American-Eurasian J. Agric. & Environ. Sci., 2 (4): 382-387, 2007
ISSN 1818-6769
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Olea europaea L. A Botanical Contribution to Culture

Sophia Rhizopoulou

National and Kapodistrian University of Athens, Department of Biology,
Section of Botany, Panepistimioupoli, Athens 157 84, Greece

Abstract: One of the oldest known cultivated plant species is *Olea europaea* L., the olive tree. The wild olive tree is an evergreen, long-lived species, wide-spread as a native plant in the Mediterranean province. This sacred tree of the goddess Athena is intimately linked with the civilizations which developed around the shores of the Mediterranean and makes a starting point for mythological and symbolic forms, as well as for tradition, cultivation, diet, health and culture. In modern times, the olive has spread widely over the world.

Key words: *Olea* · etymology · origin · cultivation · culture

INTRODUCTION

Olea europaea L. (Fig. 1 & Table 1) belongs to a genus of about 20-25 species in the family Oleaceae [1-3] and it is one of the earliest cultivated plants. The olive tree is an evergreen, slow-growing species, tolerant to drought stress and extremely long-lived, with a life expectancy of about 500 years. It is indicative that Theophrastus, 24 centuries ago, wrote: 'Perhaps we may say that the longest-lived tree is that which in all ways, is able to persist, as does the olive by its trunk, by its power of developing sidegrowth and by the fact its roots are so hard to destroy' [4, book IV.13.5]. The most ancient traces of *Olea* are fossilised leaves, found on the island of Santorini in the Aegean Archipelago, dating back 50,000-60,000 years [5, 6]. Olive cultivation originated in a valley of the river Jordan in the Eastern Mediterranean area [7] and has a history as long as that of western civilization [8, 9].

Sophocles (5th century BC) wrote a hymn to the olive tree, for his last play Oedipus at Colonos (401 BC):

- There is a plant unheard of in the fabulous land of Asia,
- unknown to Doric earth - a thing immortal;
- gift of a goddess, beyond the control of hands,
- tough, self-renewing, an enduring wealth,
- passing through generations
- the invincible grey-leafed olive.
- Aged survivor of all vicissitudes,
- it knows protection of the all-seeing eye of Zeus,
- whose sunlight always regards it,
- and of grey-eyed Athena.

Table 1: Classification of *Olea europaea*

Superdivision	Spermatophyta-seed plants
Division	Magnoliophyta-flowering plants
Class	Magnoliopsida-dicotyledons
Subclass	Asteridae-
Order	Scrophulariale-
Family	Oleaceae-olive family
Genus	*Olea*-olive
Species	*Olea europaea* L. -olive

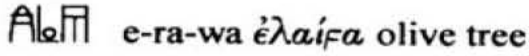

Fig. 1: *Olea europaea* L., of the Linnean herbarium (microfiche No: IDC 4.3, Department of Phanerogamic Botany Swedish Museum of Natural History)

The purpose of this study is to foster greater understanding of the botanical, historical and philological evidence for the origin and the distribution of the olive tree, 'the queen of all trees' according to Columella (Libri De Re Rustica, 42 AD).

Botanical ancestor of *Olea*: The botanical ancestor of the cultivated *Olea europaea* L. is believed to be a group of wild olives traditionally called *oleaster* olives. Over large areas in the Mediterranean province, *oleasters* thrive as a constituent of *maquis* formations, within a

Corresponding Author: Dr. Sophia Rhizopoulou, National and Kapodistrian University of Athens, Department of Biology, Section of Botany, Panepistimioupoli, Athens 157 84, Greece

climatic region that has been defined by Köppen [10], as the *olive climate* [11-13]. Wild olive trees have been treated by some botanists as an independent species, i.e. *Olea oleaster* Hoffm. & Link., but because of their close morphological and genetic affinities to the cultivated tree, most researchers dealing with Mediterranean plants today regard *oleaster* as the wild race of the cultivated species and place it within *Olea europaea* L., either as a subspecies [subsp. *oleaster* (Hoffm. & Link) Hegi], or as a variety [var. *sylvestris* (Mill.) Lehr. = var. *oleaster* (Hoffm. & Link.) DC.] [2]. Theophrastus (371-286 BC) stated that the wild olive tree differs from the cultivated olive in having spiny lower branches [14, book V.12.8] and small leaves and drupes [4, book I.14.2 & book II.2.12]. Cultivated and wild olive trees possess similar characteristics and it is difficult to distinguish stands of wild olive trees [15-17]. According to archaeological evidence, *Olea* was cultivated in Crete and Syria, as long ago as 2,500 BC [18, 19]. Genetic studies support the hypothesis that olive domestication occurred in many locations in the Mediterranean basin [20]. More recent work indicates that there must have been a period of 'pre-domestication cultivation' in which the wild ancestors of domestic species were intentionally cultivated [21, 22]. The dimensions of carbonised stones of *Olea europeaea* have proved to be an invaluable parameter that can be used to distinguish between wild and cultivated varieties [23-25].

Olea europaea is a hermaphrodite tree that blossoms in spring; two kinds of small, fragrant, cream-coloured flowers produce pollen, the species being largely wind pollinated, though, most olive varieties are self-fertile. The fruit of the olive tree is a drupe that usually changes colour from green to purple or nearly black, when fully ripe in late autumn and the oil is expressed by the fleshy pericarp. Pliny (23-76 AD) refers to Historia Naturalis (XII.14, XII.60, XV.1-7, XXIII.34-60) fifteen varieties of olives and the usefulness of olive oil. The varieties known to the modern farmer are numerous, because olive trees have been exclusively cross-pollinated. The cultivars vary considerably in size, shape, oil content and flavour and molecular markers have been used to classify them [26, 27].

The cultivation of olive trees has been expanded to Egypt, France Iberia, Israel, Italy, Lebanon, Morocco and Tunis. Olive trees have been introduced to Chile, the Caribbean, Peru, Argentina, Brazil, Mexico and finally, in the 17th century, to California. The olive tree has also been introduced into Chinese agriculture and it grows vigorously in South Australia and some parts of South Africa. *Olea europaea* is now considered as an edible, medicinal and useful plant for a healthier world. It is noteworthy that olive oil contains 14.8% saturated fat and 85.2% unsaturated fat [28] and it is valued as an important item of diet [29]. Virgin olive oil, identified by its delicate and unique aroma [30], is highly appreciated by consumers, because it is consumed in its crude form without any refining process.

Fig. 2: *Olea*, in Linear B (i.e. the first Greek writing system) used between 14th and 12th century BC.

Etymology of *Olea*: The first word for *Olea* appeared in Linear B (Fig. 2), on clay tablets found in Greece dated to the 13th century BC [31, 32]. The word *olive* and all the surviving forms are derived from the Greek word *elaa* (ελάα), according to Theophrastus) and elaía (ελαία) [33]. Thus, we have *alev* in Gothic, *olia* in old Scandinavian, *œl* (oil) in Anglo-Saxon, *olei* (öl) in old High German and *olea, oliva, oleum, olivum* in Latin [34]. The Semitic word *zeit* for *Olea* is encountered in the Arabic *zenboudje* (wild olive) and *zitoun* (cultivated olive), in the Andalousian *azenbucha,* in the Portuguese *zambugeiro*, in the word *zayit* in Israel and *zuttin* in Morocco; it is interesting to note that among the Tuaregs the wild olive is called *aleo* [32].

It would seem that a relationship in definition between the word for oil (*éleon*) and the word for mercy (*éleos*) in Greek, might be due to a false etymology [35]. However, in dramatic masterpiece-texts such as *Oedipus Rex* of Sophocles (434 BC) a person who came in supplication, seeking mercy and understanding from his follow-men, when he had committed a grave offence, holds olive branches in his hands. In *Eumenides* of Aeschylus (5th century BC), the soothsayer Pythia of the Delphi oracle announces 'I see a man with bloody hands seated at the Navel, postured in the suppliant's seat, holding a fresh stem of olive'. Olive trees were closely planted in Delphi valley from very ancient times.

In the Shakespeare's Twelfth Night of (I.5.204) 'I bring no overture of war, no taxation of homage, I hold the olive in my hand: my words are as full of peace as matter'. Therefore, it is likely that olive branch has been a symbol of peace and of the reconciliation of man with man. In this spirit, olive branches appear in the flag of the United Nations Organization and have became a symbol of longevity, purification, strength, prosperity, wisdom, victory and peace. It is well known that in the Olympic games, the winners were crowned with wreaths made of olive branches [36].

***Olea* in the (early) civilizedmediterranean province:** *Olea europaea* appears in the Bible and in the Qur'ân, as the most sacred, most revered and most adored tree, playing an important role in civilization, religion, diet and art. *Olea* was cultivated during the early Biblical period for the fruits from which precious oil was extracted, while olives were treated with pickling and salting techniques for domestic and export purposes [37]. Olive trees have been cultivated along and above the 15° isotherm providing a useful substitute for the butter and animal fats consumed by the races of the north. Hence, the olive became an emblem of national wealth and domestic plenty [19]. 'The whole Mediterranean seems to emerge from the pungent taste of black olives, a taste older than that of meat and wine; a primeval taste, like the taste of water' [38].

The species was known in ancient Egypt, as is shown by papyri (1,550 BC), mummies crowned with olive wreaths and a hymn of Ramesses III (1198-1176 BC) to the god Ra (the sun): 'I have planted many olive trees in gardens, in the city of Heliopolis; from these plants come a very pure oil to keep alight the lamps of your *altar*' [39]. In the *Iliad* and *Odyssey* of Homer (written before 700 BC), olive oil provides extensive power when used in ritual anointing. The species was, also, known in Armenia [1]. Roman people employed it largely in food and cookery; in the luxurious days of the later empire it became a favourite axiom that long and pleasant life depends on two fluids 'wine within and oil without' [40, book XXIV.150). Srabo the geographer (63 BC-23 AD) and Columella in his *Libri De Re Rustica* (42 AD) mentioned the quality of Spanish oil.

Olea from mythology to the early history of plants: The city of Athens was named after the goddess Athena, who brought the olive tree to the city. When Athena won the contest against Poseidon for the patronage of the city, an olive sprang from the barren rock of Acropolis at the bidding of the goddess. That this myth has some relation to the first planting of the olive tree in Greece seems certain according to Herodotus (485-425 BC, *Epidaurians*). In fact, Theophrastus writes that olive-wood is more apt than other woods to produce shoots even when lying idle or made into manufactured articles; this it often does, if it obtains moisture and lies in a damp place [4, book V.9.8]. The olive tree long stood on the Acropolis and, though destroyed in the Persian invasion (480 BC), sprouted again from its root [41]. To the long-lived character of olea, both cultivated and wild witness is born also by the tales handed down in mythology, as the olive at Athens [4, book IV.13.2). Aristotle (384-322 BC) tells us that even the death penalty could be imposed on a person who uprooted or destroyed a sacred olive tree. Those trees, later totally twisted (hunchbacked), being extremely old, were growing in the Academy, still in existence at the time of Pausanias (2nd century AD). It appears that the life of the individual olive (in regard to which one should make the trunk the essential part and standard in estimating the time) lasts for about two hundred years [4, book IV.13.5].

The town of Athens was surrounded by extensive olive groves down to the times of Ottoman rule, as was witnessed by travellers [42-44]; among them John Sibthorp (Professor of Botany in Oxford, 1784-1796), Sir J. E. Smith (the first president of the Linnean Society) and J. Lindley (a great East Anglian botanist) passed through a venerable forest of olives during a trip to Athens, in 1787 [45, 46]. Excavation of the Athenian Agora (1931-1970) has uncovered evidence for abundant olive plants in antiquity [47].

Material evidence of the extent of olive oil trade is plentiful. Thousands of small oil lamps have been found in Greece, during the Bronze Age (2800-1100 BC). In the first stepped Pyramid (known as the Mastaba of Sakkara), a representation of one of the earliest known oil presses exists. In the palace of Minos in Crete an olive press was in operation (2000-1000 BC). The Athenian pottery industry was stimulated largely by the demand for containers in which olive oil was exported. Oil of the sacred trees was put into black-figure amphorae, decorated with olive-harvest motives. Perfumers put their odours in oil [14, book VI.19.3] and small vessels with scented olive oil were one of the most favourite love gifts [5]. Oil in phials was used as a cleanser for the body, just like soap nowadays [18]. Samples of oil vessel (lekythos) with a depiction of a siren in front of an olive branch are exhibited in Museums and Art Galleries.

***Olea europaea* as an inspiration in art and research:** From myth into history and from there into art and research, *Olea europaea* has come to occupy a dominant place in our lives peacefully. Olive trees, features of the Mediterranean landscape, have inspired artists, who tried to capture the emerald and silver hues of the leaves shimmering against an azure Mediterranean sky or the gnarled and twisted branches that withstand the ages. In Italy, Poliphilio in *Hypnerotomachia* [48], during a fantastic journey of love through gardens, found himself in a dream 'I was encircled by pleasant hills of no great height with wild olives disposed according to the aspect of forested slopes'. In Iran, nearly four centuries later (1994), an olive grove is magnified as a place of desire and unsatisfied meeting, in the multi-awarded film of Abbas Kiarostami entitled 'Through the olive tree'. Impressionists were especially enamoured of the beauty of olive trees, which were vigorously painted by Vincent van Gogh (1853-1890). Writing to his brother Theodore (letter 587, April 1889), van Gogh stated 'I am struggling to capture the light of the olives. It is silver, sometimes bluish, sometimes greenish, off-white, on a ground of yellow, pink, violet, or orange to red ochre. It is very difficult' [49]. A couple of months later (letter 595, June 1889), Vincent declared: 'At last, I have a landscape with olive trees'.

Olea europaea has evolved a number of adaptive mechanisms to survive the prolonged summer-drought conditions in the Mediterranean environment, which affect water status and CO_2 assimilation [50, 51]. Its leaves expand within three months, during spring and are replaced after a two-year life period [52, 53]; a second growth flush occurs in autumn [54]. Their capacity to undergo dehydration is limited by a high internal diffusive resistance, which is due to the dense packing of mesophyll cells [55, 56]. A layer of peltate scales on the abaxial leaf surface may intercept incoming irradiation and impede the diffusion of CO_2 into the leaf. These scales are likely to function by trapping warm moist air below the stomatal aperture and consequently reducing water loss from the plant [57-60]. The species has been studied as a predictor of climate change [61]. Its stomatal density, investigated in leaf-samples originating from Tutankhamun's tomb (1327 BC) and from material dating to 332 BC, 1818 and 1978 AD, was used as an indicator of the effect of rising, atmospheric CO_2 levels in leaf structure and function [62, 63]. Recently, airborne pollen concentration, reflecting the flower phenology of olive populations within a radius of 50 km, has been considered as a sensitive indicator of climatic warming [64-66]. Yet from the era of Greek and Egyptian civilizations, in which the olive tree was a divine gift for the mortals [67], to the century of globalisation, *Olea europaea* remains a symbolic element of plenty, peace and serenity [37].

ACKNOWLEDGEMENTS

I wish to thank Prof. P. Valavanis for comments on literature and Danae Koukos for comments on an earlier draft of the manuscript.

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