Parkinson (1640, p. 712).

Fig. 1.30. Putative *Nicotiana bigelovii* var. *bigelovii* or *N. obtusifolium*. Source: Lobel, 1576b. Courtesy: Musée Requien, Avignon, France.

2. Names. According to Bancroft (1874, cited by Hedrick 1919), three kinds of tobacco were used among the Nahuatl natives. The *Yetl*, signifying tobacco in general (however, Humboldt [1889, cited by Hedrick 1919], indicated this name applied to the *N. rustica* cultivated by the ancient Mexicans), the *Pycicti,* and the *Quauyetl*. The notes of Humboldt on tobacco merit a renewed investigation since his diaries are now mostly published (Lack 2004). Walcott Emmart (1940) states that the names *Quauhyetl* and *Piçietl* were used for *N. rustica*; Hernandez (1651), however, displays drawings of two different plants bearing these two names (spelled differently), the *Pycietl* resembling *N. rustica* and the *Quauyietl* resembling *N. tabacum*. Estrada Lugo (1989) allocates the Aztec tobacco names found in the *Florentine Codex* (1540–1585) of B. De Sahagun as follows: *Piciete*, *Picietl*, and *Yietl* to *N. mexicana*; *Piciete*, *Picietl*, *Yietl*, and *Yecuxoton* to *N. rustica*; and *N. tabacum* and *Ecuxo* to an undetermined *Nicotiana* species.

In addition to the misidentifications of *N. rustica* as *Solanum somniferum et lethale* by Oellinger (1553) and as henbane by Dodoens (1553), Matthioli (1579), and Gerard (1597, 1633), a confusion spread by Parkinson in 1640, there were other names used by the herbalists. In Fuchs' *Vienna Codex 11 123, 3(1)*, it is named *Priapeia vel nicotiana foemina maior* (folio 261), *Priapeia vel nicotiana foemina media* (folio 263), and *Priapeia vel nicotiana foemina minor* (*Vienna Codex 11 123*, 3[1] folio 265); *Nicotiana minor seu Hyoscyamus luteus* in Besler (1613, Tafel 341 left side drawing); and *Tertia Sum Peti Species* in Neandrum (1626, p. 13).

Nicotiana tabacum is found under the names of *Indorum sana sancta, Sive Nicotiana Gallorum* in Lobel (1576a), *Nicosiana* and *Sanasancta* in Lonicer (1587), and *Sana sancta indorum* and *Tobaco of Trinidada* by Gerard (1597). In Fuchs' *Vienna Codex 11 123, 3(1)*, the plant is named *Priapeia vel nicotiana mas maior* (folio 257) and *Priapeia vel nicotiana mas minor* (folio 259). Dodoens (1608) provides several Latin names, such as *Nicotiana, Herba sacra, Sancta herba,* and *Hyoscyamus peruvianus*. Besler (1613) names his illustrations *Tabacum latifolium* (Tafel 340) and *Nicotiana maior angustifolia* (Tafel 341, right side drawing); Monardes (1619) uses *Nicotiane* or *Tabac*; Neandrum (1626, p. 7) uses *Mascula Sum Peti* species; Gerard (1633) uses *Hyoscyamus peruvianus, Tabaco,* and *Henbane of Peru*; Parkinson (1656, drawing 8) uses *Tabacco latifolium*; and Bauhin (ed. 1707) uses *Nicotiana major latifolia*.

The tobacco plants with petiolate leaves of what we identify as a putative *N. tabacum* are named *Herba sancta, Sive Tabacum minus* by

Lobel (1576b, p. 316 left woodcut); *Hyoscyamus peruvianus* by Gerard (1597); *Sana Sancta Indorum* by Gerard (1633); *Ander Gedaente Van Petun* (i.e. another kind of *petun*) by Dodoens (1608, p. 805 right side drawing); and *Foemina Sum Peti* species by Neandrum (1626, p. 9).

The other plant that could possibly be *Nicotiana bigelovii* var. *bigelovii* or *N. obtusifolium* is named *Sana Sancta, Sive Tabacum minimum* by Lobel (1576b, p. 316 right woodcut); *Nicotiane petite des Indes* (i.e. small Nicotiane from Indies) by Monardes (1619, p. 45, image reversed); *Tabacum minimum* and *Dwarf Tabaco* by Gerard (1633); and *Tabacco Anguicum* and *English Tabacco* by Parkinson (1640).

Lonicer (1587) indicates that the names *Sanasancta*, *Herba sancta,* and *Picietl* were in use by the Indians and the noun *Petum* was used in Brazil. He provides the plant names in French (*Nicotiana*/*Nicosiana*, and *Herba Reginae*) and Spanish (*Tabaco*), names that will be explained below. Interestingly, Lonicer does not give the equivalent English, Dutch, and German names. This indicates that the plant was probably not popular in those northern European countries in 1587. In 1608 Dodoens says that the Dutch name is *Bilsencruyt van Peru*; Parkinson (1640) indicates that the English name is *Tabacum anguicum* or *English tobacco*, both attesting to the common presence of tobacco in those two countries in the beginning of the 17th century.

The name *Nicotiana*/*Nicosiana* honors the name of Jean Nicot de Villemain, France's ambassador to Portugal, who sent in 1560 and 1561 *N. rustica* plants and snuff to Queen Catherine de Medicis for use at the French court (Lemaitre, 2003). This is at the origin of the name *Herba Reginae* by the French.

The origin of the term *tobacco* has been the subject of many discussions, reviewed by Boomert (2001). It could derive from the Spanish word *tabaco*, which, according to B. de Las Casas (1552), has its origin in Arawakan language, particularly in the Taino language of the Caribbean, and referred to the roll of the leaves. Baker (1965) says that *Tabaco* is the name Carib Indians gave to their cigars. *Tabaco* is also said to be a Y-shaped tube used for inhaling smoke (G. F. de Oviedo y Valdès, quoted by Ernst 1889). According to Humbold (1889), quoted by Hedrick (1919), *Tobacco* belongs to the ancient language of Hayti (Haiti) and Santo Domingo, and referred not to the plant but to the tube through which the smoke was inhaled. Other sources claim that *Tabaco* derives from either the name of an island (Lonicer 1587) or the name of a province of Yucatan where Cortes first saw the plant (Hedrick, 1919). The explanation for the origin of the word *cigar* was the Mayan term (*sik'ar*) for smoking (Encyclopedia Britannica online). The word *cigarette* is the diminutive of *cigar*.

3. Uses. In the native American culture tobacco played an important ceremonial role as a means for providing communication with the supernatural world through the medium of the shaman, for either medicinal or spiritual purposes, and in many groups tobacco was given as an offering to the gods (in particular among the Maya) or deified as a divine plant (Encyclopedia Britannica online). It was usually smoked, but also chewed, drunk, taken as snuff, and even given as an enema for relieving diarrhea or as an intoxicating potion of the treatment of recurrent diseases (Hedrick 1919). The Indian's use of tobacco leaves for smoking (as rolled leaves similar to a cigar or pipes) was immediately observed by Columbus from his arrival in the Caribbean islands in 1492 and later was observed to be widespread in the West Indies (Lack 1992). In the *Florentine Codex* (1540–1585) of B. de Sahagun, medicinal uses of *Picietl* are described. The translated Aztec text (Dibble and Anderson 1963) indicates that when ground with lime and applied by rubbing, it relieved fatigue and gout; when chewed, it caused dizziness and cut appetite, an effect that is probably related to the high incidence of women smoking today.

In Europe, tobacco was supposedly of hot and dry quality at the second degree (Monardes 1619). It was taken at once as a medicinal panacea, cleaning away all secretions and healing inner and outer ailments such as headaches, toothaches, worms infections, cough, asthma, ulcers, wounds, cuts, and so on (Parkinson 1640; Vigié and Vigié 1989). Monardes (1619) explains in detail the various properties of tobacco (hunger, thirst, and fatigue killer; anticoagulant, vermifuge, and vermicide; disinfectant; draining, healing, sedative, and digesting aid; antidote against venomous bites; and relaxant and hallucinogen) and the modalities of its use (chewed leaves, snuffed powder, applied warm leaves, plaster, decoction, juice, mixtures with oil or vinegar, leaf powder mixed with an unguent, and pills). The many properties of tobacco are due to the specific nontropane nicotine-type alkaloids present in the genus *Nicotiana*. The beauty of the plant made it also valued as a garden ornamental.

4. Conclusion. The Renaissance herbals of the second half of the 16th century attest that several tobacco species were introduced at about the same time in Europe as daturas. The earliest images we found are those of *N. rustica*, which was however confused with the yellow henbane by several herbalists. In America, tobacco was a popular plant for medicinal and social uses, and it was astonishingly fast adopted as such in Europe. The Indian fumitory and snuffing uses in particular were quickly picked up by the Europeans, and tobacco use soon became a worldwide habit. The addictive nature of nicotine is a recent discovery, but the dangers of tobacco were long understood as indicated by a

popular ditty entitled ''*Tobacco's but an Indian Weed*'' composed in 1719 by Thomas D'Urfey:

Tobacco's but an Indian weed,
Grows green in the morn, cut down at eve;
It shows our decay,
We are but clay;
Think of this when you smoke tobacco!

The pipe that is so lily white,
Wherein so many take delight,
It's broken with a touch,
Man's life is such;
Think of this when you take tobacco!

The pipe that is so foul within,
It shows man's soul is stained with sin;
It doth require
To be purred with fire;
Think of this when you smoke tobacco!

The dust that from the pipe doth fall,
It shows we are nothing but dust at all;
For we came from the dust,
And return we must;
Think of this when you smoke tobacco!

The ashes that are left behind,
Do serve to put us all in mind
That unto dust
Return we must;
Think of this when you take tobacco!

The smoke that does so high ascend,
Shows that man's life must have an end;
The vapour's gone,
Man's life is done;
Think of this when you take tobacco

C. Capsicum Peppers (*Capsicum* spp.)

Capsicum species are native to the tropical America (D'Arcy 1979) where they have been long domesticated (Roberts 2001). More than

30 species have been identified, but there are five principal ones: *C. frutescens, C. baccatum, C. chinense, C. pubescens,* and *C. annuum,* the latter being the most widely cultivated throughout the world. The introduction and adoption of *Capsicum* to Europe and Asia was rapid because of its association with the universally popular black pepper (*Piper nigrum*), and the name *red pepper* was quickly adopted. Capsicum peppers are now a key component of the cuisines of tropical countries, in particular in Asia, where it is often incorrectly considered indigenous. At the present time, a wide range of sweet and hot capsicum peppers are cultivated throughout the world for various uses.

1. First Records. There is evidence of capsicum pepper consumption 9,000 years ago with cultivation by 2500 BCE is northern Peru (Roberts 2001). An embroidery of a man holding two chili capsicum peppers with two fruits on cord around the neck dates to the early Nazca period (400 to 600 CE) in pre-Columbian Peru (Fig. 1.31A). Mochica potteries (1–600 CE) decorated with capsicum pepper images are displayed at the Museo Nacional de Arqueologia, Anthropologia e Historial del Peru, Lima (Fig. 1.31B). Stylized capsicum peppers adorning pottery from the Classic Nazca (4th to 6th centuries) is illustrated in Andrews (1995) along with

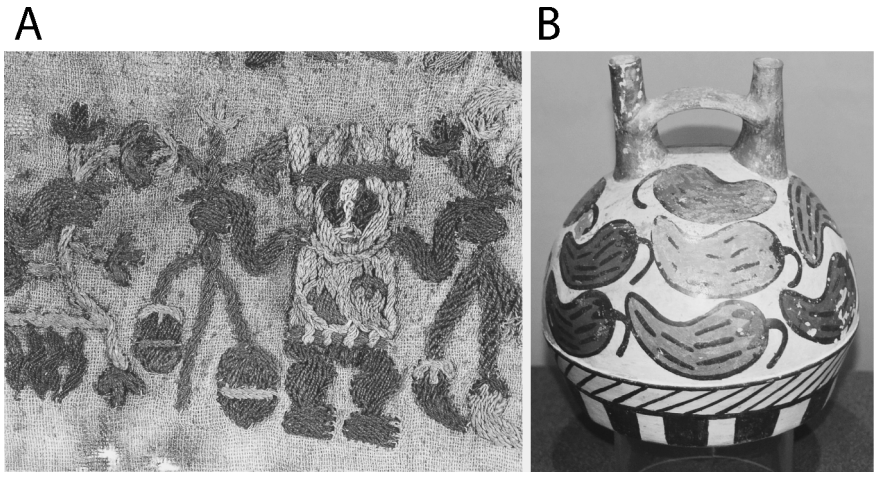

Fig. 1.31. Capsicum peppers in pre-Columbian America. (A) Fruits held by a man and with 2 fruits on cords around neck, embroidery, Peru, 400–500 CE. Source: Andrews, 1995. Courtesy of the Phoebe Apperson Hearst Museum of Anthropology and the Regents of the University of California. (B) Pottery from Peru, Mochica period (1–600 CE), Museo de Arqueologia, Lima, Peru. Courtesy: T. Andres.

fruits carved on the Tello obelisk (800 to 1000 CE) from the Chavín culture of Peruvian Andes. Some decorated spindle whorls from Colombia dating from 900 to 1500 CE have been interpreted as being flowers of *Capsicum* by McMeekin (1992).

Christophorus Columbus noted in his diaries dated 15th January 1493, the last day he was in Haiti: ''*there is also a lot of* axi*, which is their pepper, of a kind as precious as pepper, and none of the natives eat anything without it, because they find it very sound. Fifty caravels could be loaded with it each year in Haiti*'' (Lack 1992). ''Axi'' is an Arawak name which designates capsicum peppers (*C. frutescens* or *C. annuum*). Peter Martyr d'Anghiera (1457–1526), Italian-born tutor and chronicler in the Spanish court of Ferdinand and Isabella, wrote a letter to Cardinal Asconio Sforza, in September 1493 based on the first voyage of Columbus. This letter, published in 1511 as part as *De Orbe Novo* (MacNutt 1912) mentions 40 parrots brought back by Columbus as well as descriptions of new plants (mastic, aloes, and cotton) including *rough-coated berries of different colours more pungent to the taste than Caucasian pepper.* In the *Decades of the Ocean* of P. Martyr d'Anghiera published in 1516, there are references to various kinds of capsicum peppers with various names based on colors of leaves and flowers (Hedrick 1919). Chanca, physician of the second voyage of Columbus, also mentioned capsicum pepper in a letter to his chapter in Seville dated 1494 (Hedrick 1919). Friar Diego Duran in his report based on pre-1521 testimonies noted that capsicum peppers were as common as tomatoes in Aztec religious offerings and markets (Hodge 1994). Jose de Acosta (1539–1600), a Spanish missionary quoted by Bancroft (1875) and Gibault (1912), noted that capsicum pepper was the principal sauce and the only spice of the Indians. Oviedo, who reached tropical America from Spain in 1514, described capsicum peppers and their uses in detail (Flückiger and Hanbury [1879], quoted by Hedrick [1919]), as did later authors mentioned by Hedrick (1919, p. 135). All these accounts report on the morphological diversity of capsicum peppers and extolled their importance to native people of America, which explains why they immediately attracted attention during the Spanish incursions in the New World. The presence of texts (and possibly images) of capsicum peppers in the *Florentine Codex* dated 1540–1585) confirms the popularity of this species among the Aztecs of the 16th century, as food, medicinal, and ceremonial plants (Estrada Lugo 1989). A crude *Capsicum* plant with elongated and erect fruits (Fig. 1.32), labeled as a fragrant capsicum pepper (*ahhuiyac Tlatlanquaye*) is illustrated in the 1552 *Badianus manuscript* (Walcott Emmart 1940). Figure 1.33A,

Fig. 1.32. *Capsicum* sp. *Ahhuiyac Tlatlanquaye* (= fragrant capsicum pepper), *Codex Barberini* (*Badianus* ms.) 1552. Source: Walcott Emmart 1940, plate 83. *Courtesy Library of Missouri Botanical Garden Copyright: Vatican Apostolic Library.*

from the *Codex Mendoza*, an Aztec codex written by native scribes shortly after the conquest on the request of Viceroy Mendoza in 1541–42, illustrates a list of tributes including a basket with a capsicum pepper lying horizontally on top (indicating the contents of the basket) and a vertical feather (indicating the quantity). In Fig. 1.33B, from the same source, a child is exposed to the smoke of burning capsicum peppers in an intriguing rite, perhaps initiation, punitive (note that the hands of the child on the right are bound), or therapeutic.

The first capsicum pepper illustration in European documents displays a *C. frutescens* (Plate 1.24) found in the *Codex amphibiorum* (Lack 2003a). This manuscript, dated about 1540, is located in the Austrian national library in Vienna (*Cod. Min. 107*, folio 11). This relatively late date after the European encounter with America (1492) is a probable consequence of the fact that the conquest of Mexico occurred in 1521. This illustration shows a capsicum pepper image

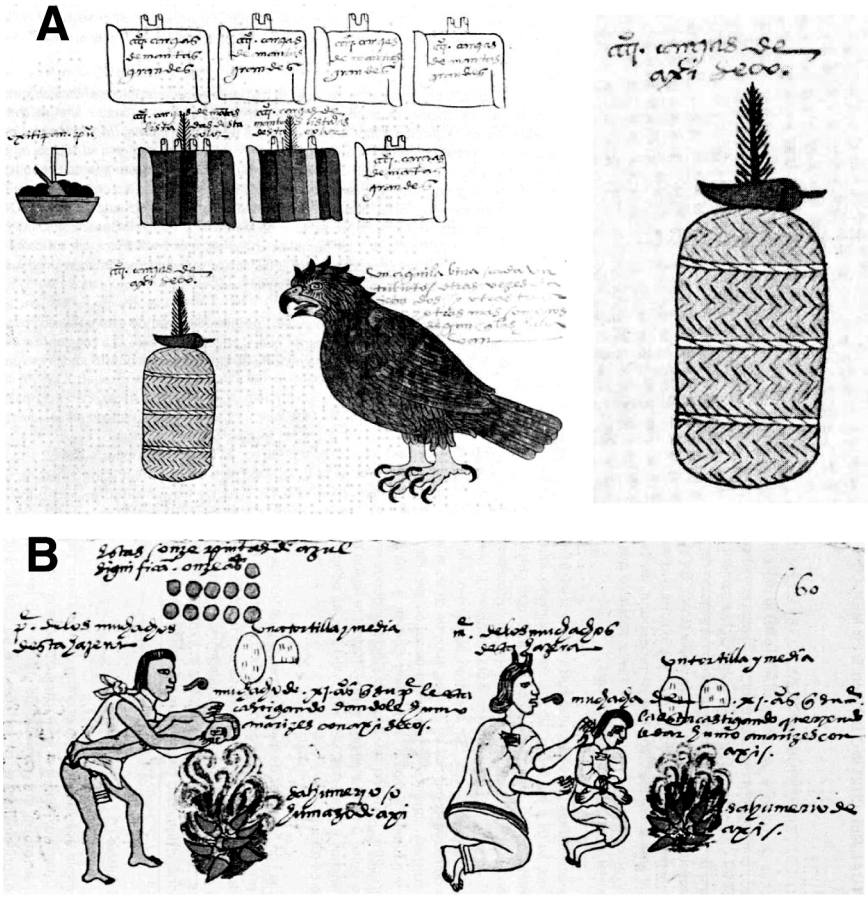

Fig. 1.33. *Capsicum* pepper in MS. Arch. Selden. A.1 (*Codex Mendoza)* 1542: (A) folio 55, list of tribute and close-up of basket containing capsicum peppers; (B) folio 60, fumes of burning capsicum pepper. Source: The Bodleian Library, University of Oxford, U.K. *Copyright: The Bodleian Library, University of Oxford, U.K.*

bearing conical and pendant fruits, immature (green) and mature (brown). A detached, longitudinally cut fruit shows the inner structure with whitish seeds; an adjacent drawing of a man bringing the fruit to his mouth carries the message of edibility. In the *New Kreüterbůch* (1543), Fuchs illustrates four kinds of capsicum pepper (Plate 1.25): one kind (folio 418) with fruits that are similar in shape and color (brown) to those of *Codex amphibiorum*, one kind

of the same shape and size but with red fruits (represented on the same illustration), and a third kind with long, narrow, pendant, green and red fruit (folio 419). The fourth kind (folio 420) shows fruits with a clear calyx constriction and thick irregularly shaped green and red fruits. This plant could be *C. chinense,* although there is only one fruit per internode, while *C. chinense* bears two. In the Oellinger manuscript, completed before 1553, folio 64 shows what appears to be *C. chinense*, with calyx constriction and the presence of two fruits per internode. Another capsicum pepper image in Oellinger (1553, folio 289, left side) displays a new morphological type with very shrivelled, pendant, and yellow fruits (Fig.1.34A). Capsicum pepper

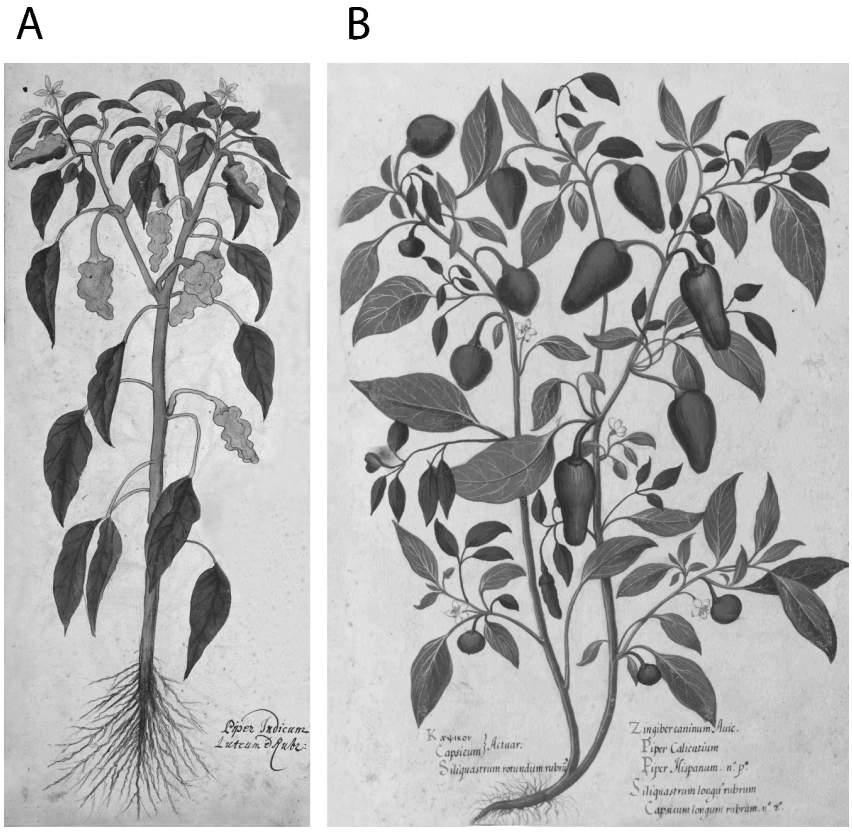

Fig. 1.34. *Capsicum annuum*: (A) Oellinger 1553, Ms. 2362 folio 289. Source: (A) Erlangen, University Library (B) Aldrovandi, *Il Teatro della Natura*, vol. 6-1, folio 48, 16th century (2d half). Note three types of fruits.; Source: www.filosofia.unibo.it/aldrovandi.Copyright: (Bologna, University Library.)

is absent from Gesner's 1565 manuscript. Aldrovandi's herbal (completed during the second half of the 16th century) folio 48 (Fig. 1.34B), displays three red fruited types, including a new small and globular type. The woodcuts of Fuchs' herbal are repeated in Dodoens (1557). Amazingly, V. Cordi (latinized as Cordus) repeats them in his 1561 herbal but as a single composite drawing of a plant bearing the 3 fruits shapes illustrated by Fuchs as separate woodcuts. Lobel (1576b) illustrates a larger and elongated capsicum pepper type, reversed copies of which are found in both editions of Gerard (1597, 1633) and in Dodoens (1608). Medium-size fruit adorn the frames of biblical scenes on the brass doors of the Pisa cathedral in Italy, 1601 (Fig. 1.35A), and Parkinson (1640) includes large detached fruits of

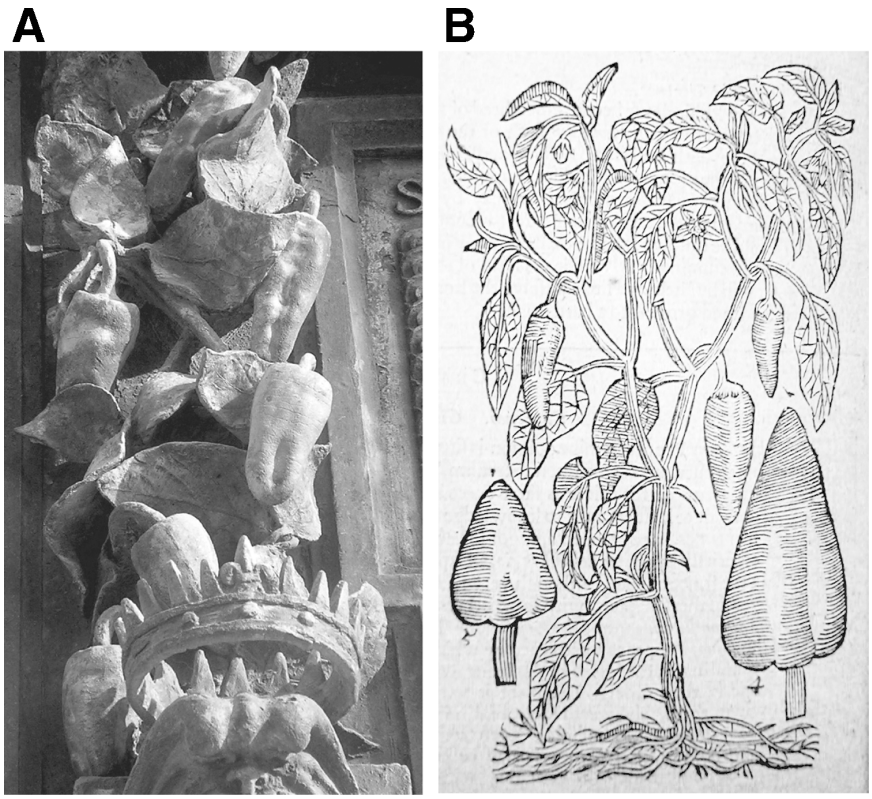

Fig. 1.35. Medium-size capsicum peppers (*C. annuum*): (A) on bronze doors of Pisa cathedral, 1601. Source: J. Janick. (B) from the herbal *Theatrum Botanicum.* Source*:* Parkinson 1640. Courtesy: Musée Requien, Avignon, France.

various shapes (Fig. 1.35B). Illustrations of Lonicer (1587), Hernandez (1651), and Bauhin (ed. 1707) do not contribute new information.

In Lobel (1576b), as well as in Dodoens (1608), Monardes (1619), image reversed, and Gerard (1633),where the same woodcut is used, a new capsicum pepper type appears (Fig. 1.36) with small erect, clustered, smooth, oblong, and dehiscent fruit, dentate and partially

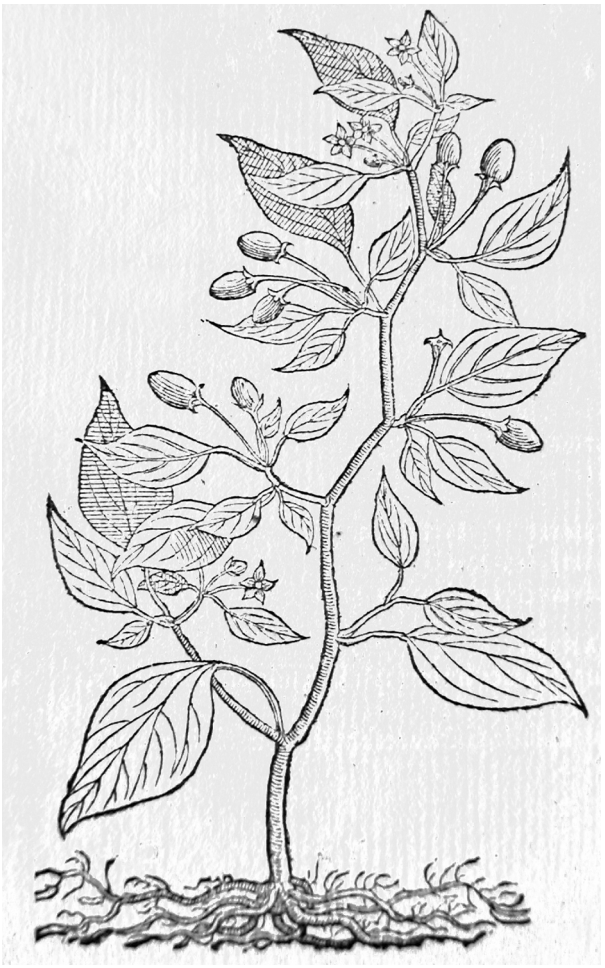

Fig. 1.36. Putative *Capsicum pubescens or C. baccatum.* Source: Lobel 1576b. Courtesy: Musée Requien, Avignon, France.

recurved calyx, and large and clearly veined leaves. This illustration suggests *Capsicum pubescens*, a strictly South American species, although the better diagnostic traits such as violet flowers and black seeds (A. Palloix, pers. commun.) are not specified on the woodcut and associated text. This illustration could also be *C. baccatum*, from Argentina/Paraguay/Bolivia region (M. Nee, pers. commun.).

Dalechamps (1587) displays a woodcut of a *Capsicum rotundum*, recopied by Monardes (1619), which could be *Solanum aethiopicum* Kumba Group. Gerard (1597, p. 292) displays in his *Indian pepper* section a woodcut labeled *Capsicum minimis Siliquis* with curiously small oblong fruits, the long and narrow acute leaves and the flowers of which, atypical of *Capsicum*, suggest that it could be a *Solanum* species. Another woodcut by Dodoens (1608, p. 1214), located in his *Van Bresilie Pepper* section and named *Balsch Bresilie pepper* (this name possibly means ''false Brazilian pepper''), represents a plant with elongated leaves and globular berries, which is probably *Solanum pseudo-capsicum* (*see* Section IV.F). These represent three cases of probable confusion between *Capsicum* and *Solanum* species by the herbalists.

In *Hortus eystettensis,* Besler (1613) includes 15 different capsicum peppers, including new types with diverse combinations of size, shape (about half are globular, half somewhat oblong), fruit position (11 pendant, 4 erect), and color (13 red, 2 yellow). In Fig. 1.37, the *Piper indicum aureum latum* (left) and the *Piper indicum siliquis flavis* (right) of Besler (1613, Tafel 327) are possibly *Capsicum baccatum*, given the yellowish color of the center of their flowers and the presence of fruits clustered by 2s that at least indicate that they are not *C. annuum*. Parkinson (1640) includes 18 images of capsicum peppers with conical and globular, and pendant or erect fruit, but no new types.

There are frequent inaccuracies in the drawings or paintings of the 16^{th} and 17^{th} century capsicum peppers, such as the absence of leaves at the axil of lateral shoots or curiously verticillate shoots and fruits. The detailed drawings of dissected flowers and fruits published by Pitton de Tournefort (1694) are worthy of mention.

Capsicum pepper is occasionally found in Renaissance art, for instance in the painting entitled *Flowers, Fruit, Vegetables and Two Lizards* by an anonymous painter referred to as the Master of Hartford, painted between 1593 and 1607, and sometimes attributed to Caravaggio (Michelangelo Merisi). Capsicum pepper is found as a solitary, bright red, long fruit in the foreground of the painting *Christ in the House of Martha*, 1618, by Velasquez and is included in *Still Leben mit Kürbisse*, ca. 1650, by van der Baren (Plate 1.20).

Fig. 1.37. Putative *Capsicum baccatum*, yellow spots on petals are characteristic. Besler, 1613, Tafel 327. *From the original hand colored copy of the University Library Eichstaett-Ingolstadt.* Source: *Der Garten von Eichstätt*, Taschen 1999. *Copyright: University Library Eichstaett-Ingolstadt.*

2. Names. There were many names for capsicum peppers in Mexico at the time of the conquest. In the botanical study of the *Florentine Codex* (Estrada Lugo 1989), there is *Aji*, *Chile* (*C. annuum*), *Chiltepin*, *Chiltecpin*, and *Chictecpitl* (*C. frutescens* var. *baccatum, C. microcarpus*, or *C. minimum*). However, given the Mexican origin of the Codex, only *C. annuum* var. *glabriusculu*m or *C. frutescens should be assumed* (M. Nee, pers. commun.). ''Axi,'' mentioned by Columbus in his diaries dated 15th January 1493, is an Arawak name which designates *C. frutescens* or *C. annuum* that he saw in Haiti. According to Irving 1849 (cited by Hedrick 1919), Peter Martyr d'Anghiera mentions other names in his *Decades of the Ocean*, i.e. *Guanaguax*, *Guaraguei*, *Squi*, *Tuna*, *Hobos*, *Atibunicix*, *Aniguamar*, and *Guaccaracca*. The Inca Garcilaso de la Vega (ca. 1539–1616), an illustrious Peruvian writer quoted by Hedrick (1919), gives

names in use in Peru for various kinds of capsicum pepper, such as *Rocot uchu* (thick capsicum pepper), *Chinchi uchu,* and *Thapi* and states that some kinds were reserved for the royal family (Vega 1609). According to J. de Acosta (1589), capsicum pepper's vernacular names were *chili* by Mexican Aztecs and *uchu* in the Cuzco language. According to Markham (1864) cited by Hedrick (1919), the *Aji* or *Uchu* seen by Pedro Cieza de Leon (1520–1554), Spanish conquistador, chronicler, and historian of Peru, during his travel in Peru is *C. frutescens*, and the Mexican *Chipatane* is a *C. baccatum*. However, this latter assumption is doubtful given *C. baccatum* is not native from Peru (M. Nee, pers. commun.).

Capsicum species were of course unknown in Europe before the American encounter, and plant names used by ancient authors for other plants were allocated to it, such as *Zingiber caninum* or *Piper caninu* of Avicenna and *Siliquastrum* or *Piperitis* of Pliny. The Latin name *Capsicum* is derived from *Capsa* (box), which probably refers to the boxy-shaped fruit. Fuchs (1543) quotes names such as *Piper indianum*, *Piper calecuthium*/*calecuthicum*, and *Piper hispanum*. Oellinger (1553) used his own semi-descriptive names, such as *Piper indicum siliquis oblongis/rotundis* and *Piper indicum luteum/rubrum.* Aldrovandi (second half of 16th century) listed a series of names among which some new declinations appeared, such as *Siliquastrum rotundum rubrum*. Dodoens (1608) proposed further variations, such as *Capsicum recurvis siliquis* and *Capsicum minimis siliquis*, while Besler (1613) gives semi-descriptive names such as *Piper Indicum maximum longum*, *Piper Indicum medium*, *Piper Indicum bifurcata siliqua*, *Piper Indicum minimum erectum*, *Piper Indicum aureum latum*, and so on. Parkinson (1640) gives also many semi-descriptive Latin names to the various types described and provides common names such as *Piper americanum, Piper brasilicum/brasilianu,* and *Piper de Guinea*. This later name was also used by Lobel (1576b) as a synonym of *Solanum pomiferum herbariorum,* which is identified as a *Solanum aethiopicum* Shum Group (*see* Section II.D.5). Through the 16th and 17th centuries, there was a diversity of common names, such as *Ginny pepper* or *Indian pepper* (English); *Indianischer Pfeffer*, *Calecutischer*/*Calechutischer*/*Chalecutischer Pfeffer* (High German); *Peper van Indien* and *Bresilie pepper* (Low German); *Poyure* / *Poiure d'Inde*/*du Brésil*/*d'Espagne* (French); *Pepe indiano* (Spanish); Pepe *cornuto*, *Pepe d'India* (Italian); and *Capsicon* (Greek).

3. Uses. The uses of capsicum peppers include medicinal, flavoring, dye, and food. Bancroft (1875), referring to J. de Acosta (1589), noted that

it was eaten by the Nahuatlan natives both green and dry, whole and ground. In the *Codex Mendoza*, dated about 1541–42 and written in Nahuatl (Mayan), unexpected social uses of capsicum peppers are reported (Fig. 1.33B). Estrada Lugo (1989), from a careful analysis of the *Codex Florentine* (1540–1585) reports also on ceremonial uses of capsicums by the Aztecs, and indicates that the capsicum peppers are mentioned throughout the whole codex (T.I books 1, 3, and 5, T.II books 6 and 8, and T.III books 10 and 11). In the *Badianus* manuscript (1552) studied by Walcott Emmart (1940), medicinal uses of capsicum peppers are described with the leaves of the so-called *Tlatlanquaye* used with other plants for curing scabies and releasing intestinal disorders. J. de Acosta (1589) said that when used with moderation, capsicum pepper helps the digestion, but if one takes too much of it, there are negative effects because its nature is very hot, volatile, and penetrating; its repeated use by young people is deleterious to their body and even more to their soul because it incites sensuality.

In Europe, Fuchs (1543) noticed the bitter taste of the leaves and hotness of the seeds. He summarized the properties of capsicum peppers by saying that it has all the good properties of black pepper. He recommended the use of a mask of capsicum pepper and honey for removing pimples.

Dodoens (1557) describes medicinal value of capsicum pepper as hot and dry in the third degree, Parkinson (1640) as hot and dry to the fourth degree. Capsicum pepper when applied with honey was known for eliminating flatulences, cold tumors, and spots on the skin, and for warming up persons with chills. However, Dodoens warns that it is dangerous to use this herb, which, if ingested by dogs, kills them with high frequency. Parkinson (1640) notices that capsicum pepper has a nature contrary to that of the other nightshades, being exceedingly hot when the others are very cold. He refers to the inflammatory properties of capsicum peppers and notes that wine or cold water do not calm the irritation, which, however, will cease spontaneously after a time without any after-effects. Capsicum pepper reportedly provokes blisters on the skin and various disorders, such as weeping, sneezing, coughing, and, in extreme cases, vomiting. Parkinson observes that if a capsicum pepper fruit, whether green or dry, is *put into a mother* after delivery, it will make her sterile forever. Nevertheless he asserts that capsicum pepper, when used correctly, has beneficial medicinal properties, such as analgesic and diuretic. According to Dodoens (1557), capsicum pepper was used for giving taste and color to meats, and Bauhin (ed. 1707) adds that though biting and caustic, it had a better taste

than black pepper, and could also be used for manufacturing some kinds of biscuits. This use in pastries is confirmed by Parkinson (1640).

Although the hot capsicum peppers have long been widely used as a condiment, very common in Mexican and Asian cuisine, the nonspicy or ''sweet'' capsicum peppers also have become an important food worldwide, consumed raw, cooked, or stuffed with meat or cheese. In Hungarian cuisine, dried capsicum peppers (paprika) of two types, sweet and hot, are used both as a flavoring and a colorant, commonly used for chicken and meat (paprikás).

The pungency of *Capsicum* species and their medicinal properties are due to the presence of capsaicine and related molecules (capsaicin, also known as 8-methyl-*N*-vanillyl-6-nonenamide), the most pungent of the capsaicinoids (molecules specific to the genus *Capsicum*, which are produced by glands located in the placenta (Palloix et al. 2003). Capsaicin is used in modern defensive sprays.

4. Conclusion. Capsicum peppers were well known to Central and South American Indians. The first European records of capsicum peppers are contemporary to those of tomato (*see* Section IV.D), that is, during the 1540s. Their fiery taste, present in all the types introduced during the 16th century, is responsible of their association in the mind of the Renaissance herbalists with black pepper (*Piper nigrum*). They were later referred to as ''red'' peppers to distinguish them from the black pepper of India. Thanks to this safe botanical association, they escaped suspicious comments from herbalists, and despite their fiery taste, their adoption by Europeans was to be broad and swift.

The first introductions to Europe had small to medium-size, pendant or semierect fruit, mostly red at maturity (a few brown or yellow) and all pungent. The progressive increase in morphological diversity with time is traceable from the descriptions, drawings, paintings, and carvings of the 16th and 17th centuries. However, there is no trace of the square or rectangular large-size nonpungent (sweet) types; perhaps these types did not exist in Mexico or were not introduced at first, or perhaps they did not exist and were selected only later in Europe. *Capsicum annuum* is the main species found in the historical documents of the period studied, but some drawings closely resemble *C. pubescens*, *C. chinense,* and *C. baccatum*, thus indicating that several species were introduced in Europe early. The frequent inaccuracies of the illustrations require a cautious approach in regard to definitive identifications, but it is clear that several images represent other *Capsicum* species than *C. annuum*.

D. Tomato (*Solanum lycopersicum* = *Lycopersicon esculentum*)

Tomato has become one of the most important world crops and is widely consumed fresh and processed with a world production of 125 million tonnes (FAO, 2005). The origin of the cultivated tomato is discussed at length by Jenkins (1948), who summarizes his findings as follow: *The ancestral form of the cultivated tomato was originally confined to the Peru-Ecuador area. After spreading north possibly as a weed in pre-Columbian times it was not extensively domesticated until it reached Mexico, and from there the cultivated forms were disseminated*. Jenkins considers the introduction of tomato in Mexico as very ancient because of the wide genetic diversity found there in wild and cultivated forms, as well as transitional forms between cultivated types and between them and the wild *L. esculentum* var. *cerasiforme*. The domestication of tomato might have occured in Mexico because of its fruit similarity with the commonly used local husk tomatoes. Harlan (1975) suggests that the biloculed domesticated forms found in southern Mexico and Guatemala are the oldest cultivated types. Another hypothesis advanced by de Candolle is a domestication in Peru, but according to Peralta and Spooner (2007) the question of the original site of domestication of cultivated tomato is likely to remain unsolved fovever.

1. First Records. McMeekin (1992) considers that in a set of decorated spindle whorls (dated 900–500 CE), one type from Colombia, dated 500 to 1000 quite accurately represents a tomato flower (Fig. 1.38), but this interpretation is controversial. Tomato was common is Mexico at the time of the conquest (see details below), and Estrada Lugo (1989) mentions the use of tomatoes by the Aztec as a medicinal plant (*Florentine Codex* of B. de Sahagun, T.I book 2, T.II book 8, T.III book 10), but the entire Codex has not been accessed. Pre-Columbian and 16th century images from America were not found so far, apart a doubtful image entitled *Tomazquitl* and depicting a plant with entire leaves and bunches of five globular red fruits, which is present in the *Codex Badianus* (plate 69 in Walcott Emmart 1940). The Spaniard friar Diego Duran, describing from direct evidence of witnesses the Aztec ways of life before 1521 (year of the conquest of Mexico), notes that tomato (and capsicum pepper) were common in religious offerings and markets (Hodge 1994). Hernán Cortés (1485–1547), the famous conqueror of Mexico, in a letter dated September 3, 1526, addressed to the Spanish crown and translated into French by Charnay (1996, p.404) wrote (text translated here into English):

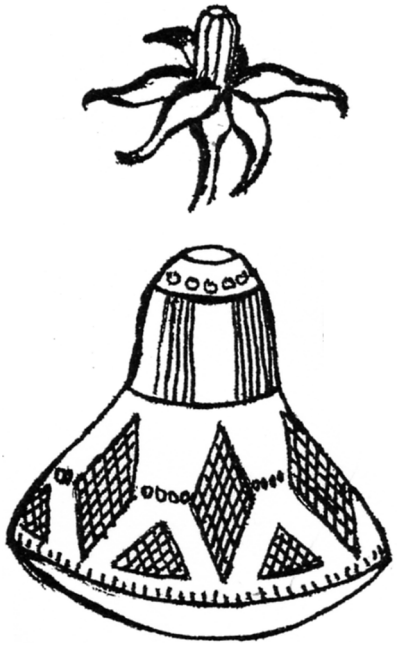

Fig. 1.38. Colombian spindle whorl (500–1000 CE) reproducing tomato flower features. Source: McMeekin 1992.

> *We visited the town, which was well built with streets lined with well aligned houses, and in each of them, rough and spun cotton, ready to be used textiles, and plenty of maize, beans, cacao, tomatoes and salt, caged chickens, pheasants and partridges, as well as those dogs which are excellent food, and if we had had our ships nearby we could have shipped with all those goods.*

Hernandez (1651) comments that tomato was one of the most important crops cultivated by ancient Mexicans, and J. de Acosta (1589) notes that tomatoes were used when fresh, healthy, and juicy for preparing sauces. All these brief mentions of tomato, though frustratingly imprecise, provide evidence that tomato was common in Aztec life. Since the conquest of the Aztec empire occurred in 1521, the first European images of tomato appear later than other species originating from earlier conquered New World areas, such as *Cucurbita pepo* depicted as early

as 1503 to 1508 (Paris et al. 2006) and maize in 1515 to 1518 (Caneva 1992; Janick and Caneva 2005).

According to Allen McCue (1952), tomato is first mentioned in the European literature in a chapter on the mandrake by P. A. Matthioli (1544), with the following description:

> *Another species [of Mandrake] has been brought to Italy in our time, flattened like the melerose [sort of apple] and segmented, green at first and when ripe of a golden colour, which is eaten in the same manner [as the eggplant—fried in oil with salt and pepper, like mushrooms].*

The association of tomato to mandrake by Matthioli can be explained by similitude of their globular goldish berries (*see* Plate 1.6 for mandrake fruits), since the tomato fruits he observed in 1544 were yellow. In his later 1554 publication, Matthioli adds that the Italian name for tomato is *Pomi d'oro*, and its Latin equivalent *Mala aurea*, and takes note of a red type. Unfortunately, Matthioli does not provide a woodcut of the plant, neither in 1544 nor in 1554.

The topic of the first European image of tomato is a subject of debate, because contemporary images were produced by several Renaissance herbalists, some being published mid-16th century, and the others having remained unpublished for centuries till their ''discovery'' during the 20th century. Shortly after Matthioli, there is indeed a sudden spurt of images the chronology of which is difficult to unravel. Dodoens (1553) is the first to have published a woodcut of tomato, though this latter is of a mediocre quality and the fruits barely visible (Fig. 1.39). In the Oellinger manuscript which was completed before 1553 (and only published in microfiches in 1996), two tomato drawings show fruits in clusters; the fruits are large, deeply ribbed, and turning from green to either red, folio 541 (Plate 1.26 left) or orangish, folio 543 (Plate 1.26 center). The third drawing displays a plant with small globular light yellowish fruits, folio 545 (Plate 1.26 right). Another contemporary tomato image is located in the Fuchs'Vienna codex (*11 122*, 2(3) folio 161) that was very lately published by Baumann et al. (2001). This image, painted by Albrecht Meyer between 1549 and 1556 (Plate 1.27), although not morphologically exact, displays single erect fruits of various shapes (globular, globular and flattened, with or without ribs), sizes (small and large), of which various colors are displayed (greenish, yellowish, reddish). Two other contemporary tomato images are located in the

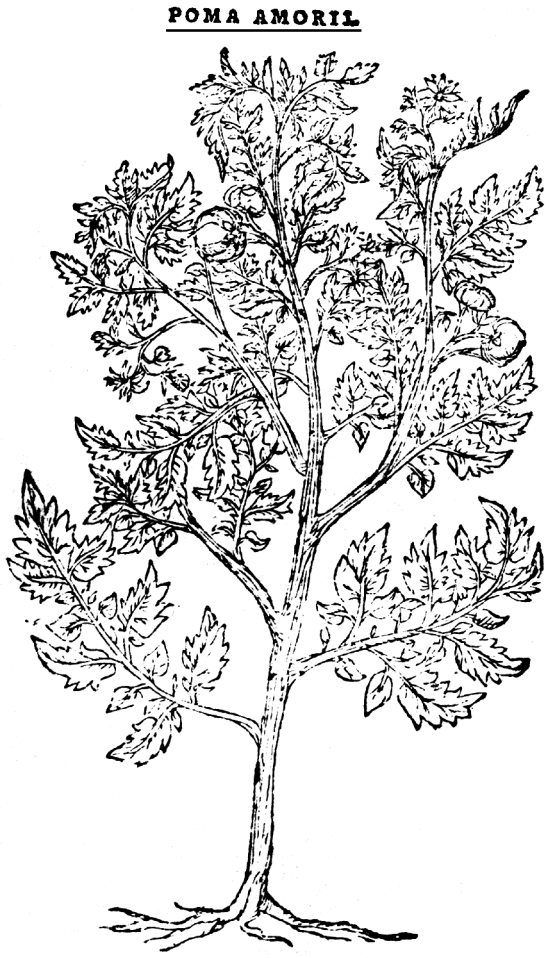

Fig. 1.39. First published tomato image. Source: Dodoens 1553. Courtesy: Library of Missouri Botanical Garden.

manuscript of Gesner's (*MS 2386*) folio 42 (Plate 1.28) dated 1553, and folio 37v (Fig. 1.40) dated (before) 1565 and which display respectively details of flowers and fruit. Such dissection of tomato reproductive organs was to be found again only much later in Pitton de Tournefort (1694).

Dodoens (1557) describes the fruits as large apples, flat, ribbed, of red or whitish or yellow color, and the woodcut, the same as in the 1553 edition, displays a simplified plant with small ribbed and flattened

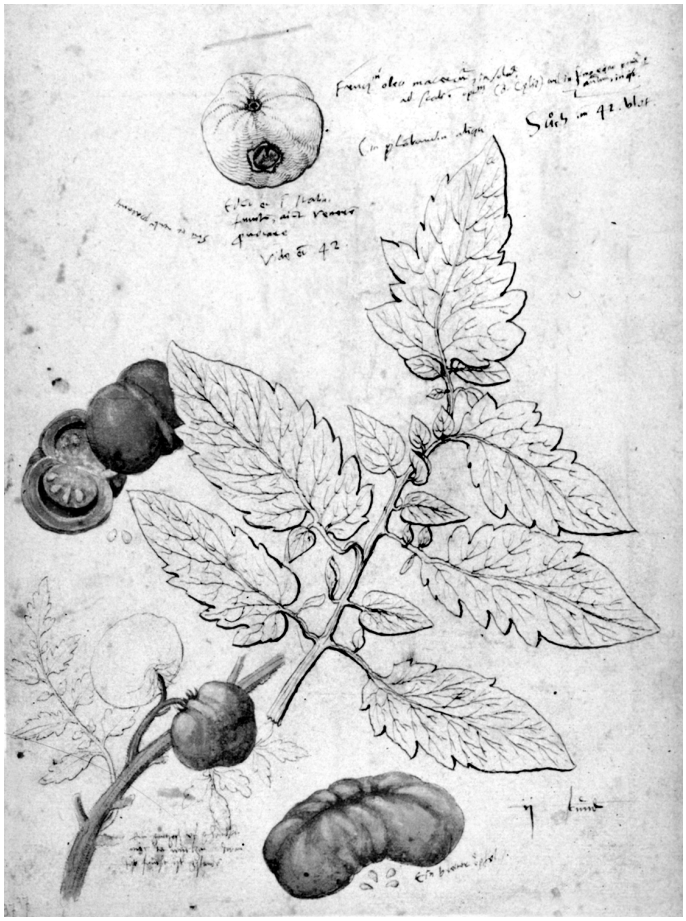

Fig. 1.40. Tomato. Gesner 1565, *Ms 2386,* folio 37v. Source: Erlangen, University Library. Copyright: Erlangen, University Library.

fruits. This woodcut, reversed, was to be used later by Dalechamps (1587 and 1653). In his later publications (1574, 1608), Dodoens used another woodcut representing a tomato plant (much more realistic than the 1553 one) with lateral shoots and clustered large flat and ribbed fruits (Fig. 1.41); this woodcut was also used by Lobel (1576b, 1581) and is found in Gerard (1633). A very close woodcut was published by Matthioli (1598), by Gerard (1597), and by Parkinson (1640). A colored illustration in the Camerarius's Florilegium (*MS 2764*) dated 1576–1589, represents a branch with leaves, a truss of flowers, and globular slightly flattened green and red fruits (folio 175r).

Fig. 1.41. Tomato. Source: Dodoens 1574. Courtesy Musée Requien, Avignon, France.

Durante published in 1585 a stylized drawing, with globular flattened and ribbed fruits (Fig. 1.42A). Matthioli (1586) displays on a single woodcut several fruit types (small or large, globular or flattened, ribbed or smooth (Fig. 1.42B), which were later on copied by Zwinger (1696 and 1744). The simplified painted image by Aldrovandi (vol. 9, folio 435, second half of the 16th century), represents only a branch with two flattened, ribbed, reddish and green fruits, one inflorescence and four leaves.

Very realistic tomato fruits (still large, globular, flattened and ribbed) as well as clearly recognizable leaves, are found on a bronze door of the

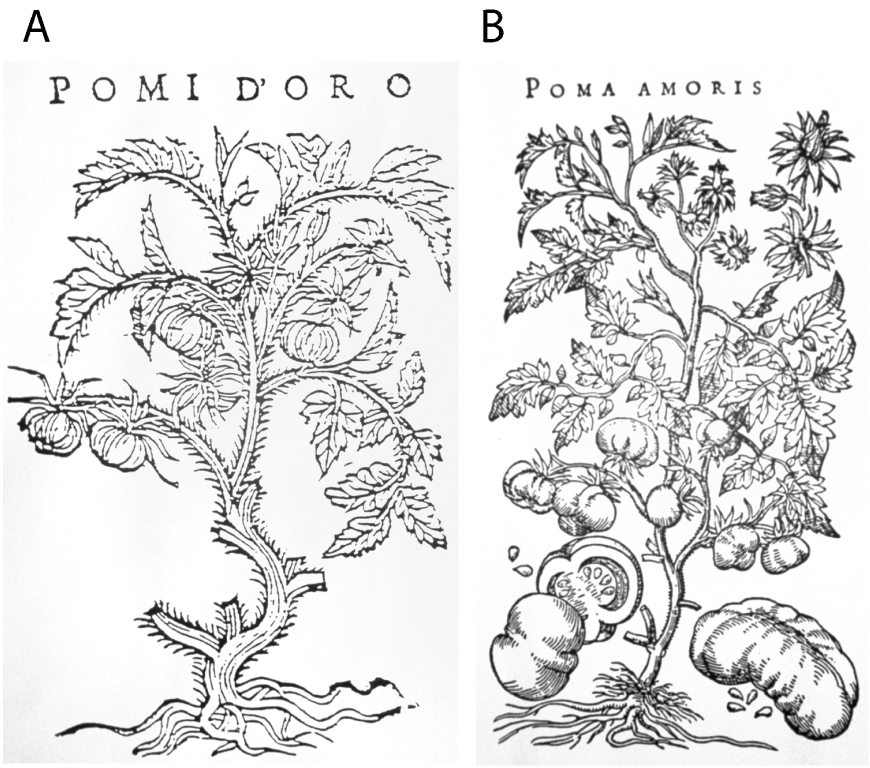

Fig. 1.42. Tomato. Source: (A) Durante 1585; (B) Matthioli 1586. Note presence of several fruit types. Source: Matthioli 1586. Courtesy: Musée Requien, Avignon, France.

Pisa cathedral (Fig. 1.43) dated to 1601. The tinted illustrations of Besler (1613) display a similar fruit type, with detailed yellow, Tafel 319 (Plate 1.29 top) and red, Tafel 320 (Plate 1.29 bottom), fruits and also show yellow flowers. The black-and-white drawings published by Parkinson (1635, 1656) and Bauhin (1650–1651) do not introduce new graphic information about tomato morphology.

The texts by Gerard (1597) and Parkinson (1635) describe fruits of sizes varying between those of a goose egg and a large apple, bright shining red, pale reddish, yellow or pale yellow, and several authors mention the ''foul'' odor of tomato vegetation. Interestingly, Parkinson mentions (without providing a drawing) a *Poma amoris minus*, *sive Mala Aethiopia parva* (small Love apple*)* with similar but smaller leaves, long weak trailing branches, long many-flowered bunches, and

Fig. 1.43. Large, ribbed tomato with leaves on bronze door of the Pisa cathedral, Italy, 1601. Source: J. Janick.

globular yellowish berries the size of grapes that could be a weedy form of tomato. However, the presence of the word *Aethiopia* in the plant name is confusing and indicates an African origin of the plant, which could then be a form of *Solanum aethiopicum*.

2. Names. The name *tomate* (Spanish, French) and *tomato* (English) derive from the suffix *tomatl* or the words *tomates* or *miltomates* in the Nahuatl language (Estrada-Lugo 1989). *Tomatl* was applied to several different solanaceous plants, including species of *Lycopersicon*, *Physalis,* and *Saracha*, and the various derivations of this name, as well as other Mexican names, are discussed extensively by Martinez (1937) and Jenkins (1948).

In the 16th century Europe, there were many names for tomato. Some authors thought that the plant was the *Lycopersicum* mentioned by Galen, or the *Glaucium* of Dioscorides. *Solanum pomiferum* and other denominations are found in herbals, such as *Pomum amoris*, *Poma amoris*, *Pomum aureum*, *Pomum aureiium*, *Solanum pomiferum vel amoris*, *Solanum pomiferum aureum*, *Mala aurea*, *Aurea mala, Lycopersicum* (Latin); *Pomi d'oro* (Italian); *Pommes d'amours* and *Pommes dorée*s (French); *Gold Oppffel*, *Goldt Apffelkraut*, *Gulden Appelen* (High and Low German); and *Golden Apples, Amorous apples, Apples of love*, *Love apples* (English).

Several other names were combinations of one of those names appended by a short description, such as, for instance, *Poma amoris minora lutea, Poma amoris majora media* and *minor, Pomum amoris majus fructu rubro, Solanum pomiferum fructu rotundo, molli*.

The generic name kept by the botanists, *Lycopersicon*, which means peach (*persikon*) of wolf (*lykos*), indicates some distrust toward this plant. According to Miller (1731), the Greek physician Galen (131–ca. 200) designated under the name of *Lykopersikon* a plant from Egypt whose sap was malodorous (tomato also has malodorous sap). This name has been used again by several botanists, who spelled it *Lycopersicum* or *Lycopersicon*. In the 18th century, the species was named as *Solanum lycopersicum* by Linnaeus, and then as *Lycopersicon esculentum* by Miller, but modern taxonomy is bringing tomato back to the genus *Solanum* (Spooner et al. 1993); however scientists and horticulturists resist this change because the binomial *Lycopersicon esculentum* is so ingrained in the literature and general usage.

While most fruits of tomato cultivated at present are red, the appellation *gold* or *yellow* which was commonly used in the past indicates that many of the early tomatoes introduced were yellow. Why it was named *Love apple* is unclear. This popular name could be linked to the red color, which is associated with the flush of passion, and to the nonbitterness of the fruits. Parkinson (1635) gives perhaps a good explanation by saying that he had tomatoes in his garden only for curiosity and for the amorous aspect or beauty of the fruit.

3. Uses. Tomatoes are described as medicinal plants in the *Florentine Codex* of B. de Sahagun; and there is a need to locate those texts, which are said to be in T.I. books 2 and 3 T.II book 8 and T.III book 10 (Estrada Lugo 1989). Dodoens (1557) noticed that the plant came from abroad, and was found only in the gardens of some herbalists; flowering was in July and August, ripe ''apples'' were produced in August and September. Less than one century later, Gerard (1597) stated that the *Apples of love* grew in Spain, Italy, and such hot countries, thus giving us insight at the rapidity at which tomatoes were adopted in countries of the Mediterranean basin. Dodoens (1557) considered the plant properties unknown, but based on the fruit taste, he considered tomato of a ''cold'' nature (in particular the leaves), and quite different from the dangerous mandrake. In 1608 he still referred to mandrake when he considered the properties of *Aurea mala*. Gerard (1597) and Dalechamps (1653) also considered *Golden apples* as having a cold nature. Blackwell (1737) still referred to the cooling and moistening effect of the outward applications of the fruit.

Gerard (1597) believed that the fruits brought very little nourishment to the body, while Dalechamps (1653) affirms that this food was bad and corrupted. In 1600 Olivier de Serres depicted the utilization of ''*les pommes d'amour, de merveille, et dorée*s'' (love apple, apples of marvel, and goldish) in arbors; their fruits were not good for eating, but were appropriate for medicine and pleasant to handle and smell.

In 1635 Parkinson said that in the hot countries where they naturally grew, love apples were much eaten to cool and quench the heat and thirst of hot stomachs and that when boiled or infused in oil in the sun, they were thought to be good *''to cure the itch, assuredly it will allay the heat thereof.''* Gerard (1597) describes very precisely the plant, in particular the *''long and trailing branches, leaning or spreading upon the ground, not able to sustain themselves*,'' a description confirmed by Parkinson (1635).

Despite some negative opinions, tomatoes clearly were consumed from the beginning of their presence in Europe, first in sauces, according to Olivier de Serres (1600, ed. 1804). Matthioli (1544) as well as Gerard (1597) and Dalechamps (1653) noted that they were commonly fried in or boiled with oil, salt, and pepper. The *Apples* were eaten in Spain and Italy with oil, vinegar, and pepper mixed together as a sauce for meat, as the British did with mustard in their comparatively cold country (Gerard 1633). In Italy they were eaten with oil and vinegar as were cucumbers (Blackwell 1737).

4. Conclusion. From several early European literary reports, it appears that tomato was well known by the Aztecs, as *Physalis* species were (*see* Section III.B). Since both were used for similar purposes by the Aztecs and shared common names, it is difficult, in the absence of New World iconography, to ascertain which species is referenced in the New World sources. However our investigation is insufficient, and Aztec and Maya codices need to be investigated in depth for illustrations.

In Europe, the first description of tomato (Matthioli 1544) woodcuts (Dodoens 1553), and painted illustrations (Oellinger, image dated before 1553; Fuchs, image dated 1549–1556; Gesner, one image dated 1553 and the other before 1565) are a bit later than those of capsicum peppers -1543 (*see* Section IV.C). Renaissance iconography shows that a great diversity of fruit shapes, sizes, and colors was early available in Europe, with a dominance of large multiloculate ribbed fruits. The common use of names involving ''gold'' suggests that many early introductions had yellow fruits. The early naturalists clearly knew that tomato was related to the European nightshades, and hence they considered it with some suspicion in view of the European antipathy

toward these plants. The many tinted early tomato illustrations, such as those of Oellinger, Fuchs, and Gesner demonstrate that botanists were eager to include this new species into their medico-botanical treatises. Tomato became rapidly adopted as a food crop, in particularly in southern European countries where it well adapted.

E. Potato (*Solanum tuberosum*)

The origin of potato and its domestication is southern Peru and possibly northern Bolivia. The crop was cultivated throughout the Andes long before the Inca Empire. According to Humboldt (cited by Hedrick 1919), potato was cultivated in all temperate regions of Chile to Colombia (''New Granada'') at the time of conquest of Peru in 1532 by Francisco Pizarro (1475–1541).

1. First Records. Many potato-like ceramic vessels (Fig. 1.44) were left in tombs (Spire and Rousselle 1996) by successive cultures of the Nazca (400 BCE–600 CE), Mochica (1–600), Chimu (900–1450), and Chimu-Inca (1100–1400). The veneration of pre-Inca populations for *Pachamama* (goddess of Earth) was very much linked to the worship of plants associated with other divinities, such as *Axomama*, the mother

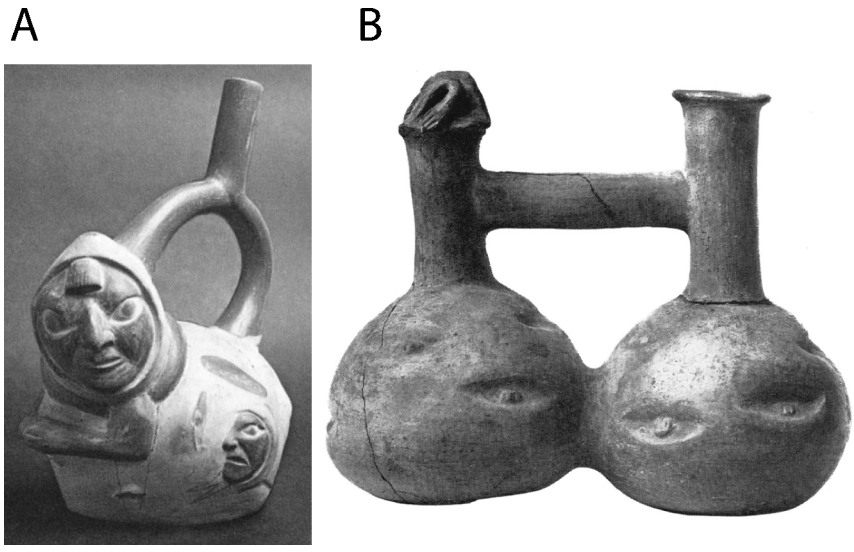

Fig. 1.44. Potato as terra-cotta vessels from Peru: (Left) proto-Chimu period, ca 300 CE; (Right) Chimu period, ca 900 CE. Source: (Left) Leonard 1973; (Right) Hawkes 1990.

of potato. According to Hedrick (1919), there were early reports of American tuberous species by Europeans traveling to America, but it is impossible to ascertain that they referred to potato and not to other American edible tuberiferous species such as sweetpotato (*Ipomoea batatas*), arracacha (*Aracacia xanthorrhiza*), oca (*Oxalis tuberosa*), ullucu (*Ullucus tuberosus*) and Jerusalem artichoke (*Helianthus tuberosus*). According to McAdam (1835) and Markham (1864) (cited by Hedrick 1919), the first European report of the Indian *Papas* (potatoes) was made in 1553 by Pedro Cieza de León, who reported that the inhabitants of the country of Collao had a high esteem for their principal food consisting of potatoes, which they called *chunus* when dried. The culture of the potato in Inca agriculture (Fig. 1.45) is beautifully illustrated in a calendar of the months illustrated with Indian life, the drawings of which are labeled with a mixture of Spanish and Quechuan. This calendar (referenced in Felipe Guaman, 1615. *Poma de Ayala*, Peru) was sent by a hispanized Peruvian to the King of Spain in 1580 as part of a treatise (Leonard 1973). Information on papas

Fig. 1.45. Potato culture in Peru. Filipe Guaman, *Poma de Ayala*, 1615: (A) planting, December; (B) harvest, June. Source: Leonard 1973.

is found also in reports of the Spanish missionary José de Acosta (1589), as well as Garcilaso de la Vega (Hedrick 1919).

In Europe, 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 herbalists. In 1588, then based in Vienna, 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 (Brücher, 1975). The next year Clusius received from P. de Sivry a watercolor (Plate 1.30) labelled with the Italian and Latin 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. However, the English herbalist John Gerard was the first to publish a woodcut image as well as a description in his *Herball* of 1597 (Fig. 1.46A), where he says*: ''the roote is thicke, fat, and tuberous, not much differing either in shape, colour, or taste from the common potatoes* (=sweetpotato), *saving that the rootes hereof are not so great nor long; some of them round as a ball, some oval or egge fashion; some longer, and others shorter: which knobbie roots are fastened unto the stalkes with an infinite number of threedie strings.''* Matthioli published another drawing in 1598 (Fig. 1.46B); close copies of it are found in Parkinson (1640, 1656) and Zwinger (1744). Clusius published a description of the potato in Latin as well as a drawing of its aerial part, roots, and tubers in his 1601 *Rariorum plantarum Historia* (Fig. 1.46C). In 1600 the French agronomist Olivier de Serres (1539–1619), quoted by Hedrick (1919), wrote that potato was recently brought to France from Switzerland. A detailed illustration of the potato with leaves, flowers, fruits and tubers is found in Besler (1613, Tafel 345) (Plate 1.31).

2. Names. Potato was and still is called *papas* by Andean Indians and *chunus* [chuño in Bolivia] when dried. The arrival of the potato in Europe at the same time as other crops with tuberous roots caused confusion in the botanical nomenclature. Gerard named it *Battata Virginiana* and *Potatoes of Virginia*, thus producing the first confusion between potato (Indian name *papas*) and sweetpotato (Indian name *Batatas*). According to Hedrick (1919), the presence of potatoes in Virginia as described by Hariot (1588) could be linked to a trip of Sir R. Hawkins in 1565, when he relieved the famine among the French on the banks of the river May (St. Johns) Florida and sailed northward toward Virginia. *Battata* and *Potato* names were also applied to other species such as Jerusalem artichoke (*Helianthus tuberosus*), which Parkinson

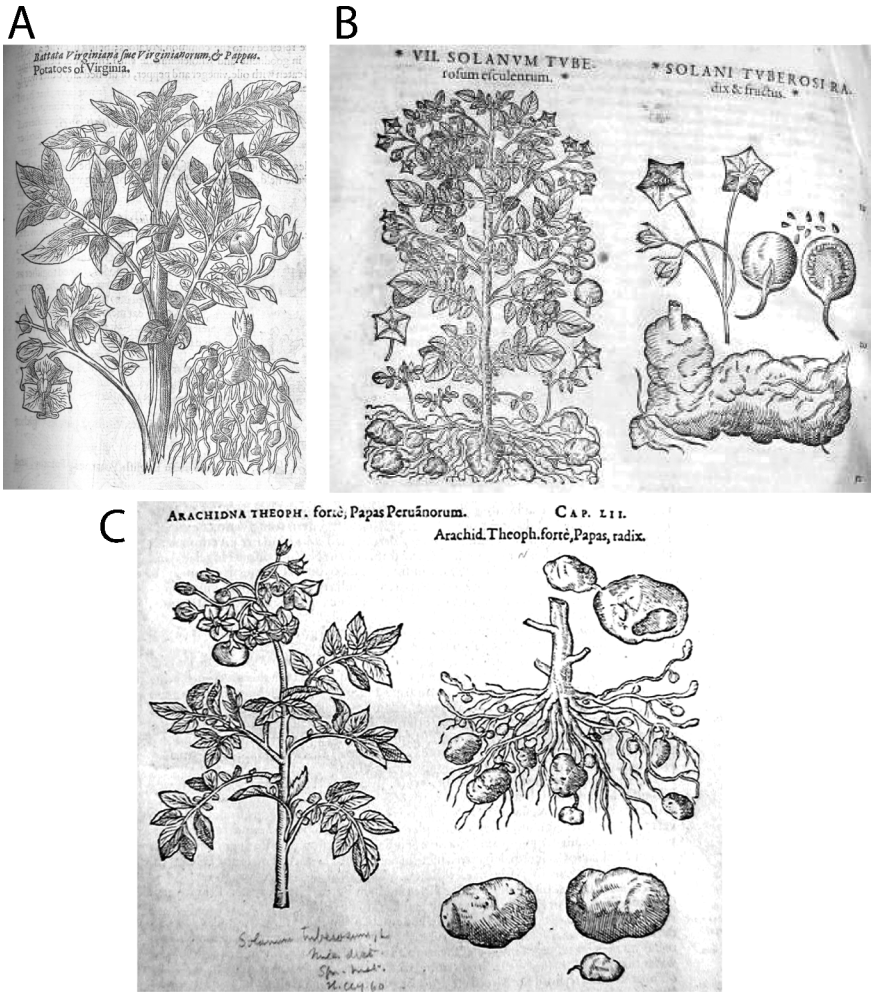

Fig. 1.46. First potato illustrations in European herbals. Source: (A) Gerard 1597; (B) Matthioli 1598; (C) Clusius 1601. (B) and (C) Courtesy Musée Requien, Avignon, France.

(1656) called *Battatas de Canada* and *Potatoes of Canada*. The names used by Clusius (1601) were *Arachidna Theophrasti forte* and *Papas peruănorum*, but he also took note of the name *Taratouffli* (the name associated with the watercolor sent to Clusius). According to Spire and Rousselle (1996), Bauhin allocated the name *Solanum tuberosum* to potato in his *Phytopinax* (1596); Matthioli (1598) designated potato as *Solanum tuberosum esculentum*.

3. Uses. Gerard (1597) mentioned the culinary use of the potatoes of Virginia; he describes them as *a food as also a meate for pleasure, equall in goodnesse and wholesomenesse unto the same, being either rosted in the embers, or boyled and eaten with oyle, vinegar, and pepper, or dressed any other way by the hand of some cunning in cookerie*. However, he mentions that Bauhin said that the roots was forbidden in Burgundy, where they were called Indian Artichokes and the frequent use of which was said to cause leprosy. Apart from this negative comment and the comparison of potato fruits to those of mandrake by Clusius (1601), little suspicion is noted toward potato in the early herbals.

4. Conclusion. Because of the late conquest of the Inca Empire (1531–1537) potato entered the medico-botanical manuals toward the end of the 16th century, i.e. much later than other American Solanaceae such as capsicum pepper and tomato. Its early European iconography is scarce and insufficient for commenting about tuber morphology and color. Probably the underground growth of the tuber made the plant less attractive than its berry-bearing solanaceous cousins. With the exception of a comparison of potato fruits to those of mandrake by Clusius (1601) and Gerard's mention of the fear of leprosy by some people, we found no hint of suspicion of potato in the herbals examined. However and at least in France, the late development of this new crop only from the 18th century onwards, i.e. two centuries after the first introductions, was due to the fear the tubers inspired, because of remaining Middle Age superstitions that Hell and Evil are located underground (Rousselle-Bourgeois and Spire 2003). Potato was destined to become one of the top 10 world crops in importance.

F. Other New World Nightshades

Other solanaceous species are mentioned in codices and Renaissance herbals, but their iconography is very scarce and the related texts limited. In Aldrovandi (vol. 5-2, folio 190), there is a beautiful illustration of a plant, one of the names of which is listed as *Solanum arboreum Indicum*: the name and the narrow entire leaves, white flowers, and small globular solitary and erect bright red berries suggest a shrubby, and probably American (*indicum* indicates the foreign origin of the plant) *Solanum* species. *Solanum pseudocapsicum*, a species widespread from Mexico to Argentina, is found in Gesner's *Ms. 2386* (fol.264 dated 1560) and a woodcut of a plant – probably the same species –with elongated leaves and globular berries, said to be

red in the text, is found in Dodoens (1608, p. 1214), Gerard (1633, p. 361), and Parkinson (1640, p. 353) (Fig. 1.47). S*olanum muricatum* (pepino), although not found in the Renaissance herbals, deserves a special mention, since there is a wealth of beautiful pre-Columbian potteries (Fig. 1.48) of the period Mochica-Chimu (200–1400 CE) conserved at the Archaeology Museum of Lima, Peru. It is likely that other nightshades are present in the Renaissance herbals since we did not investigate them exhaustively.

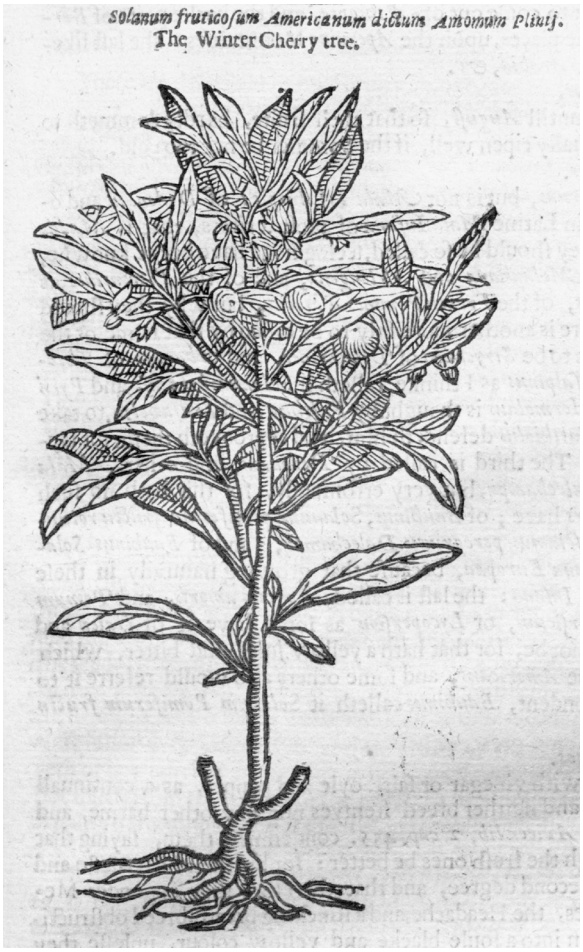

Fig. 1.47. Putative *Solanum pseudocapsicum*. Source: Parkinson 1640. Courtesy: Library of Missouri Botanical Garden.

Fig. 1.48. *Solanum muricatum* as terracotta vessel, Mochica-Chimu period (200–1400 CE), Museo de Arqueologia, Lima, Peru. Courtesy: J. Prohens.

V. DISCUSSION

A. Historical Sources

Our investigation on the iconography of solanaceous plants is based on an analysis of several hundred images of objects, woodcuts, watercolours, and associated texts, as well as paintings, that were assembled in 2005 and 2006. Most of them come from European sources and a few from pre-Columbian resources and New World codices. There is a need to better investigate pre-Columbian documents (potteries, embroideries, codices) as well as the texts written by Spanish conquistadors, chroniclers, priests, and physicians who witnessed directly or indirectly the social habits of the Indians and may have commented on the use of solanaceous plants.

For Europe, our analysis (herbarium information is not included) concentrates on images (and to a lesser extent to the related texts) dated before the end of the 17th century and found in Middle Age manuscripts including P. Dioscorides' *Codex Aniciae Julianae* (herbal of 512 CE), and Renaissance herbals of O. Brunfels (1464–1534), G. Oellinger (1487–1557), H. Bock -Tragus- (1498–1554), L. Fuchs (1501–1566), P. Matthioli (1501–1577), J. Dalechamps (1513–1588), V. Cordi (1515–1544), C. Gesner (1516–1565), R. Dodoens (1517–1585), J. Theodorus -Tabernaemontanus- (1520–1590), U. Aldrovandi (1522–1605), A. Lonicer (1528–1586), C. Durante (1529–1590), Ch. de l'Ecluse (1526–1609), M. de Lobel (1538–1616), J. Bauhin (1541–1611), J. Camerarius (1545–1607), J. Gerard (1545–1612), G. Bauhin (1560–1624), B. Besler (1561–1619), J. Parkinson (1567–1629), J. Zanoni (1615–1682), J. Pitton de Tournefort (1656–1708), and F. Zwinger (1658–1724).

The sources are numerous, dispersed, and often difficult to identify, locate and access, and in addition there are many slightly differing copies or editions of manuscripts and herbals. Furthermore Renaissance herbalists and first botanists often published several books. As a result we gathered and analyzed the information in a patch work style. However, some sources have been relatively well investigated including the *Codex Aniciae Julianae*, the BNF manuscripts available on line in 2005 and 2006 (http://mandragore.bnf.fr/html/accueil.html) and the herbals of G. Oellinger, L. Fuchs, P. Matthioli, J. Dalechamps, R. Dodoens, U. Aldrovandi, A. Lonicer, C. Durante, Ch. de l'Ecluse, M. de Lobel, J. Gerard, B. Besler, J. Parkinson, and F. Zwinger.

Other sources were investigated only partially: Aztec codices, several Middle Age manuscripts quoted in this paper, and the herbals of O. Brunfels, H. Bock, V. Cordus, C. Gesner, J. Theodorus, J. Camerarius, J. and G. Bauhin, J. Zanoni and J. Pitton de Tournefort. However, many sources were not investigated, in particular some writings of Middle Age Europeans (e.g. Albertus Magnus, 1193–1280), as well as Persian and Arab sources, e.g. Al Rāzi or Rhazes (846–930), Avicenna (980–1037), Ibn al Baitar (1188?–1248) Averroes (1126–1198), as well as some other Renaissance herbalists e.g. H. Barbarus (1454–1493), J. Ruel (1474–1537), A.M. Brasavola (1500–1555), and A. Cesalpino (1519–1603). These documents and others, including sculpture and mosaics of antiquity, deserve to be investigated in the future for a more exhaustive study of the Solanaceae iconography. To extract all the information there is a need to revisit these documents with the help of specialists of the various solanaceous genera involved and of linguists able to decipher and understand ancient and Medieval paleography, including Greek and Gothic writing, Latin, and old forms of Renaissance European languages.

The next step will be to investigate the rich iconographic documentation of the Grand Period of Botany in the 18th and 19th centuries. The images gathered so far are assembled into a database (www.hort.purdue.edu/newcrop/iconography/default.html) that solanaceae scientists, historians, and art specialists are invited to consult. We hope that this database will be enlarged progressively by contributions from workers in these fields (*see* Janick et al. 2007).

Some special difficulties in working with botanical documents, especially those from antiquity to the Renaissance, deserve comment. Understanding the medico-botanical history, identification of the most relevant authors and their publications, localization of the documents, and identification of libraries that have a copy are key issues. The next practical difficulty is to obtain the special authorization required to enter the inner sanctums of these libraries. All of this may appear trivial but can be a real obstacle. Furthermore, the permission to take snapshots (technically easy with a digital camera) or to get scans, photocopies or xerographic images varies from relatively easy to impossible to obtain, depending on the policy of each library. Copyrights are an impediment, as are the expenses required to travel abroad for extended periods of time, a severe hardship for researchers in this field since pre-Linnaean books are not circulated via interlibrary loans. The superprotective measures applied by the keepers of these precious historical documents are understandable, but the negative side effect is that they deter free access to scientific information. We are extremely grateful to the libraries (and librarians) who have been extremely helpful to us and have made possible our first harvest of solanaceae images (*see* Acknowlegments).

The difficulties of locating specific plant images in Aztec documents are similar to those encountered in exploring European sources. Analytical publications such as those of Dibble and Anderson (1963) and Estraga Lugo (1989) are invaluable for understanding old documents such as the *Florentine Codex*.

Medieval and Renaissance works are often based on authors of antiquity such as Theophrastus, Dioscorides, and Pliny, whose texts and illustrations have been continuously hand-copied (or reprinted from the 16th and 17th centuries onward) and enriched by new plants and commentaries. This means that the modern researcher faces a wealth of literature, where changes are quite laborious to detect from one edition to the other. Another difficulty is the problem of locating the entries of interest in huge documents, mostly consisting of many hundreds of pages, because (1) the plants may be referred to under various names in the indexes (when these exist); (2) the order of the plants is not always

alphabetical (e.g. the text can be arranged by medicinal properties, ailments, or type of plant); (3) text and illustrations may not be next to each other; (4) there may be only text or only illustrations; (5) the text is often difficult to undertand (Latin, Old Dutch, etc.), and (6) the text on a given plant is sometimes included in a chapter devoted to another plant or to a group of plants and hence headed by a different plant name. As a result, the seemingly simple task of locating a given species or determining the earliest mention or image of a given species is fraught with difficulties, especially when the plant is absent from the document, which often occurs when tracking early illustrations or mentions of New World species. Furthermore, the script and language problems are complicated by the diversity of names designating a single plant, by the multiple use of the same plant name, and by erratic spelling. A further complication is the inherent loss of information when a drawing or watercolor prepared by an illustrator who saw the plant is transferred on a wood block or a copperplate by graphical artists who did not see the plant.

The scholastic process of slavishly copying was a real impediment to increase of knowledge. Indeed, there is a whole range of inaccuracies because the recopying process maintained errors and often added new ones. There are problems in images both of poor craftsmanship of the artist (e.g. Fig. 1.39), and in some cases artistic licence, particularly in Medieval documents (e.g. the eggplant tree of Plate 1.15). Thus, in many cases inaccurate proportions, plant morphology, and colors of plant organs make the plant image difficult or impossible to determine precisely or even to recognize. The precision and faithfulness of plants drawings and paintings improved considerably from the mid-16th century onward with the herbals of Brunfels (1530) and Fuchs (1542, 1543), which can be seen as innovative while the precision (and artistry) of 18th and 19th century illustrators is unrivaled. A problem specific to Renaissance iconography is that the printers of this time often used the same woodcuts for several herbals, resulting in iconographic redundancy, sometimes mislabeled or reversed (when the image taken as model was redrawn and recut).

A number of innovative iconographic techniques was invented during the 16th century to incorporate genetic diversity in images and as much information as possible in a single illustration. Thus, some authors used fanciful illustrations, making a composite of a single plant to demonstrate the range of fruits shapes and colors. This can be seen for instance in the tomato painting of the Fuchs' *Vienna Codex 11122, 2(3)* folio 161 (Plate 1.27) or the illustrations of capsicum peppers of Aldrovandi (vol.6-1, folio 48) shown in Fig. 1.34 (B). Another artistic

innovation, starting with Fuchs' 1542 herbal, is the almost systematic inclusion of flowers and unripe and ripe fruits on a single drawing, which are rarely observed simultaneously in nature. From all these reasons, it is obvious that extreme care must be taken when interpreting plant images and texts from antiquity to the Renaissance.

An additional problem is that several herbals remained unpublished for various reasons, and existed only as manuscripts, often long forgotten. Only in the course of the 20th century have facsimile editions been produced. Dating the illustrations they contain is a real problem.This is in particular the case of the manuscripts by Oellinger (finished before 1553), Gesner (whose manuscript was incomplete at his premature death from plague in 1565), Fuchs (who died in 1566, before having succeeded in having his Vienna codex published), and Aldrovandi (whose herbal can only be vaguely dated as ''second half of the 16th century''). The precise date at which the illustrations of these herbals were painted remains often obscure unless designated by the artist and becomes very difficult to determine as is the case of the first European images of tomato.

B. Iconography of the Solanaceae

Most ancient authors were conservative. When writing about any species it was customary to refer to descriptions made by former authors (from antiquity to their contemporary counterparts) or to plants bearing some likeness. With the excitement of new plants returning from explorers, adventurers, and travelers to Africa, Asia, and America, Old World, botanists were eager to acquire, grow, describe, and analyze new plant finds, a frenzy that quickly spread to the upper crust of society who financed the flourishing production of various magnificent herbals, and florilegia in the 17th and 18th centuries. The absence of a reliable methodology for naming and classifying plants (a situation resolved only with the binomial nomenclature system based on Carolus Linnaeus' *Systema Naturae*, first published in 1735, and *Species Plantarum*, first published in 1753) forced Renaissance herbalists to classify the novelties with the conceptual tools at hand. Hence they compared the new Solanaceae finds to well-known ones with which they shared some likeness. They allocated to the New World plants names and/or properties of Old World ones, compounding the confusion. Thus, for instance, they used the name *pepper*, associated with *Piper nigrum* (Piperaceae) for *Capsicum* species (Solanaceae), *Hyoscyamus* for henbane as well as for tobacco, while eggplant and tomato were suspected of malevolent properties because of their association to mandrake.

Especially striking is the recurrent and almost systematic resort of Renaissance authors to compare various Solanaceae by, indicating that the modern sense of botanical family was intuitively understood. The comparisons included plant growth habit, leaf, fruit, flower and seed shapes and colors, as well as odor and taste. However, because of inaccurate descriptions and haphazard use of plant names, confusions within the Solanaceae and with plants of other families abound. Thus, belladonna was taken for a kind of mandrake; tomato and eggplant were both love apples; tomato and scarlet eggplant were both *S. pomiferum*; *S. somniferum* designated *Atropa belladonna* as well as *Withania* spp. and *Scopolia* spp.; *Guinea pepper* designated capsicum pepper spp. as well as *S. aethiopicum*; sweetpotato (*Ipomoea batatas,* Convolvulaceae) and potato (*Solanum tuberosum,* Solanaceae*)* were both named *batatas*, and so on.

The powerful physiological and psychoactive effects of several Solanaceae on humans was well known since antiquity in a number of the Old World species (mandrake, henbane, belladonna, al kekenge, and other less known species) and of the New World species (particularly datura and tobacco) by pre-Columbian civilizations. These effects varied from benevolent to malevolent, depending on species, plant parts used, dose, recipe, and mixture with other plants. As a result, the Solanaceae plants were incorporated into brews, potions, lotions, drops, plasters, powders and ointments used as anti-inflammatories, anticongestives, disinfectants, anesthetics, narcotics, sexual stimulants, and hallucinogenics. This diversity of effects was of course frightening (because unexplained) and served appropriately for use in ''black'' magic as evidenced by the term *nightshades* (*Nachtschatten* or *Nachtschaden* in German), very appropriately assigned to solanaceous plants. The Solanaceae were generally considered ''cold'' in Medieval and Renaissance medicine, with the exception of the fiery ''hot'' capsicum pepper, tobacco, and *S. dulcamara*. We now know that their various pharmaceutical and psychotropic properties (healing, mind disturbing, or even death inducing) are due to the presence of many tropane alkaloids, such as hyoscyamine, hyoscine, and atropine.

Mandrake was the species most often referred to by Renaissance herbalists when writing about solanaceous species since many of them share several common morphological traits, particularly leaf and fruit traits. This is undoubtedly the reason why the malevolent properties of mandrake, as well as henbane, datura, and belladonna, were attributed in various degrees to eggplant, tomato, and potato. Of all the Old World Solanaceae, mandrake had the most complex relationships with the human imagination, a fact reflected in its Medieval

iconography. In the New World, the wealth of ceramic imagery of potato and pepino indicates the importance of these crops in pre-Columbian South America.

At the time of the European encounter with the New World, capsicum peppers, husk tomatoes, and tomatoes were very common in Mexico, as was potato in Peru. Despite the early statement by Europeans that these plants were common crops in the New World, old fears toward nightshades were still expressed in some herbalists' early commentaries. Capsicum pepper probably suffered least from the negative aura of the family, but this was due to its association with black pepper, which was so valuable in the ancient world. In fact, it was the frenzied and competitive search for black pepper and other spices via an ocean route to Asia that led to the encounter with the New World. An amazing paradox is that tobacco, which was widely cultivated in various parts of the Americas and first considered a panacea by Europeans, is a truly malevolent species, whose disastrous effects are only now being fully appreciated.

VI. CONCLUDING REMARKS

Plant iconography from antiquity to the late Renaissance, first exclusively developed for medicinal purposes and later also for botanical concerns, is a source of knowledge as well as a repository of great artistic value. This iconography has been the basis of a number of exquisite books, such as *The Illustrated Herbal* (Blunt and Raphael 1979), *Ein Garten Eden* (Lack 2001), *Ein Garten für die Ewigkeit, der Codex Liechtenstein* (Lack 2003b), and *Promenade dans des Jardins Disparus* (Bilimoff 2001). This rich treasure, an invaluable source of information about taxonomy, crop domestication and history, lost traits, genetic diversity, and plant uses is useful for researchers in botany, genetics, and horticulture. The difficulties in accessing these documents scattered in many libraries has rendered horticultural and botanical analyses arduous. The recent digitalization of these resources by libraries and the development of online iconographic databases should facilitate future research and make the information more easily accessible to a wide audience in various disciplines.

The survey of the rich and astonishing information resources that iconography provides opens up a new approach to the study of the Solanaceae, to horticultural sciences, as well as to art history and the humanities. However, plant iconographic research requires time and care, as well as interdisciplinary collaboration. Drawings provide only partial information, which needs to be completed by the associated texts

when they exist. For example, the certainty of crediting any authors with *the first* illustration of a given species is a very fragile assumption, correct only until an earlier illustration is found. The recent example of *Cucurbita pepo* is instructive to this regard, since the earliest European illustration was identified in Fuchs (1542) by Sturtevant in 1890, then the date dropped down to at least 24 years to a Renaissance ceiling painted in the villa Farnesina by Giovanni da Udina in 1515–1518 (Caneva 1992), and then reduced another 10 years to a prayer book illustrated by Jean Bourdichon between 1503 and 1508 (Paris et al. 2006). Indeed, given the scattering of the ancient manuscripts and printed herbals over many countries, libraries, private collections, and possibly monasteries, the ''first'' drawing should be recognized as the ''first'' only until an earlier document or image is located. The case for the first European image of tomato appears especially difficult since it seems impossible to determine with certainty the chronology of the woodcut present in Dodoens (published 1553) and the watercolors of Fuchs' *Vienna codex* (painted 1549–1556), Oellinger's manuscript (dated before 1553), and Gesner's manuscript (2 images dated 1553, 1565). Perhaps priority is not all that important since all Renaissance herbalists were actively involved in the exchange and dissemination of these gifts from the New World.

This review concerns only a very small number of solanaceous species when compared to the some 2,000 species of the family. However, our iconographic search has yielded interesting information. There are very few, if any, mentions of the magical uses of Solanaceae in Renaissance herbals. Herbalists of the 16th and 17th centuries, although living at a time when sorcery and witchcraft were considered a reality, refrained from commenting on these dangerous activities, an admirable intellectual and scientific attitude. We note that while Renaissance artists included solanaceous plants in their paintings (e.g. Plate 1.20) and carvings (Fig. 1.12), the frequency was much less than for cucurbits, probably because the fruits were less spectacular. In the printed herbals, fruit images of eggplant and tomato were morphologically not very distant from present-day types, at least as far as shape, color, and to a lesser extent size, are concerned. For the tomato this suggests that the breeding process of the Native Americans had already gone far beyond domestication. However, the absence of elongated tomatoes in the documents of the period covered here suggest this trait to have appeared quite recently, and for capsicum pepper, large, sweet fruits seem to be absent from Renaissance herbals, suggesting that modern breeding efforts have created a substantially new type, unless these tomato and capsicum pepper types existed in Mexico and were only lately

introduced to Europe. Later breeding efforts of all these species, in particular since the second half of the 20th century, have focused on traits such as resistance to biotic stress and productivity, which have greatly advanced horticultural progress.

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IX. MANUSCRIPTS

A. Bibliothèque municipale, Rouen, France

Leber 1088, Ms 3054: Tacuinum sanitatis, Italy, 15th century.

B. Bibliothèque nationale de France, (BNF), Paris, France [available on http//mandragore.bnf.fr]

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Français 12319: Livre des simples médecines. France (Nord), 15th century (3rd quarter).
Français 12320: Livre des simples médecines. France (Nord), 15th century (middle).
Français 12321: Livre des simples médecines. France (Nord), 15th century (middle).
Français 12322: Livre des simples médecines. France (Ouest), ca. 1520–1530. [We also used the text translated in French of Le livre des simples médecines, circa instans, Matthaeus Platearius d'après le manuscrit français 12322 de la Bibliothèque Nationale de Paris. Ed. Ozalid et textes cardinaux. Paris. 1986].
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Latin 6823: Manfredus de monte imperiali, de herbis. Pise, Italy, ca. 1330–1340.
Latin 6862: De ponderibus medicinalibus. France, 9th century (middle).
Latin 9333: Ibn butlân, taqwim es siha (trad. anonyme) = *Tacuinum Sanitatis*. Germany, Rhenanie, 15th century.
Latin 9474: *Horae ad Usum Romanum* (Grandes Heures d'Anne de Bretagne). France, Tours, ca. 1503–1508.
Nouvelle Acquisition Latine 1673: Ibn Butlân, taqwim es siha (trad. anonyme) = *Tacuinum sanitatis*. Italy, Milan, ca. 1390–1400.
Nouvelle Acquisition Française 6593: Livre des simples médecines. France (Bourgogne), 1452.
Supplément persan 1568: djamâlî yazdî, farah-nâma-i djamâlî. India, 17th–18th century.
Supplément turc 1063: qazwînî (al-), 'adjâ'ib al-makhlûqât (trad. rûdûsîzâde). Istanbul, Turkey, 1685 (= hégire 1096).

C. Bodleian Library, University of Oxford, UK

Codex Mendoza (also known as *Codex Mendocino*, *MS. Arch. Selden.* A.1. Ca 1541–1542.

D. British Library, London, UK

Add. Ms. 41623: *Codex bellunensis*. 15th century. [Source: Blunt and Raphael, 1979.].
Besler, B. 1613: Hortus Eystettensis. Hand coloured print edition. Reference *10. Tab.29.*

E. Erlangen University Library, Germany (Universitätsbibliothek, Friedrich-Alexander Universität Erlangen-Nürnberg)

MS 2362: Oellinger G., *Magnarum medicine partium herbariae et zoographiae imagines.* Dated before1553. [Source: Microfiches in Magnarum medicine partium herbariae et

zoographiae imagines, G. Öllinger, S. Quicchelberg, ed. Helga Lengenfelder, 1996.] [Note: this document should be considered as the first publication of Oellinger's manuscript.]

MS 2386: Gesner C. (also spelled Gessner K.), Collectanea ad ''*Historiam Plantarum*'' pertinentia sive Fragmenta ''*Historiae Plantarum*'' relicta. 2°. 2 Bde. UB Erlangen-Nürnberg *MS.2386*. Dated before 1565. [Source: Wickert 1993.]. A facsimile of the 8 volumes of this manuscript was published 1970–1980 by *Dietikon-Zürich: Graf* under the title ''*Gesner, Conrad: Conradi Gesneri historia plantarum: Kommentar von Heinrich Zoller. Transkription u. Übers. von Martin Steinmann. Künstl. Beurteilung von Karl Schmid.* '' Another complete edition but with size reduced illustrations was published later with the title ''*Gesner, Conrad: Conradi Gesneri historia plantarum/ hrsg. von Heinrich Zoller . . . .* '' by *Dietikon-Zürich: Urs-Graf-Verl. 1 (1987). Dietikon-Zürich, 1987. – 2 (1991). Dietikon-Zürich, 1991*. In volume 2, plants names are listed in Latin and German.

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J. University Library, Bologna, Italy (Biblioteca Universitaria di Bologna)

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K. University Library Eichstaett-Ingolstadt, Germany (Katholische Universitaet Eichstaett-Ingolstadt)

Besler, B. 1613: Hortus Eystettensis. Hand coloured print edition (3 vol.). Call number *183/ 1 SJ II 2894*.

L. Unknown Library

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M. Vatican Library, Rome, Italy (Bibliotheca apostolica vaticana)

Badianus manuscript, also known as *Codex Barberini, Latin 241* (1552). [Source: Walcott Emmart 1940.]

N. Vienna National Library, Austria (Österreichische Nationalbibliothek)

Cod. Med. Gr. 1: *Codex Aniciae Julianae* (also known as C*odex Constantinopolitanus, Codex Byzantinus, Codex vindobonensis, Dioscoride de Vienne*): De Materia Medica. Ca. 512. [Source: Der Wiener Dioskurides, Codex medicus grazecus 1 der Österreichischen Nationalbibliothek, Akademisch Druck-u Verlagsanstalt 1999 (facsimile ed.).]

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O. Paintings

Arcimboldi, G. 1573. *Summer*. Le Louvre, Paris.

Campi, V. circa 1580. Frutti vendola. Collection Fugger, Schloss Kircheim, Germany.

Cipper G.F., [also known as Todeschini], G.F. ca. 1700. Detail of *Scena di mercato*. [private collection, (quoted in Mazzini, 1955)]. Source: L Ravelli, 2004.

Master of Hartford, before 1607 (possibly 1593). Flowers, fruits and two lizards. Galleria Borghese, Rome, Italy.

Van Balen, H. ca. 1618. *Wedding of Thetis and Pélée*. Le Louvre, Paris.

Van der Baren, J.A. ca 1650. *Still Leben mit Kürbissen*. Kunst historische Museum, Vienna, Austria.

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Zucchi, F. ca. 1600. *Ritratto composito.* Museo di Capodimonte, Napoli.