Scientific Paper

Gastronomy and the citron tree (Citrus medica L.)

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Abstract

In the area of primary domestication, the fruit of the citron tree (Citrus medica L.), and to a limited extent its leaf and flower, have traditionally been used as a raw condiment, candied, or more rarely, salted. In the area of secondary domestication – the hot Mediterranean climate – culinary uses multiplied during an active phase of cultivar development in the 10 to 16th centuries. In the 19th century, citron products were widely used in the gastronomy of Northern Europe, mainly in sweet dishes.

The establishment and dissemination by the Tintori nursery in Tuscany of a remarkable collection of citron trees and, later, the appearance on markets of the fingered ‘Buddha’s Hand’ cultivar revived interest in citron tree products. Initial results from a methodical examination of their current culinary applications reveal a positive contribution to savoury cuisine as a result of contemporary cooking, maceration and extraction techniques. Cultivars are selected specifically for these different uses. The use of steam extraction to create "citron floral water" (hydrosol) is promising.

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Introduction

The Citron (Citrus medica L. or Citrus medica cedra Ferr.) is the Cinderella of citrus gastronomy despite having been the first citrus fruit to spread far from its primo-domestication zone (Tolkowsky, 1938). If the leaves, flowers and fruit have been used in the past, modern culinary research shows that it is far from having achieved its potential. In light of actual gastronomic technologies the citron definitely has a wide range of new applications.

Early culinary uses of the leaf, flower and fruit of the citron tree

The four main uses of citron (Citrus medica L.) are as

- an ornamental tree (Andrews, 1961)
- a medicinal plant (Lanzoni, 1690) whose anti-inflammatory properties are proven (Kima et al., 2013)
- a culinary plant and
- a liturgical fruit (Scora, 1975).
In the Western world, the inclusion of the citron in the *lulab*, the ritual bouquet used for the Jewish holiday of Sukkot, is a tradition likely adopted by the Jews from the Mesopotamians who, according to *Nabatean Agriculture,* a Late Antiquity treatise cited by Ibn al-‘Awwâm, believed the citron represented purity. Its use in this ritual ensured that there was strong homogeneity among cultivars (Nicolosi, 2005). According to Isaac (1959), it contributed to the wider use of the citron in Mediterranean cuisine: candied citron has been documented in the Jewish communities of North Africa. In 17th century Italy candied citron was preserved and presented in the Ḥirōset, the fruit dish served at Passover, or at the festive meal on the 15th of Ṣebat (New Year of the Trees).

A fingered cultivar originally from Southern China, the ‘Buddha’s Hand’ citron, has been also used as a ritual fruit, placed on Buddhist altars. Due to its widespread distribution, this citron has experienced a revival in Europe as a fashionable exotic fruit (Brigand, 2010).

The citron tree’s first domestication area was the southeastern section of the Eastern Himalayas with its subtropical climate and monsoons (Swingle and Reece, 1967). Wild types were reported in Assam and Bhutan, with possibly acclimatized varieties in Yunnan, Vietnam and Thailand (Froelicher et al., 2011) as well as in the Middle East (Chapot, 1963). The fruit is still consumed fresh and candied in the region. The tree migrated to the southeastern Mediterranean through Mesopotamia in ancient times (Loret, 1891; Ramón-Laca 2003). It has been attested in Egyptian digs dating to the 21st century BC (Gallésio, 1811; Albertini (2013: 299) dates the citron tree’s arrival in Egypt at around 1590 BC where it was grown only marginally. The Babylonian Talmud (2nd century) mentions its consumption in the Middle East stating that the citron symbolizes a wise man of visible and known value because “it has a pleasant scent and tastes delicious”; it was eaten by children at the end of the holiday of Sukkot.

However, it appears that, in the Western world, the fruit of the citron tree was valued primarily for its decorative rather than consumable features. The three *citrum* recipes provided by Apicius (1st century AD), in which *citrum* is often translated by “citron”, should actually be treated as recipes for Calabaza squash (*Cucurbitaceae* of the *Lagenaria* genus). The only true reference to the citron tree (*citrus*-i) was to the use of its leaf (*Folia citri*) in an aromatic maceration, in this case, in a recipe for rose wine without roses.

The Mediterranean: second domestication area – late appearance of a cuisine using the fruit and flower of the citron tree

During the middle ages and at the beginning of the Renaissance period, the Mediterranean region and the Arabian Peninsula were an active secondary domestication area. To the extent that “the citron tree presents very little gene diversity due to strong homozygosity and weak polymorphism between cultivars” (Rocca Serra and Ollitrault, 1992), only a few hybrids and mutants appeared during this time of more frequent cultivation. In Seville in the 12th century, Ibn al-Awwâm described a number of varieties: “the Cordoba citron is a large pointed fruit, the *Qosyt*, large and smooth, the Chinese citron as large as an eggplant, round and acidic…”

The author likely included under the term “citron” varieties of the lemon with a thick mesocarp (which the Italians refer to as *pane* “bread”), a frequent occurrence until the 10th century. Raw and candied versions of the fruit were exported from al-Andalus to the north. In Egypt, the *Kanz al-Fawâ’id ft tanwi* provided a recipe for candying the fruit. *L’Anonyme Andalou,* cited by Lucie Bolens (1990), mentions using the leaf of the citron tree (“used widely in Andalusi cuisine” according to Derenne 1999) in lamb stew, in a mint and borage drink, and in the Jewish recipe for chicken with fennel, garum, etc.

Domestication of the citron and the development of cultivars and hybrids continued until the 16th century. The diversity of citrons (5 cultivars) can be seen in a 1715 painting by Bartolomeo Bimbi, depicting the Medici collection, which contained the Mediterranean cultivars of the time. The collection was started by Cosimo I (1554–1568) and was at its best under Cosimo III.

Cuisine using the flower and fruit of the citron tree came into its own during the Renaissance. In the 16th century, Bartolomeo Scappi, chef to Pope Pius V (1500–1577), documented a variety of recipes with a notably Arab influence: candied fruit (*scorza di cedro e di melangole confette asciutte* and *Polpa di cedro confetta asciutta*), citron flowers in spicery (*Fiore de cedro conditi*) or in a mixed salad (*Fiori di cedro in insalata* – menu 12, dish 12), and slices of fresh citron in a recipe for roasted turkey or pheasant, served cold with sugar and small capers on citron slices marinated in sugar, salt and rosewater. In 1593, there is also mention of a sweet/acidic citron verjuice (Di Romolo Rosselli, 1996).

In the late 16th century, with the orange tree and orangeries coming into fashion, the citron tree spread throughout Europe. There is a wealth of iconography with its fruit, by such artists as Josefa de Óbidos (1630–1684) and Antonio de Pereda, in

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3This work exists only in an Arabic translation published by Fahd (1993).
5See also Marks (2010) for other mentions of Jewish culinary uses of the citron.
6Babylonian Talmud, tractate Menachot, 27a.
7Babylonian Talmud, tractate Succah, 4:3.
8Marcus Gavius Apicius. *De re coquinaria*, compilation from the late 4th century, texts partially from the 1st century, Northern Italy. Cited from André (1974).
9The question of the Latin name for citrus will be the subject of a note by Peter Nahon in the *Revue des études latines* to appear in late 2016.
10*Kanz al-Fawâ’id ft tanwi al-mawâd* [Treasury of good advice for preparing the table], 10th century Egypt; recipe quoted by Zaouali (2010).
12Oil on canvas, 174 × 233 cm, Paggio a Caiano, Museo della Natura Morta.
14See Killemann (1916).
15Still-Life with Fruit, 1650, Museu Nacional de Arte Antiga, Lisbon.
Portugal and with Dutch painters. In Paris under Louis XIII, Cardinal de Richelieu (1582–1633) drank aigre de cédrat à la Royale, an orange drink acidified with lime, sweetened with honey and mulberry juice, and flavoured with the zest of the red citron (Savary and Savary, 1741). It is likely that the Arabs in Andalusia used the fruit in alcoholic drinks or in infusions, a practice still followed in Calabria, Sicily and Corsica.

Modern cuisine: Northern European cuisine adopts the citron

Growing the citron tree is a delicate task as it is averse to cold winds, intense heat and especially to low temperatures. In the southern Mediterranean countries, the mesocarp is commonly used raw in salads or carpaccio, sweetened (frozen as a crunchy sorbet), candied and eaten directly or in pastries, in liqueur, or as a dried zest or confit. In the rest of Europe, the citron is used in cooking as either a confit or an essential oil, which is extracted mechanically from the green citron and called "citron water" (eau de cédrat).

In the 19th century, the fruit became available to the best kitchens and the range of uses expanded. In 1839, the Count de Courchamps (1839) listed 54 uses of citron in cooking, only one of which involved a savoury dish – the juice of the green citron on foie gras "at the time of serving" – and a few neutral or acidic options – distilled citron water, aigre de cédrat (a beverage, see "The Mediterranean: Second domestication area – late appearance of a cuisine using the fruit and flower of the citron tree"), citron vinegar, and ravigote vinegar with citron zest. His list of 74 desserts contains 17 mentions of citron. The fruit and flower, but not the leaf, are used:

- Milano citron: fruit preserved in sugar and mustard;
- Citron peel or zest: rubbed on sugar to prepare citron cookies, in whipped cream with four zests (orange citron and bitter orange, in madeleines, in crème royale with citron(with eggs), in darioles à la Duchesse, in meringues, in vanilla potato croquettes, in apple pudding with pistachios, in citron pudding, and in riz à la Dauphine;
- Citron confit, dried, candied, in marmalade, in Talladins, in Baba à la Carême; in Chantilly de la Charlotte à la Richelieu, and in chancottenes with pistachios;
- Citron frosting/icing (bouchées or petits fours with citron), on grel, in pastries called Mirlitons, chopped citron in plum pudding, in moulded pudding, and in pudding à la parisienne;
- Citron syrup, citron liqueur
- Sabayon, mousse, jellied, sorbet, citron ice
- Slices of citron on pigeon heart and cherry compote
- Citron flowers in citron flower ice
- Citron juice in ice, green tea cream and citron juice
- Essence of citron in Chantilly mousse
- In cream, in potatoes with citron cream

Late 20th century: a more methodical approach to a fruit of the future

A better knowledge of the available cultivars

It was not until the second half of the 20th century that the Tintori family in Pescia, Italy, between Florence and the sea, brought together the remainder of the Florentine collections into what is today the most complete collection of citron trees since the Medici: 13 Citrus limonimeditica (de l’Institut national de la recherche agronomique (INRA) lists 4 varieties available in 2014) and 19 C. medica (INRA 7). The Tintori nomenclature for these plants has been adopted by such specialists as Niels Rodin, a grower/processor in the Riviéra Vaudoise, Switzerland. In this paper, we have included Tintori’s cultivar numbering to be precise. Many other varieties have been identified: Cotton (2002) lists 193 known denominations (including 157 cultivars of C. medica and 36 of C. limonimeditica), notably in Morocco (see also Chapot, 1950) although we never have been able to locate them there, let alone taste them.

The Tintori collection serves as the foundation for our systematic review of the uses of citron in modern cuisine. The collection contains the main types of citrons: the long, thin ‘Moroccan’, the short, conical ‘Yemenite’, the bumpy ‘Braverman’, and the red and orange citrons. These fruits are easily transported, keep well and mature slowly on the tree with fresh fruit available from late October to early spring in the northern hemisphere. The tree grows well in a sheltered southern exposure, in open fields, and along the southern coast of Portugal. The varieties with large fruit must be supported to ensure good development.

Certain cultivars have been excluded from this paper because of their disappointing flavour or texture or disagreeable bitterness. As an example, the ‘Rob el Arsa’ (26f) is not included because of its grainy peel and neither is the ‘Pigmentata’ (23).

Use of the pericarp primarily

The citron's pericarp (its entire envelope of the fruit including the mesocarp or albedo and the epicarp or zest) lacks both fats (lipids) and sugars (carbohydrates) but is high in fibre. The zest is rich in volatile flavonoid compounds (rutin and neohesperidin), limonene and gamma-terpinene (Venturini et al., 2014; Fleisher and Fleisher, 1991). The essential oil does not have a long-lasting aroma or offensive taste and therefore it is best to serve the zest at the beginning of the meal to best appreciate its properties. The mesocarp is not bitter in most cultivars.

16Willem Kalf, Nature morte à l’aiguière d’argent (73,8 × 65,2 cm), 1655–57, Rijksmuseum, Amsterdam.
17Malisset (1803) gives an early account of making citron water in Nice, Tuscany, Corfu, Greece, Thailand and India.
18Vivai Oscar Tintori, Via Tiro a segno 55, 51012 Castellare de Pescia (PT), Italy; see (http://www.oscartintori.it/)
The mesocarp (albedo)

Chef Vincent Farges selected the 'Etrog' (29), 'Diamante' (27), 'Maxima' (32), 'Mangiagli' (26g) and 'Buddha's Hand' (28) cultivars and ranked the 'Crisipolia' (26a) first because of the texture and taste of its albedo. (Recipes of Chef V. Farges: sliced 'Crisipolia' citrus with first beans, Moroccan mint and Galega olive oil – toasted flat bread; citron in cream flavoured with paprika and oxalis.)

Jean-Paul Brigand tested several cultivars with eight random groups of people with differing taste experiences and cultures. The groups were served slices of fresh fruit consisting of the albedo and zest and slices consisting of the albedo, zest and the acidic pulp. Based on these tests, it was decided to cultivate in Portugal the ‘Crisipolia’ (26a). It ripens from January to April.

Peter Nahon grows the 'Temani' (the Hebrew word for 'Yemenite') as an indoor plant in France (Nahon, 2015). This cultivar from Yemen has almost no pulp and the albedo is of excellent quality. 'Peretonne' (22) hybrid, which has relatively small fruit, is not included here although its albedo is very edible and has an excellent texture.

Working with the 'Maxima' (32) cultivar, Chef Vincent Farges uses the uncooked pericarp, albedo and pulp and reduces them to a paste that looks like mustard and is made like a wasabi paste. It is served with white meat. He uses the 'Buddha's Hand' variety in carpaccio: "Buddha's Hand, supions, dried tomatoes".

Epicarp (zest): a wide range of uses

The zest has always been used in savoury dishes and with egg preparations such as pastéis de nata (a citron flan "pastel de nata" chez A. Passard). Today, it is found more frequently in omelettes, soufflés, bread, foie gras with citron jelly or baking (Chef Vincent Farges: duck foie gras, glazed with soy, seaweed and 'Etrog' citron (29)).

The raw zest is used in sous vide (vacuum) maceration and is especially interesting in dry maceration: dried figs sous vide with citron zest for 1 month. This type of dry sous vide maceration can be applied to all dried fruits and to cheeses. The zest is well suited to sous vide cooking for short periods of time, particularly with fish. To avoid the zest becoming bitter when cooking for longer periods, it should first be blanched 1–3 times.

For cooked zest, Chef Pascal Meynard prefers the 'Maxima' (32) with its smooth peel: confit with salt (brine) and herbs – bay, pepper, coriander and fennel seeds – sous vide at 55 °C for 3 h.

The leaf

The leaf is used in liquid maceration like a bay or boldo leaf. This is a very traditional use of citron leaves. In the 13th century in Murcia, Ibn Razin al-Tujibi used the leaf of the 'Utrug' (29) citron in a court bouillon for his daurade au miel et au moût (bream with honey and must). For this use, the leaf of the 'Diamante' cultivar was preferred because of its subtle, round flavour, while the leaf of the C. limonimeditca 'Peretonne' (22) hybrid was considered more interesting for olive oil with a citron leaf.

The juice

Citrons do not have much juice. Chef Pascal Meynard extracts juice not just from the pulp but from the entire fruit – a sort of citron absolute. This juice is transformed into two ices with different textures – one with agar and gelatine and the other with agar that is then spun.

The flower: the wonder of citron floral water

Since citron flowers are difficult to transport, the decision was made to process them as a hydrosol (citron floral water) through steam extraction.

'Pompia' (26b) is the best cultivar for this use because it produces large flowers in clusters. The citron floral water obtained (1 kg of flowers for 1 l of hydrosol) is quite different from orange floral water, being more vegetal and better suited to use in vegetable or fish dishes.

Chefs Hans Neuner and Leonardo Pereira use citron floral water in green salads. The first flavours his light vinaigrettes with it and the second uses it as follows: "lettuce dish as a first course of our tasting menu with the Cedrat Hydrolat. I basically compress a few varieties of lettuce in the hydrosol and cook them briefly while still compressed. It is served with the roots of the lettuce, red currants and a milk of raw pine nuts."

Conclusion: extensive opportunities for creative cuisine

In modern cuisine, the products of citron tree offer an aromatic palette and original textures. It is used sustainably because it meets demands for healthy food and responsible cuisine (good conservation, easy to transport, easy to use fresh, no waste, very rarely allergy-generating, no known medical contra-indication). The tree is part of a long cooking tradition: typical of the vocabulary of Mediterranean tastes and scents, it has become easy to work with partly thanks to the Tintori nursery’s collection. Moreover, today’s growing techniques with grafted plants and biological pest control in insect proof

20Vincent Farges, executive chef, 2005–2015, Fortaleza do Guincho, Estrada de Guincho, 2750-642 Cascais, Portugal, and from 2015 at the Sandy Lane Resort, St. James, Barbados, West Indies.


22Hans Neuner, Ocean Restaurant at Vila Vita Parc, Rua Anneliese Pohl, Alporchinhos, 8400-450 Porches, Portugal.


24Private communication from L. Pereira to the author (2015).
environments or with the use of fabric fruit bags make it possible to produce fruit without pesticides.

Our research shows that the pericarp is well suited to current cooking techniques including steam, sous vide, maceration and the search for texture. The complimentary taste of the zest, which is neither too strong nor too evanescent, lends itself well to an association of two flavours and has considerable success in savoury dishes. We also revealed the value of citrus floral water, which adds an elegant note to both savoury and sweet dishes by providing just the right aromatic touch.

Despite its long-standing culinary use, the citron still has a vast unexplored potential in creative cooking. Numerous areas are yet to be explored notably its use in beverages (beer, gin, hydrosol in water), Japanese and Korean cooking techniques and the use of dried leaves, flowers and fruit.

References