



## THE PLANTS OF JERICHO. THE EARLIEST CULTIVARS BETWEEN SYMBIOSIS AND DOMESTICATION

NIGRO L.

*Sapienza University of Rome*

*Corresponding author email: [lorenzo.nigro@uniroma1.it](mailto:lorenzo.nigro@uniroma1.it)*

(RECEIVED 16 JAN 2023; RECEIVED IN REVISED FORM 30 JAN 2023; ACCEPTED 2 FEB 2023)

**ABSTRACT** – Pre-Pottery Neolithic Jericho is the archaeological site in Palestine which provided the earliest archaeobotanical evidence of plant domestication. Together with an overview of finds and their historical-archaeological significance, this paper suggests considering the relationship between humans and plants at its earliest stage as a biunivocal one, as plants became an irreplaceable source of food for humans and domesticated plants could not have existed without humans.

**KEYWORDS:** TELL ES-SULTAN; PRE-POTTERY NEOLITHIC; ARCHAEOLOGY; ARCHAEOBOTANY; DOMESTICATION; FOOD CROPS; FRUIT TREES.

### INTRODUCTION

The central core of this article is to testify through the exemplary case study, for antiquity and complexity, of Tell es-Sultan/ ancient Jericho in Palestine, how archaeology and archaeobotany can help us to understand the peculiar relationship developed between a human community and specific plants, the cultivation of which blossomed over the centuries. If we put emphasis on human initiative we talk about domestication, however if we want to have a look from the perspective of reciprocal adaptability of plants and humans we could perhaps speak of symbiosis. The excavations conducted for more than a century at Tell es-Sultan by four archaeological expeditions<sup>1</sup> have returned a large collection of archaeobotanical finds (Hopf, 1969; 1983; 2008; Moricca et al., 2021), that have been retrieved thanks to the abilities of the archaeologists, but above all thanks to the extraordinary climatic conditions of the site, that allowed to preserve them for millennia. This is due to the geological

characteristics of the Jericho soil, to the morphology of the archaeological site, and to its paleoclimatic conditions (Mimi & Jamous, 2010; Ighbareyeh, 2019). However, this significant amount of botanical data has been only partially studied, focusing on specific periods of the ancient settlement. In the present contribution, I intend to offer a sketch summary of some salient historical-archaeological themes, with respect to which the archaeobotanical data known so far either provides curious and stimulating indications or suggests the need to further deepen the research. In this preliminary work, I focus on Pre-Pottery Neolithic, the period of the first great cultural flourish of Jericho, roughly between 11,000 and 6,000 BC, hoping that the readers of this journal will be inspired to study more in depth and extensively what the excavations of Jericho have made available, contributing to the knowledge of the site.

### The first domesticated plants

That hunters and gatherers collected edible plants is quite evident although relatively difficult to prove archaeologically.

That some of these plants are the ones that would be cultivated first is instead certain, and the excavations at Jericho, although still far from having systematically collected and simultaneously studied the paleoenvironmental and archaeobotanical data, have well demonstrated it (Hopf, 1969; 1983; 2008; Moricca et al., 2021).

At the end of the Mesolithic in the Levant, during the Natufian, when the first sedentary hunters settle on the limestone spur overlooking the spring of 'Ain es-Sultan (Kenyon, 1981, 268, 271-274, pls. 144b-145, 299a; Nigro, 2014a, 57), several plant species are brought with them to sow. Eight of these are the first domesticated founder crops (Weiss & Zohari, 2011, 237; Zohary et al., 2012, 1-2). Three cereals: barley and two types of wheat, *Triticum monococcum* L.<sup>2</sup> and *Triticum turgidum* subsp. *dicocum* (Schrank ex Schübl.) Thell. (einkorn and emmer); four pulses: lentil, chickpea, pea, bitter vetch, and flax. Although they belong to different species, are annuals, and are similarly harvested, dried and processed, – cleaning, milling, possible grinding, etc., (Weiss & Zohari, 2011, 237). These plants were selected throughout the foothills of Western Asia in what we call the Fertile Crescent by different human communities (Zohary & Hopf, 2000; Zohary et al., 2012), among which that of Jericho appears to be one of the most precocious in the domestication of the greatest number of different species (Zohary et al., 2012, Map 1). Nevertheless, the domestication process was polyphyletic with each community or regional area specializing on specific crops.

Following the findings of the layers between Natufian/Proto-Neolithic and Pre-Pottery Neolithic A, the first cultivated plants appear to be wild emmer (*Triticum turgidum* subsp. *dicocoides* (Asch. & Graebn.) Thell.), wild einkorn (*T. boeoticum* Boiss.), and the small lentil (*Vicia orientalis* Beg. & Diratz.) (Hopf, 1983). Followed shortly afterwards by flax (*Linum bienne* Mill.) (Hopf, 1983 sub *L. usitatissimum* L. subsp. *angustifolium* (Huds.) Thell. ) and barley (*Hordeum spontaneum* K.Koch) (Badr et al., 2000). They are crops that are practiced in relative extension, which therefore mark the definitive transition to agriculture. Within a millennium these species will be domesticated<sup>3</sup> and will become *T.monococcum* (Hopf, 1983, 580) and *T. turgidum* subsp. *dicocum* (Hopf, 1983, 582; Weide, 2015, 381-424), *Hordeum vulgare* L., *V. lens* Coss. & Germ. (Hopf, 1983, 584), and *L. usitatissimum* L. var. *usitatissimum* (Helbæk, 1959; Hopf 1983, 586) recognizable by more regular shapes and slightly larger sizes (Weiss & Zohari, 2011, 238).

*Triticum monococcum* and *T. turgidum* subsp. *dicocum*, in addition to being resilient during cultivation, once harvested, and after the necessary dehiscing to eliminate the glumes, could be stored for several seasons, before being consumed. These characteristics made them the main grains used to produce flour. Even though according to Maria Hopf (1983,

582), barley and wheat were brought to Jericho from Syria and Anatolia where domestication had already begun, the complete sequence of occupation in Jericho and the presence in the Natufian strata of the wild ancestor of emmer, *T. turgidum* subsp. *dicocoides* seem to suggest that it was precisely the community settled in the Pre-Pottery Neolithic A at Tell es-Sultan that carried out this domestication. It was a centuries-long process that took place during the eleventh millennium BC and involved barley and wheats (emmer and einkorn, the latter more widespread in Jericho).

Other than cereals, an essential role in increasing the variety of the diet of Jerichotes with proteins is played by legumes. Next to the lentil (*Vicia lens*), progressively appears the chick-pea (*Cicer arietinum* L.), the field pea (*Lathyrus oleraceus* Lam.) and the bitter vetch (*Ervilia sativa* Link.) (Hopf, 1983); the latter probably introduced in connection with the beginning of breeding of goats as fodder.

Among the cultivated plants of the first Neolithic community of Jericho, one can hardly overlook the importance of flax (*Linum usitatissimum*), whose seeds were used to obtain the precious oil used for handicrafts and constructions, for the preparation of body ointments, perfumes and foods (Pengilly, 2003) and from whose stems a resistant and malleable fiber was produced for the making of ropes, mats, bags and wicks covered in wax, useful for lighting a fire, and, only later, fabrics and textiles (Allaby et al., 2005, 63; Geyer, 2012,1). The cultivation of flax plants, that can reach the height of 1.2 m (Orendi, 2020, 63), and the processing of their products (seeds and stems) required a lot of water and a considerable workforce (not particularly specialized), from the preparation of the fields for sowing and harvesting, to the maceration, extraction and straightening of the fibers of their woody stems for textile production (Karg, 2011, 507; Shamir, 2020). Therefore, to cultivate flax, fertile arable land and water for irrigation are needed, while the subsequent processing, demands more water and well-plastered tanks for soaking the fibers, and mastabas and platforms for hammering, drying and extract them (Karg, 2011, 507). In her recent study on cultivations, by examining Egyptian papyri of the mid-sixth century of our era, Isabelle Marthot-Santaniello (2020, 113-114) points out that given these conditions, the cultivation of flax could be favorably alternated with that of wheat. In Jericho, since the Pre-Pottery Neolithic, when the waters of the spring of 'Ain es-Sultan were regularized (Nigro, 2014b, 28), the most favorable environmental conditions for the cultivation of flax arose, and at the same time the exponential growth of the population provided the necessary workforce for agriculture (Nigro, 2020, 180). The production of fibers is not yet fully demonstrated by the archaeological record until the Bronze Age. As far as archaeological finds are concerned, the carefully plastered silos brought to light in the layers of the

Pre-Pottery Neolithic were indeed used to store the precious seeds of barley, wheats and flax, the first real wealth of the Neolithic community (Nigro, 2016, 6). Some of such silos, due to the hydro-repellent quality of their plaster may have been used to soak the flax stems.

Nonetheless, in the Neolithic society of Jericho, flax has a central position, equivalent to that of barley and wheat. From the interaction of the cultivation of cereals, legumes, and flax, the first agricultural society was born. The question is: is production carried out at a family, clan, or community level?

### Fruit trees

In Neolithic Jericho, fruit trees represent a very important source of sustenance since the time of hunters and gatherers, as the intake of sugars was essential for the intense physical activity of humans at the time.

Some wild fruits were fundamental for the subsistence of the first inhabitants of Tell es-Sultan. The most widespread was probably the carob tree (*Ceratonia siliqua* L.), whose bacilliform fruits, the carob pods, also called bread of St. John<sup>4</sup>, are edible and sweet (Zohary, 2002). The dried carob seeds (*qarat* in Arabic, the ‘carats’), are so light that they were later used as a unit of measurement for precious powders (spices and colors), gold and precious stones. Carob fruits are rich in sugar and give a lot of energy but are overly sweet; they are also good for animals and are easily preserved when dried.

Very similar to the carob tree is the jujube (*Ziziphus spina-christi* (L.) Willd.) (Zohary, 1973, 380-383), a shrub that to defend itself from goats has developed thorns 6-8 cm long and whose fruits, the jujube dates, were one of the favorite sweets of the first inhabitants of Jericho<sup>5</sup>.

Other edible fruit plants available in the Jericho area are the wild pumpkin (*Citrullus colocynthis* (L.) Schrad.), the Egyptian caper (*Capparis spinosa* L. var. *aegyptia* (Lam.) Boiss.), and, while it is very common and known, the “Sodom apple” (*Calotropis procera* (Aiton.) W.T. Aiton), however, it has got lethal properties and it is not edible (but provides a fiber possibly used to make containers or fabrics) (Zohary, 1962).

Different is the case of the pistachio (*Pistacia vera* L.), a plant that was selected and grafted to eat the tasty dried fruits, and also the terebinth (*P. terebinthus* L. subsp. *palaestina* (Boiss.) Engl.) (Lipshitz & Bigger, 1990; Zohary, 1973, 135), the lentisk (*P. lentiscus* L.) and the mastic tree (*P. atlantica* Desf.) (Hopf, 1983, 588), which were exploited for the fruits, the wood and the fragrant resin (Golan-Goldhirsh, 2009, 69-70). In the steppe and around the spring, it is also widespread the *Tamarix nilotica* (Ehrenb.) Bunge., a bushy plant with disinfectant and anti-inflammatory properties (Hopf, 1983, 577).

Much more significant is the contribution provided by fruit trees that are cultivated for the first time to ensure their productivity and quality of their fruits, and where human intervention is necessary (Zohary & Spiegel-Roy, 1975; Weiss, 2015).

The first one, the fig (*Ficus carica* L.) (Goor, 1965; Hopf, 1983, 587; Lev-Yadun, 2022), is of the utmost importance, and in order to increase its productivity the inhabitants of Jericho practiced pollination and learnt the gender of individual plants. Archaeobotanical remains show that its domestication has produced local varieties since Pre-Pottery Neolithic A. The fig was a source of sugar and a reserve of yeast, essential to trigger the fermentation of fruit juices and thus enabling their preservation (Nigro & Rinaldi, 2020, 186).

The second fruit plant attested in the Pre-Pottery Neolithic A is the pomegranate (*Punica granatum* L.) (Hopf, 1983, 587; Spagnoli, 2019). The wild species, the *P. protopunica* Balf. f., characterized by marked vertical ridges and overall small dimensions, in Jericho was transformed into the ‘apple of paradise’<sup>6</sup>. A golden red apple, with 613 seeds, a symbolic prime number for the Bible; a fruit with healing, antiseptic, anti-inflammatory and aphrodisiac properties, whose astringent juice could be used in the precipitation of milk rennet and in the fermentation of fruit as well as to produce wine, symbolic of life and fertility<sup>7</sup>. The pomegranate (*P. granatum*) – perhaps as early as the Pre-Pottery Neolithic – is in fact a symbol of fertility and beauty (Abram, 2009). The third fruit tree cultivated in Jericho since the Neolithic is the date palm (*Phoenix dactylifera* L.) (Goor, 1967; Hopf, 1983, 589), which represented another significant source of extremely precious energy for all those who ventured in the desert, where dried dates, that could be kept for a long time (Chao & Krueger, 2007, 1080), could support travelers and be planted in oases, – the actual palm needs water (Longo, 2001, 617). But the secret was to have understood the mechanism of pollination and to have the flowers available, which in the climate of Jericho was more than easy. The date palm with its very long leaves (up to 5 m) with their long stems with sharp, hard and pointed ends and its fibrous but resistant wood also offered a useful building material, suitable to cover the first huts of the Neolithic village and to innervate the adobe walls. It is curious that this palm, *P. dactylifera*, was given the name of those who marketed it in the first millennium BC, the Phoenicians, just like the other great tree-symbol domesticated in Jericho in the Neolithic, the pomegranate (*Punica granatum*) (Nigro & Spagnoli, 2018, 59).

Last of the series of fruit trees is the almond tree (*Prunus dulcis* (Mill.) D.A. Webb) (Zohary & Hopf, 1993) which also appears among the most common and essential plants for the diet of the Pre-Pottery Neolithic. Domestication, in this case, counteracted the presence of hydrogen cyanide in

the seed. The drupes are not edible, but the seed is, although in some cases it can develop amygdalin, which is toxic. Almonds could provide an important protein intake, but to consume them without harm, they needed to be roasted first. Since the plant is not self-fertilizing, domestication indicates the acquisition of practical knowledge that was certainly sophisticated for the Neolithic. The retrieval of 1 mm thick shells may not be sufficient to tell whether these were already domesticated specimens, but the presence of almonds in the archaeological record of Neolithic Jericho is nonetheless significant.

Finally, the vine (Goor, 1966a; Zohary, 1995) and the olive tree (Goor, 1966b; Eitam & Heltzer, 1996; Barazani et al., 2023), whose cultivation must take place on a large scale to produce a significant economic effect, were instead the result of the first urban society of the Bronze Age and, therefore go beyond the scope of the present study, and require a dedicated one. Nevertheless, grapes and olives have been found in the archaeological contexts of Neolithic Jericho.

## AROMATIC AND MEDICINAL PLANTS

A separate chapter is that of aromatic and medicinal plants very common and already known from the Paleolithic and that grew abundantly in the region of Jericho: mallow (*Malva sylvestris* L.), marjoram (*Origanum majorana* L.), oregano (*Origanum vulgare* L.), sage (*Salvia* L.), rosemary (*S. rosmarinus* Spenn.) and finally the so-called “rose of Jericho” (*Anastatica hierochuntica* L.). Other useful herbs, such as calendula (*Calendula officinalis* L.), oat (*Avena sativa* L.), borage (*Borago officinalis* L.), poppy (*Papaver somniferum* L.) and rose, special for pollinating insects, are witnessed in pollen residues (Hopf, 1983, 591).

Another plant certainly exploited at least since the Neolithic that grows abundantly in the Jericho area is henna (*Lawsonia inermis* L.) and a purple flower (*Crocus sativus* L.) with whose dried stigmas a spice is produced, the first that men have cultivated, as well as harvested and imported: saffron. The coloring property of this plant added a symbolic component (Martinez, 2022, 19).

## TUBERS

Tubers and roots, which were the result of the experience of the Natufian gatherers, are equally present as the carrot (*Daucus carota* L.) and the beetroot (*Beta vulgaris* L.) (Zohary, 1962), while the onion will be selected in Egypt

later. This kind of plant remains are very rare to be found and the possibility of properly defining their contribution to the Neolithic diet of the Jericho inhabitants is scarce.

## TIMBER TREES

Firewood or construction timber is a very rare material in the Jericho region. Several shrubs that grow in the steppe surrounding the oasis (that during the Neolithic it's irrigated only minimally), can take on an arboreal appearance (Fahn et al., 1986). In addition to the different species of *Pistacia* that are endemic and the other fruit trees already mentioned, the wood available to the inhabitants of Jericho came exclusively from the poplars (*Populus* L.) that grew along the Jordan River (Zohary, 1962, 165), from tamarisks (*Tamarix tetragyna* Ehrenb.) (Hopf, 1983, 577; Western, 1971), and from acacias (Red Acacia, *Vachellia seyal* (Delile) P.J.H.Hurter)<sup>8</sup> that could reach a maximum height of 10 m, with beams no longer than 4-5 m.

It is evident that these plants were exploited, but they were also fully integrated into the daily life of the inhabitants of Jericho.

## Conclusions

The results of the excavations at Tell es-Sultan/ancient Jericho show how the first definitively settled community in Pre-Pottery Neolithic A found numerous sources of subsistence in plants and began to cultivate them intensively. The archaeobotanical data and the specificity of domesticated plants and their cultivation lead one to ask some basic questions: were there farmers who specialized in the primary production of grains and legumes and others who devoted themselves to fruits and aromatic and medicinal plants? Are there plants (particularly tubers and vegetables) that escape the archaeological record – such as cauliflowers, which sources would like to have originated in Cyprus (Maggioni, 2015, 51), but which may also have originated in the alluvial valleys of the great rivers of the Near East -? What may be the indicators of domestication of fruit trees?

Other plants, small in size, are not attested: but is this sufficient to say that they were not used by the inhabitants of Jericho? Sesame (*Sesamum indicum* L.), for example, native to Africa (Mehra, 2000), may have reached the Jordan Valley as early as the Neolithic period.

The process of domestication represents an extraordinary phenomenon particularly for those species whose modifications we are able to describe: the eight Neolithic founder crops represent the abilities of the human community of Jericho to select seeds, store them and pass them on through generations

(at least 40 for 1,000 years). Territory, human community, and cultivar became increasingly integrated, not only as an anthropological and botanical process, but a cultural phenomenon. The culture of the seed that needs to be harvested, preserved, sown and allowed to blossom and grow becomes – for the first time in history – a conceptual and cultural palimpsest on which to build the development of the human community. Thus, humans can be said to be “botanizing,” desiring to resemble plants and nature in order to seize and develop their fruitfulness, resilience and generosity. That is why I believe we can speak of symbiosis, of living together.

Even if many points remain obscure, and I do not think that this brief note has helped to clarify them all, I hope that readers more experienced than I will be interested in the issues discussed above and will further develop the research.

## ACKNOWLEDGEMENTS

I am not sure that my contribution can find a worthy place in a scientific venue as high as the one that hosts it and I am grateful to the Editor for accepting it, even if the setting of the text and the study that generated it are perhaps not exactly orthodox from the point of view of an archaeobotanist. I want to thank Claudia Moricca for having re-read the text (the responsibility for what has been written is totally mine).

## REFERENCES

- Allaby R.G., Peterson G.W., Merriwether D.A., Fu Y., 2005. Evidence of the domestication history of flax (*Linum usitatissimum* L.) from genetic diversity of the *sad2* locus. *Theoretical and Applied Genetics* 112, 58-65.
- Abram M., 2009. The Pomegranate: Sacred, Secular, and Sensuous Symbol of Ancient Israel. *Studia Antiqua* 7(1/4), 23-33.
- Badr A., Müller K., Schäfer-Pregl R., El Rabey H., Effgen S., Ibrahim H.H., Pozzi C., Rohde W., Salamini F., 2000. On the Origin and Domestication History of Barley (*Hordeum vulgare*). *Molecular Biology and Evolution* 17(4), 499-510.
- Barazani O., Dag A., Dunseth Z., 2023. The history of olive cultivation in the southern Levant. *Frontiers in Plant Science* 14, 1131557.
- Chao C.T., Krueger R.R., 2007. The Date Palm (*Phoenix dactylifera* L.): Overview of Biology, Uses and Cultivation, *HortScience* 42(5), 1077-1082.
- Eitam D., Heltzer M., 1996. Olive oil in antiquity. Israel and Neighbouring countries from the Neolithic to the Early Arab Period. *History of the Ancient Near East/Studies*, VII, Padova.
- Fahn A., Werker E., Baas P., 1986. Wood anatomy and identification of trees and shrubs from Israel and adjacent regions. Israel Academy of Sciences and Humanities, Jerusalem.
- Gallo E. (Ed.), 2019. Conceptualizing Urban Experiences: Tell es-Sultan and Tall al-Hammām Early Bronze cities across the Jordan. Proceedings of a workshop held in Palermo, G. Whitaker Foundation, Villa Malfitano, June 19th 2017. Rome «La Sapienza» Studies on the Archaeology of Palestine & Transjordan 13, 79-108 = ROSAPAT 13.
- Garstang J., 1927. The Date of Destruction of Jericho. *Palestine Exploration Fund Quarterly Statement* 59(2), 96-100.
- Garstang J., 1930. Jericho. Sir Charles Marston's Expedition of 1930. *Palestine Exploration Fund Quarterly Statement* 62(3), 123-132.
- Garstang J., 1931. The Walls of Jericho. The Marston-Melchett Expedition of 1931. *Palestine Exploration Fund Quarterly Statement* 63(4), 186-196.
- Garstang J., 1932a. Jericho: City and Necropolis. *Liverpool Annals of Archaeology and Anthropology* 19, 3-22, 35-54.
- Garstang J., 1932b. A third season at Jericho. *Palestine Exploration Fund Quarterly Statement* 64, 149-153.
- Garstang J., 1933. Jericho: City and Necropolis. *Liverpool Annals of Archaeology and Anthropology* 20, 3-42.
- Garstang J., 1934. Jericho: City and Necropolis. Fourth Report. *Liverpool Annals of Archaeology and Anthropology* 21, 99-136.
- Garstang J., Droop J.P., Crowfoot J., 1935. Jericho: City and Necropolis. Fifth Report. *Liverpool Annals of Archaeology and Anthropology* 22, 143-184.
- Garstang J., Ben-Tor I., Fitzgerald G.M., 1936. Jericho: City and Necropolis. Report for Sixth and Concluding Season, 1936. *Liverpool Annals of Archaeology and Anthropology* 23, 67-100.
- Garstang J., Garstang J.B.E., 1948. *The Story of Jericho*. Revised edition. London.
- Geyer P.S., 2012. Flax. In: A. Erskine, R.S. Bagnall, K. Brodersen, C.B. Champion, S.R. Huebner (Eds.). *The Encyclopedia of Ancient History* 1-2. Wiley.

- Golan-Goldhirsh A., 2009. Bridging the gap between ethnobotany and biotechnology of Pistacia. *Israel Journal of Plant Sciences* 57, 65-78.
- Goor A., 1965. The History of the Fig in the Holy Land from Ancient Times to the Present Day. *Economic Botany* 19(2), 124-135.
- Goor A., 1966a. The History of the Grape-Vine in the Holy Land. *Economic Botany* 20(1), 46-64.
- Goor A., 1966b. The Place of the Olive in the Holy Land and Its History through the Ages. *Economic Botany* 20(3), 223-243.
- Goor A., 1967. The History of the Date through the Ages in the Holy Land. *Economic Botany* 21(4), 320-340.
- Helbæk H., 1959. Notes on the evolution and history of *Linum*. *Kuml (Aarbog forjysk arkaeologisk selskab)*, 103-129.
- Hopf M., 1969. Plant Remains and Early Farming in Jericho. In: P. Ucko, G.W. Dimbleby (Eds.) *The Domestication and Exploitation of Plants and Animals*, London, 355-359.
- Hopf M., 1983. Appendix B: Jericho plant remains. In: K.M. Kenyon, T.A. Holland, *Excavations at Jericho. Volume Five. The Pottery Phases of the Tell and Other Finds*, London, 576-621.
- Hopf M., 2008. Plant remains and early farming in Jericho. In: G.W. Dimbleby (Ed.) *The Domestication and Exploitation of Plants and Animals*, New York, 355-359.
- Ighbareyeh J., 2019. Bioclimate of Jericho in Palestine. *Palest Tech Univ Res J.* 7(1), 1-7.
- Karg S., 2011. New research on the cultural history of the useful plant *Linum usitatissimum* L. (flax), a resource for food and textiles for 8,000 years. *Vegetation History and Archaeobotany* 20, 507-508.
- Kenyon K.M., 1951. Some Notes on the History of Jericho in the Second Millennium B.C. *Palestine Exploration Quarterly* 83, 101-138.
- Kenyon K.M., 1957. *Digging Up Jericho*, London.
- Kenyon K.M., 1960. *Excavations at Jericho. Volume One. The Tombs Excavated in 1952-4*, London.
- Kenyon K.M., 1965. *Excavations at Jericho. Volume Two. The Tombs Excavated in 1955-8*, London.
- Kenyon K.M., 1981. *Excavations at Jericho. Volume Three. The Architecture and Stratigraphy of the Tell*, London.
- Kenyon K.M., Holland T.A., 1982. *Excavations at Jericho. Volume Four. The Pottery Type Series and Other Finds*, London.
- Kenyon K.M., Holland T.A., 1983. *Excavations at Jericho. Volume Five. The Pottery Phases of the Tell and Other Finds*, London.
- Lev-Yadun S., 2022. Remains of the Common Fig (*Ficus carica* L.) in the Archaeological Record and Domestication Processes. In: M.A. Flaishman, U. Aksoy (Eds.) *Advances in Fig Research and Sustainable Production* 11-25. CAB international, Oxford.
- Lipshitz N., Biger G., 1990. Ancient dominance of the *Quercus calliprinos* – *Pistacia palaestina* association in mediterranean Israel. *Journal of Vegetation Science* 1(1), 67-70.
- Longo C., 2001. *Biologia vegetale: forme e funzioni*, Turin 2001.
- Maggioni L., 2015. Domestication of *Brassica oleracea* L. Doctoral Thesis No. 2015:74, *Acta Universitatis Agriculturae Sueciae, Alnarp*.
- Marthot-Santaniello I., 2020. Flax growing in late antique Egypt: evidence from the Aphrodito papyri. In: *Egyptian Textiles And Their Production: ‘Word’ and ‘Object’ (Hellenistic, Roman, and Byzantine Periods)* 10, 107-115.
- Martínez G.M.J., 2022. Crocuses dyes in ancient Mediterranean World. *Journal of Textile Engineering & Fashion Technology* 8(1), 17-22.
- Mehra K.L., 2000. History of sesame in India and its cultural significance. *Asian Agri-History* 4, 5-19.
- Mimi Z.A., Jamous S.A., 2010. Climate change and agricultural water demand: Impacts and adaptations. *African Journal of Environmental Science and Technology* 4(4), 183-191.
- Moricca C., Nigro L., Gallo E., Sadori L., 2021. The dwarf palm tree of the king: a *Nannorrhops ritchiana* in the 24th-23rd century BC palace of Jericho. *Plant Biosystem-An International Journal Dealing with all Aspects of Plant Biology* 155(4), 823-832.
- Nigro L., 2005. Tell es-Sultan/Gerico alle soglie della prima urbanizzazione: il villaggio e la necropoli del Bronzo Antico I (3300-3000 a.C.). Rome «La Sapienza» *Studies on the Archaeology of Palestine & Transjordan*, 1, Rome = ROSAPAT 1.
- Nigro L. (Ed.), 2007. Byblos and Jericho in the Early Bronze I: social dynamics and cultural interactions. *Proceedings of the International Workshop held in Rome on March 6th 2007 by Rome “La Sapienza” University, Rome «La Sapienza»*

- Studies on the Archaeology of Palestine & Transjordan 4, Rome = ROSAPAT 4.
- Nigro L., 2010. Tell es-Sultan/Jericho in the Early Bronze II (3000-2700 BC): the rise of an early Palestinian city. A synthesis of the results of four archaeological expeditions. Rome «La Sapienza» Studies on the Archaeology of Palestine & Transjordan 5, Rome = ROSAPAT 5.
- Nigro L., 2014a. The Archaeology of Collapse and Resilience: Tell es-Sultan/ancient Jericho as a Case Study. In L. Nigro (Ed.) Overcoming Catastrophes. Essays on disastrous agents characterization and resilience strategies in pre-classical Southern Levant. Rome «La Sapienza» Studies on The Archaeology of Palestine & Transjordan 11, Rome, 55-85.
- Nigro L., 2014b. Aside the Spring: Tell es-Sultan/Ancient Jericho: the tale of an early city and water control in Ancient Palestine. In: T. Tvedt, T. Oestigaard (Eds.), A History of Water. Series III. Volume 1: Water and Urbanization, 25-51. London, New York. I.B. Tauris.
- Nigro L., 2016. Tell es-Sultan 2015 A Pilot Project for Archaeology in Palestine. Near Eastern Archaeology 79(1), 4-17.
- Nigro L., 2020. The Italian-Palestinian Expedition to Tell es-Sultan, Ancient Jericho (1997–2015): Archaeology and Valorisation of Material and Immaterial Heritage. In: R.T. Sparks, B. Finlayson, B. Wagemakers, J.M. Briffa (Eds.), Digging Up Jericho: Past, present and future, Archaeopress Oxford (Summertown), 175-214.
- Nigro L., 2023. Jericho. From the Neolithic to the Bronze and Iron Ages: The Urban Diversity. In: F. Cavaliere, E. Cirelli, C. D’Orazio, G. Giacosa, M. Guidetti (Eds.) Proceedings of the 12th International Congress on the Archaeology of the Ancient Near East Volume 2, Bologna, 399- 414.
- Nigro L., *in press*. La Missione Archeologica di Tell es-Sultan/ Gerico del MoTA-DACH e dell’Università di Roma «La Sapienza» (1997-2022): tutela e valorizzazione del patrimonio archeologico nei territori palestinesi. Scienze dell’ Antichità *in press*.
- Nigro L., Rinaldi T., 2020. The divine spirit of bees. A note on honey and the origins of yeast-driven fermentation. Vicino Oriente XXIV, 185-196.
- Nigro L., Sala M., Taha H. (Eds.), 2011. Archaeological Heritage in the Jericho Oasis. A systematic catalogue of archaeological sites for the sake of their protection and cultural valorization, Rome «La Sapienza» Studies on the Archaeology of Palestine & Transjordan 7, Rome = ROSAPAT 7.
- Nigro L., Spagnoli F., 2018. Pomegranate (*Punica granatum* L.) from Motya and its deepest oriental roots. Vicino Oriente XXII, 49-90.
- Nigro L., Taha H. (Eds.), (2006). Tell es-Sultan/Jericho in the Context of the Jordan Valley: Site Management, Conservation and Sustainable Development. Proceedings of the International Workshop Held in Ariha 7th – 11th February 2005 by the Palestinian Department of Antiquities and Cultural Heritage – Ministry of Tourism and Antiquities, UNESCO Office – Ramallah, Rome “La Sapienza” University, Rome «La Sapienza» Studies on the Archaeology of Palestine & Transjordan 2, Rome = ROSAPAT 2.
- Orendi A., 2020. Flax cultivation in the southern Levant and its development during the Bronze and Iron Age. Quaternary International 545, 63-72.
- Pengilly N.L., 2003. Traditional food and medicinal uses of flaxseed. In: A.D. Muir, N.D. Westcott (Eds.), The Genus *Linum*, New York, 252-267.
- Sellin E., Watzinger C., 1913. Jericho. Die Ergebnisse der Ausgrabungen. (22. Wissenschaftliche Veröffentlichungen der Deutschen Orient-Gesellschaft). Leipzig.
- Shamir O., 2020. Continuity and Discontinuity in Neolithic and Chalcolithic Linen Textile Production in the Southern Levant. In: W. Schier, S. Pollock (Eds.), The Competition of Fibres: Early Textile Production in Western Asia, Southeast and Central Europe (10,000–500 BC), Ancient Textiles Series 36, 27-37.
- Spagnoli F., 2019. The Golden Pome: The Pomegranate from its Deepest Roots to Modern Culture. The Ancient Near East Today 7(2).
- Weide A., 2015. On the Identification of Domesticated Emmer Wheat, *Triticum turgidum* subsp. *dicocum* (Poaceae), in the Aceramic Neolithic of the Fertile Crescent. Archäologische Informationen 38, 381-424.
- Weiss E., 2015. “Beginnings of Fruit Growing in the Old World” – two generations later. Israel Journal of Plant Sciences 62(1-2), 75-85.
- Weiss E., Zohary D., 2011. The Neolithic Southwest Asian Founder Crops. Their Biology and Archaeobotany. Current Anthropology 52(S4), S237-S254.
- Western A.C., 1971. The Ecological Interpretation of Ancient Charcoals from Jericho. Levant 3(1), 31-40.
- Zohary M., 1962. Plant life of Palestine: Israel and Jordan. Ronald Press Co., New York.
- Zohary M., 1973. Geobotanical Foundations of the Middle East, Gustav Fisher Verlag Press, Stuttgart.

Zohary D., 1995. The domestication of the grapevine *Vitis vinifera* L. in the Near East. In: P.E. McGovern et al. (Ed.), *The Origins and Ancient History of Wine*, Amsterdam, 23-30.

Zohary D., 2002. Domestication of the carob (*Ceratonia siliqua* L.). *Israel Journal of Plant Sciences* 50(sup.1), 141-145.

Zohary D., Hopf M., 1993. *Domestication of Plants in the Old World* (3<sup>rd</sup> ed). Oxford University Press, Oxford.

Zohary D., Hopf M., 2000. *Domestication of plants in the old world: The origin and spread of cultivated plants in West Asia, Europe, and the Nile Valley*. Oxford University Press, Oxford.

Zohary D., SpiegelRoy P., 1975. BEGINNING OF FRUIT GROWING IN THE OLD WORLD: Olive, grape, date, and fig emerge as important Bronze Age additions to grain agriculture in the Near East. *Science* 187(4174), 319-327.

Zohary D., Hopf M., Weiss E., 2012. *Domestication of Plants in the Old World: The origin and spread of domesticated plants in Southwest Asia, Europe, and the Mediterranean Basin* (4<sup>th</sup> Edn). Oxford University Press, Oxford.

## SITOGRAPHY

<https://sites.google.com/uniroma1.it/sapienzatojericho>.

## NOTES

- 1 The Austro-German mission (1907-1909) directed by Ernst Sellin and Carl Watzinger (Sellin & Watzinger, 1913); the first British mission (1930-1936) directed by John Garstang (Garstang, 1927; 1930; 1931; 1932a-b; 1933; 1934; Garstang et al., 1935; 1936; Garstang & Garstang, 1948); the second British mission (1952-1958) directed by Kathleen M. Kenyon (Kenyon, 1951; 1957; 1960; 1965; 1981; Kenyon & Holland, 1982; 1983); and the Italian-Palestinian mission (1997-2022) (Nigro, in press); [major excavation reports have been published: ROSAPAT 1,2,4,5,7,13 and more than 100 articles on refereed journals (for the latest see Nigro, 2023); for the complete and updated bibliography of «La Sapienza» Expeditions to Palestine & Jordan see <https://sites.google.com/uniroma1.it/sapienzatojericho>].
- 2 The nomenclature of the species follows the *International Plant Names Index* (IPNI; <https://www.ipni.org/>) and the accepted taxa agree with *Plants of the World Online* (POWO; <https://powo.science.kew.org/>)
- 3 Features of domestication can be summarized as following: ear shattering in cereals, pod's indehiscence in legumes and indehiscence of capsules in flax. In all cases, the seeds are retained by their containers in the cultivated plants. Another distinctive element of cultivated plants compared to wild ones are the size of the seeds (Weiss & Zohari, 2011, 238).
- 4 St. John the Baptist, a hermit in the wilderness of Judah (near Jericho), evidently ate it (Matt. 3:11, 11:1-11; 14:1-12 and synoptics).
- 5 Some authors suggest that the fermented jujube juice was the drink usually consumed by the Lotophagi, the inhabitants, according to some, of the island of Djerba, narrated in Book IX of the *Odyssey*. The jujube broth, or jujube, is sweet and cloying: “andare in brodo di giuggiole”, in Italian, lit. “getting into jujube broth”, means to gloat out of vanity.
- 6 One of the hypotheses is in fact that the “apple” of Genesis 1 that Eve picks from the tree of the knowledge and offers to Adam, is not really an apple, but a *malon* known from the Greek version of the Septuagint, that means simply “the fruit”. It could therefore also be a pomegranate, among the first domesticated apple-shaped fruits in the Near East.
- 7 (Nigro & Spagnoli, 2018, 49) This same apple embellished with a seven- or nine-pointed crown was chosen by the ancient kings of the Levant as the finial of their ivory and gold sceptres. A plant that for Pharaoh Tuthmosis III, who conquered Palestine and Syria on behalf of his mother, Queen Hatshepsut, was the most beautiful of his “Syrian garden” that he had represented carved in Karnak, in front of Thebes, Egypt.
- 8 Otherwise known as *Faidherbia albida* (Delile) A.Chev., in Hebrew *shittah* or plural *shittim*, with whose wood the Ark of the Covenant it is said to be made of in the Exodus (Ex. 37:1: “Bezalel made the ark of acacia wood—two and a half cubits long, a cubit and a half wide, and a cubit and a half high”).