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Roman plant remains from Veli Brijun (island of Brioni), Croatia

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Abstract. 41 archaeobotanical samples were analysed, which had been collected from the seabed at uvala Verige (Verige bay) on the island of Veli Brijun, Croatia, the site of a Roman villa which was settled from the 1st to the 5th century A.D. From the analysis of plant macrofos-sils it is evident that the eu-Mediterranean evergreen woodland, today described as *Quercion ilicis* in the phyto-sociological system, already existed in the Roman period. During this period it became degraded as a result of human activities to other vegetation types such as maquis and garrigue scrub, and grassland. The remains of *Vitis vinifera* (grapevine), *Olea europaea* (olive), *Ficus carica* (fig), and *Pinus pinea* (stone pine) were most frequently recorded; they all derive from very important and characteristic Mediterranean foods. *Prunus avium* (sweet cherry) and *P. persica* (peach), some vegetables and spices were probably cultivated, too, as well as some cereals, most probably *Panicum miliaceum* (millet). *Juglans regia* (walnut), *Castanea sativa* (sweet chestnut), and *Corylus avellana* (hazel) were possibly cultivated on the island or imported from neighbouring Istria. The records of some fresh water plants show that there was fresh water in uvala Verige and its surroundings in Roman times, much more than today.

Key words: Mediterranean vegetation – Cultivated plants – Roman period – Veli Brijun island – Croatia

Introduction

As part of the Croatian-Bavarian project "The hydroarchaeological investigation of the Roman villa in uvala Verige on the island of Veli Brijun", samples were taken from the excavated layers for the study of plant macrofossils during the excavations there in 1997. The investigation of seeds, fruits, and other plant remains should provide information on the Roman period nutrition, agriculture, trade and vegetation in the vicinity of the site, which was inhabited from the 1st to the 5th centuries A.D.

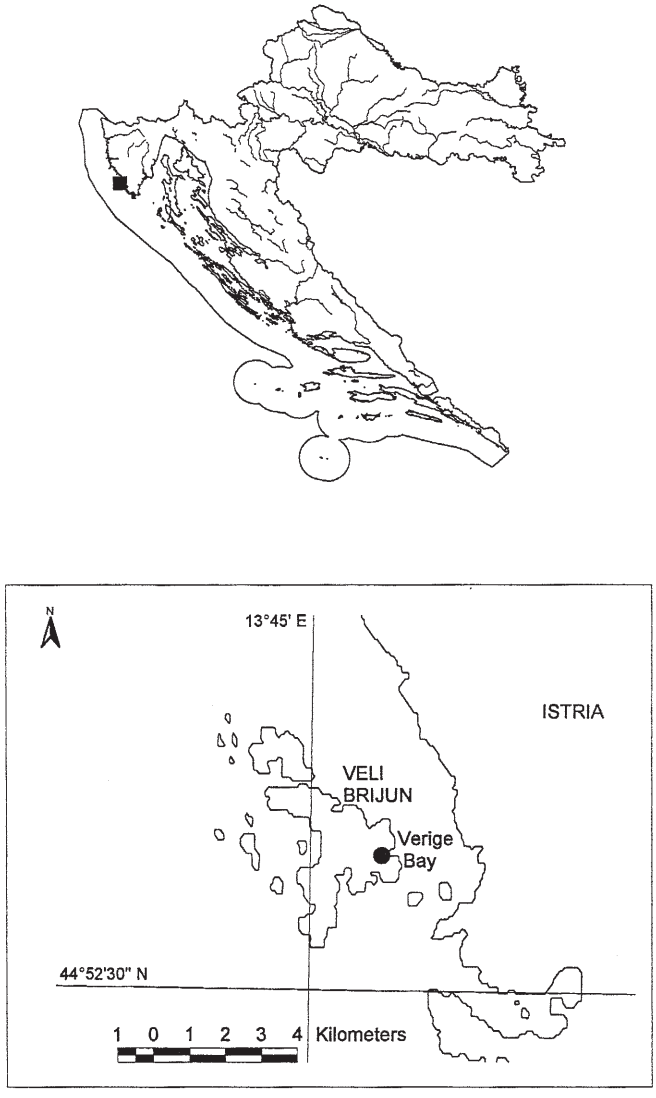

Fig. 1. Geographical location of the investigated territory around uvala Verige (Verige bay)

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The site

Brijuni (the Brioni islands) is a group of 14 small islands, which lie southwest of the coast of Istria, in the Adriatic Sea (13°42'-13°48'E and 44°53'-44°57'N), western Croatia. The largest island of this group is Veli Brijun (Fig. 1).

Veli Brijun is situated in the eu-Mediterranean vegetation zone characterised by plants with evergreen leaves, the *Quercion ilicis* zone (Šugar 1991/92, 1994).

Brijuni were intensively settled from prehistoric times onwards and almost all the major culture periods are represented there. The earliest remains of human settlements date to the mid-Neolithic at about 3000 uncal B.C. Artefacts show that the Histri (a western Illyrian tribe), the Romans, Goths, Byzantines, Franks, Slavs and Venetians lived there in turn until the 14th C. In A.D. 1312 the first onslaught of the plague killed many inhabitants and in consequence the islands were abandoned and devastated; the plague recurred several more times. Malaria also increased and so Brijuni were almost completely deserted from the 18th C up to 1893. After that, an Austrian industrialist bought the islands and changed their character intensively, by draining the wetlands to form a famous tourist landscape (Bralić 1990).

One of the greatest archaeological sites is the Roman palace in uvala Verige, situated on the east coast of the relatively flat island of Veli Brijun (Fig. 1). The complex of the palace is situated on the inside part of uvala Veriga, but also on the slopes of the Gradina, Dubovac and Mrtvi vrh hills covering an area of ca. 6 ha. The residence was built in various phasesfrom the 1st century B.C. to the 1st century A.D. It developed from a relatively small "villa rustica", a building with a water reservoir and a big winery, to a magnificent palace with three terraces, three temples, quarters for priests, baths with pools for warm and cold water, an aqueduct, a sewage system, farm buildings, quarters for servants and slaves, gardens and a quay (Fig. 2). The similarity of this layout to those of other Roman imperial palaces from Julian and Claudian times suggest that the large building complex of uvala Verige may have been one of the Roman imperial summer residences, even if there is no direct evidence that the palace was built for an emperor or his family. The degradation of the palace started in the 2nd or 3rd century A.D. It is not quite clear at the moment which parts of the complex were still in use after this period, but it is clear that some parts were used in the late Roman period. The present Roman complex at uvala Verige is composed of walls and posts up to 2 m high and partly submerged under the sea to a depth of around 1 m (Begović-Dvoržak 1990, 1993/94).

During the excavation of the Roman complex at uvala Verige in 1997, samples for archaeobotanical analysis were taken from sections E1 and D2 which were situated at least 1.2 m under the present mean sea level, near the west side of the north mole in front of previous farm buildings (Fig. 2). 9 different layers in section E1 and eight different layers in section D2 were archaeologically recognised. The layers are dated by the archaeologists from the 1st to the 5th centuries A.D.

Material and methods

During the excavation divers collected one or more samples from each layer of the excavated area of the site below sea-level (Fig. 2). The contents of two Roman amphorae and one oil-lamp were also taken for analysis. The volumes of the samples ranged from 0.3 to 2.25 litres. In several cases hand picked material was also present.

The samples were treated in the usual way for waterlogged material. The whole sample was washed through three sieves, with mesh diameters of 2.5, 1.0 and 0.315 mm, respectively, placed one on top of the other, so that three fractions were obtained. Seeds, fruits and other plant remains were picked out and sorted using a binocular microscope with 10 x magnification and afterwards identified using 10-20 x magnification. Before adding the results of the three fractions together, the numbers of seeds and fruits found in each subsample of a fraction were converted to the total numbers for that fraction in cases when only a portion of a subsample was analysed.

The seeds, fruits and other plant remains were identified by comparison with a reference collection of recent seeds and fruits, and plants in the herbarium, and also with the help of literature (especially Beijerinck 1947). Because it was not possible to compare the recorded material with a complete collection of Mediterranean reference material, which does not yet exist, a very few plant remains could not be identified.

To collect data on the nutrition, agriculture, vegetable trade and vegetation of the Veli Brijun area in Roman times the results of the analyses of various samples are taken together.

Results and discussion

By the analysis of 41 samples from Veli Brijun, 8,271 well preserved and mostly non-carbonised macrofossils of entire, half and fragmented seeds, fruits, and other plant remains were sorted. 7,608 or 91.9 % of them were identi-

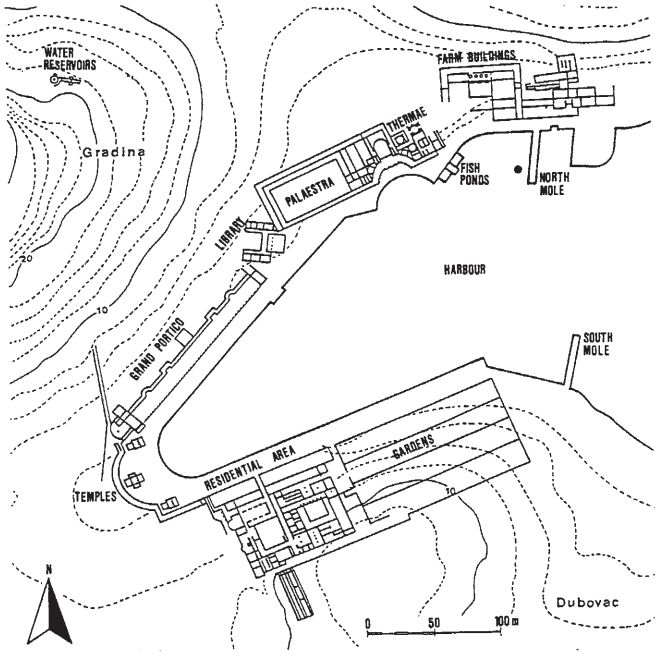

Fig. 2. Plan of the residential complex at uvala Verige (Verige bay), according to Begović-Dvoržak (1990). The site of the excavation, from which the samples were collected, is marked by a black dot

fied. 62 taxa (7,427 plant remains or 97.6 %) of identified macrofossils were identified to species level, 28 taxa (156 plant remains or 2.1 %) to genus level, 3 taxa (10 plant remains or 0.1 %) to family level, and 11 of them (16 plant remains or 0.2 %) could not be determined with certainty; these records were marked by "cf" in Table. 1.

In spite of the fact that the layers with the samples were deposited in stratigraphical order, it has not yet proved possible for the archaeologists to date the material more exactly than the total time-span between the 1st to the 5th century A.D. The plant remains were more or less evenly distributed in the various layers. Therefore we only present a summary list of the plant remains recorded (Table 1); for more details see Šoštarić (1999). The nomenclature of plant taxa is according to Pignatti (1982), and the recorded plant taxa in the table are arranged in alphabetical order.

Some critical identifications

Cucumis sativus (cucumber) (Fig. 3a). One light-brown, oval, somewhat flattened seed with a clear margin was found in a Veli Brijun sample. The size of the seeds of *C. sativus* is very variable, as is the seed size of the related species *C. melo* L. (melon). It is possible to distinguish the seeds of these two species by the fine anatomy of the seed surface: *C. melo* seeds have fine straight, parallel lines of cells on the whole seed surface, while *C. sativus* seeds have fine straight parallel lines in the middle of the seed surface, and parallel lines which follow the oval shape on the rest of the seed surface (Küster 1988).

Daucus carota s.l. (carrot) (Fig. 3c). Five dark-brown mericarps with grey ribs, which had lost the characteristic spines through the actions of the sea and substrate, were found in the Veli Brijun samples. The species *D. carota* s. l. includes various taxa, which have different taxonomic positions. According to Pavletić and Škalamera (1983) six *Daucus* species s. str. occur now in Croatia: *D. carota* L. (= *D. carota* L. subsp. *carota*), *D. major* (Vis.) Pospichal (= *D. carota* L. subsp. *major* /Vis./ Arcangeli), *D. maximus* Desf. (= *D. carota* L. subsp. *maximus* /Desf./ Pall.), *D. hispidus* Desf. (= *D. carota* L. subsp. *hispidus* / Desf./ Heywood), *D. hispanicus* Gouan (= *D. carota* L. subsp. *hispanicus* /Gouan/ Thell.), *D. dentatus* Bert. (= *D. carota* L. var. *dentatus* /Bert./ Fiori), and the cultivated *D. sativus* (Hoffm.) Roehl. (= *D. carota* L. subsp. *sativus* / Hoffm./ Arcangeli). The *Daucus* species s. str. can be determined by the structure of the mericarp, if it is well preserved, however preservation in the examples from the Veli Brijun samples was not good enough for their identification to a higher level than the *Daucus* species s. str. which were mentioned above. From the present-day context of the locality, it is possible that the *Daucus* mericarps from the Brioni samples can derive either from the cultivated carrot (*D. sativus*) or from the Mediterranean species *D. major* and/or *D. maximus* (Hegi 1926; Pavletić 1984).

Juniperus phoenicea (Phoenician juniper) (Fig. 3d). Brown twigs with small scaly leaves were found in 48.7 % of the Veli Brijun samples. Our first impression was that these plant remains could be identified as either *Cupressus sempervirens* L. or *J. phoenicea*. A detailed comparison with recent material showed that all of them were *J. phoenicea*. Phoenician juniper has small, scaly, rhombic leaves of a length between 0.8-1.2 mm, and the twigs look fairly compact. *Cupressus sempervirens* (Mediterranean cypress) also has small, scaly, rhombic leaves, but they are somewhat longer (1.2-1.8 mm) than those of *J. phoenicea*, and the twigs with scaly leaves look less compact than those of *J. phoenicea*.

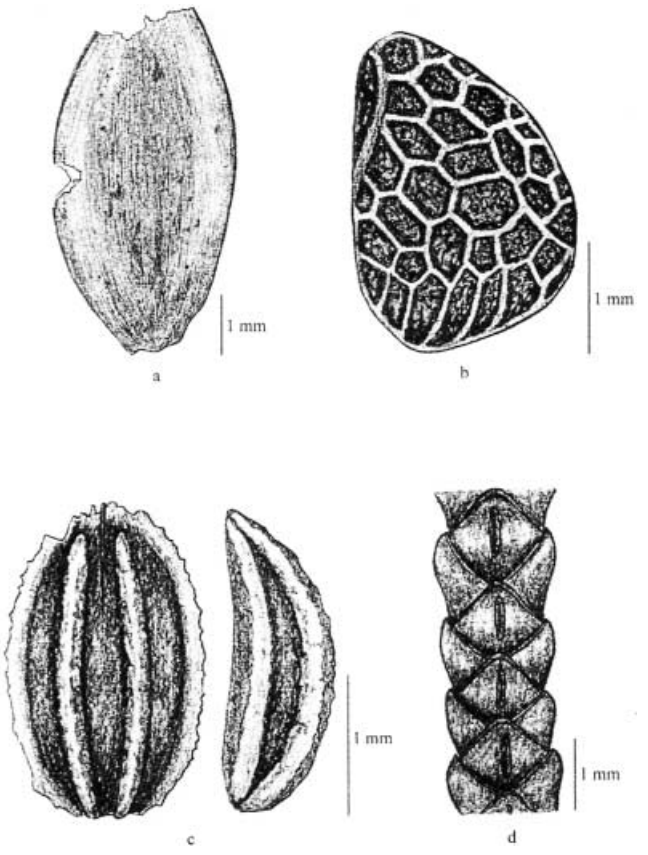

Fig. 3. Plant remains from the Veli Brijun samples: **a** *Cucumis sativus*; **b** *Rubus fruticosus* agg.; **c** *Daucus carota* s. l.; **d** *Juniperus phoenicea*

Rubus fruticosus agg. (Fig. 3b). The pips of blackberry, found in the Brioni samples, are rounded with a conspicuous irregular honeycomb-like structure on the surface. The aggregate *R. fruticosus* includes many rather indistinguishable species of blackberries, of which the most widespread in the coastal region of Croatia today is *R. ulmifolius* Schott var. *heteromorphus* (Ripart) Sudre (= *R. dalmaticus* Trattn.), and it mostly grows in sub- and eu-Mediterranean woodlands, in maquis and garrigues, and rarely in rocky pastures (cf. Horvatić 1963).

The plant remains

The plant list (Table 1) represents a thanatocoenosis (death assemblage) (Behre and Jacomet 1991). This means that the plants did not grow together on the same site forming a biocoenosis (living assemblage) but were deposited together in layers as the result of various human activities. The places from which samples were collected were in front of the former farm buildings, in the harbour,

Table 1. The list of taxa found in samples and identified. Explanation of the abbreviations: B bud; L leaf; T thorn; Tl twig with leaves; Tt - twig with thorns; * hand-picked material

Taxon	a	b	c
Adonis sp., achene	1	2.4	1
Ajuga chamaepitys (L.) Schreber, nutlet	1	2.4	1
Alisma plantago-aquatica L., achene	2	4.8	2
Anagallis arvensis L., seed	2	4.8	2
cf. *Anagallis arvensis* L., seed	1	2.4	1
Anthemis arvensis L., achene	26	63.4	89
Apiaceae, mericarp	6	14.6	6
Apium graveolens L., mericarp	1	2.4	2
Atriplex latifolia Wahlenb./ *A. patula* L.	1	2.4	1
Atriplex sp., seed	2	4.8	2
Atriplex/Chenopodium sp., seed	1	2.4	2
Brassica nigra (L.) Koch, seed	1	2.4	1
cf. *Bromus* sp., caryopsis	1	2.4	1
cf. *Callitriche* sp., nutlet	3	7.3	4
Campanula sp., seed	3	7.3	3
Campanulaceae, seed	1	2.4	1
Carex hallerana-type, nutlet	1	2 4	1
Carex sp., nutlet	4	9 7	4
Castanea sativa Miller, nut skin	1	2 4	1
Cerastium sp., seed	2	4 8	2
Chenopodium album L., seed	16	39 0	29
Chenopodium sp., seed	8	19 5	9
Cirsium sp., achene	1	2.4	1
Corylus avellana L., nut shell	6	14.6	6
Cucumis sativus L., seed	1	2.4	1
Daucus carota L. s.l., mericarp	4	9.7	5
Euphorbia helioscopia L., seed	10	24.3	15
Fallopia convolvulus (L.) Holub, nutlet	1	2.4	1
cf. *Fallopia convolvulus*, nutlet	1	2.4	1
Ficus carica L., pip	40	97.5	2069
Fumaria officinalis L., nutlet	1	2.4	2
Fumaria cf. *officinalis*, nutlet	2	4.8	2
Glaucium corniculatum (L.) Rudolph, seed	1	2.4	1
Hypericum perforatum L., seed	4	9.7	5
Juglans regia L., nut shell	33	80.4	456
Juncus sp., seed	15	36.5	21
Juniperus phoenicea L.	20	48.7	42L, 8B, 68Tl
Lepidium sp., seed	1	2.4	1
Linum catharticum L., seed	4	9.7	4
cf. *Linum catharticum*, seed	2	4.8	2
L. flavum L., seed	7	17.0	7
Linum sp., seed	1	2.4	1
Malva sp., nutlet	1	2.4	1
Medicago arabica (L.) Hudson, legume	1	2.4	4
Melandrium/Silene sp., seed	1	2.4	1
Mentha sp., nutlet	3	7.3	3
Mycelis muralis (L.) Dumort., achene	1	2.4	1
Myosoton aquaticum (L.) Moench, seed	1	2.4	1
Myrtus communis L., seed	5	12.1	7
Olea europaea L., stone	38	92.6	1182
Orlaya grandiflora (L.) Hoffm., mericarp	1	2.4	1
Panicum miliaceum L., glume	7	17.0	8
Papaver argemone L., seed	2	4.8	2
P. dubium L./P. rhoeas L., seed	1	2.4	1
P. somniferum L., seed	1	2.4	1
cf. *Pastinaca sativa* L., mericarp	1	2.4	1
Picris hieracioides L., achene	2	4.8	2
Pinus pinea L., cone	26	63.4	321
P. pinea L., seed	39	95.1	1557
Pinus sp., cone	1	2.4	1
Poa annua L., caryopsis	2	4.8	2
Poaceae, caryopsis	3	7.3	3
Polygonum aviculare L., nutlet	13	31.7	16
P. persicaria L., nutlet	2	4.8	2
P. cf. *aviculare*, nutlet	1	2.4	1
Polygonum sp., nutlet	3	7.3	5
Portulaca oleracea L., seed	14	34.1	21
Primula sp., seed	1	2,.4	1
Prunella laciniata (L.) L., nutlet	2	4.8	2
P. vulgaris L., nutlet	2	4,8	3
Prunella sp., nutlet	2	4.8	2
cf. *Prunella* sp., nutlet	1	2.4	1
Prunus avium L., fruitstone	3	7.3	6+1*
P. persica (L.) Batsch, fruitstone	1	2.4	1+20*
Quercus ilex L., acorn	1	2.4	4
Ranunculus acris L., achene	13	31.7	13
R. arvensis L., achene	2	4.8	2
R. repens L., achene	1	2.4	1
R. sardous Crantz, achene	3	7.3	6
Ranunculus sp., achene	5	12.1	7
Rosa/Rubus sp.	10	24.3	18T, 1Tt
Rubus fruticosus L. agg., pip	24	58.5	55
Rubus sp., pip	24	58.5	53
Rumex acetosa L., nutlet	2	4.8	2
R. acetosella L., nutlet	13	31.7	31
R. obtusifolius L./R. pulcher L., nutlet	9	21.9	10
Rumex sp., nutlet	6	14.6	7
cf. *Rumex* sp., nutlet	1	2.4	1
Sambucus nigra L., pip	2	4.8	2
Sambucus sp., pip	3	7.3	3
Satureja montana L., nutlet	1	2.4	1
Setaria sp., caryopsis	1	2.4	1
Silene gallica L., seed	15	36.5	19
Silene sp., seed	1	2.4	1
Solanum nigrum L., seed	8	19.5	9
Solanum sp., seed	1	2.4	1
Stellaria media (L.) Vill., seed	5	12.1	5
Thalictrum sp., achene	2	4.8	2
Torilis sp., mericarp	1	2.4	1
Triticum cf. *spelta*, glume base	1	2.4	1
Typha angustifolia L./T. latifolia L./, seed	11	26.8	13
Urtica urens L., nutlet	1	2.4	1
Valerianella dentata (L.) Pollich, achene	8	19.5	9
Verbena officinalis L., nutlet	3	7.3	3
Vitis vinifera L., pip	40	97.5	1204
V. vinifera, fruit stalk	24	58.5	76
Total			7608+21*

a = Total number out of 41 samples in which macrofossils occur
b = Percentage (%) of 41 samples in which macrofossils occur
c = Total number of macrofossils found in samples

and during the Roman period the sediments were already below sea level (Fig. 2). The plant materials were probably deposited by human activity as rubbish. Some of the plant remains could have reached the sampling site by some other means, such as by wind. Because the various plants originate from a variety of habitats in the near or far environs of the Roman palace, they have been grouped in five categories on the basis of their values as food or medi-

cine or for cultural or ritual uses (groups 1 and 2 in Table 2), the ecological indicator values, and the phytosociological status of the species (groups 3, 4 and 5 in Table 2).

The number of cereal chaff remains is small. There was only one piece of *Triticum* cf. *spelta* (possible spelt chaff). It is therefore possible that cereals (or already processed flour) was imported to the island. This is likely because an emperor or other high status people lived in the palace of Veli Brijun, who probably did not produce crops themselves. The number of *Panicum miliaceum* (millet) remains is small, too, but they were distributed through different layers. However, this distribution of millet remains supported by a high percentage of remnants of cornfield weeds, which are classified as *Chenopodietea* weeds today, and the fact that millet was a common Roman crop of warm places allow us to conclude that millet was probably produced on the island, but maybe also other cereal species which could not be traced. In principle, the island is big enough for local grain cultivation. However it is uncertain whether cereals were grown locally, since these crops could also have been imported from other areas. Perhaps some crops were cultivated, some only imported, but on the basis of present evidence this question cannot yet be answered.

Gardens were important parts of the uvala Verige complex, and it is therefore possible that vegetables and spice plants, such as *Cucumis sativus*, *Papaver somniferum*, *Apium graveolens*, *Brassica nigra*, *Daucus sativus* and *Satureja montana*, were cultivated locally as well as, probably, some other plants which were not found in the samples.

The most frequently recorded plant remains from the site are *Vitis vinifera* (grapevine), *Olea europaea* (olive), *Ficus carica* (fig), and *Pinus pinea* (stone pine). Their remnants were found in large numbers in almost all samples, which gives the impression that these plants were important as food for humans. This is not surprising because it is well known that olives, grapevine and figs are some of the most important food products in the Mediterranean basin for a very long time. The importance of local olive and wine production and processing is also supported by the existence of many Roman oil and wine presses at uvala Verige as well as on other places on the island.

When considering the fairly large number of *Ficus* (fig) pips, one should not forget that one fig can contain hundreds of pips. But since the fig pips occurred in almost all samples through different layers, we can conclude that fig was certainly an important food product.

The seeds of *Pinus pinea* (stone pine) are easily transported, but since many fragments of cones were found and because the climate is suitable, we can conclude that stone pine grew locally. The mature closed cones can be opened by heating next to a fire, and this process also removes the resinous smell of the seeds. This is probably the reason why the seeds and cone fragments were partly carbonised.

The typical habitats of *Castanea sativa* (sweet chestnut) and *Juglans regia* (walnut) are mesophilous or moderately thermophilous deciduous woodlands, which are absent from the island today, but possibly occurred there in Roman times. However the nuts can easily be transported, could therefore have been imported from neighbouring Istria where they were very possibly cultivated in the Roman period.

Table 2. The identified plant taxa grouped in five categories

1. CULTIVATED AND USEFUL PLANTS, HERBS	
Triticum cf. *spelta*	*Apium graveolens*
Panicum miliaceum	*Brassica nigra*
Cucumis sativus	*Daucus carota* s.l. (*D. sativus*)
Papaver somniferum	*Satureja montana*
2. CULTIVATED AND USEFUL FRUITS, TREES, AND SHRUBS	
Ficus carica	*Castanea sativa*
Olea europaea	*Juglans regia*
Pinus pinea	*Myrtus communis*
Vitis vinifera	*Corylus avellana*
Prunus avium	*Rubus fruticosus* agg.
Prunus persica	*Sambucus nigra*
3. WEEDS AND RUDERAL PLANTS	
Secalinetea (Secalinion mediterraneum):	***Chenopodietea:***
Ajuga chamaepitys	*Anagallis arvensis*
Anthemis arvensis	*Atriplex patula*
Fallopia convolvulus	*Chenopodium album*
Papaver argemone	*Euphorbia helioscopia*
Papaver dubium	*Fumaria officinalis*
Papaver rhoeas	*Glaucium corniculatum*
Ranunculus arvensis	*Medicago arabica*
Valerianella dentata	*Poa annua*
	Polygonum aviculare
	Polygonum persicaria
	Portulaca oleracea
	Ranunculus repens
	Rumex pulcher
	Solanum nigrum
	Stellaria media
	Urtica urens
4. PLANTS OF FRESH WATER ENVIRONMENTS	
Alisma plantago-aquatica	*Myosoton aquaticum*
Typha angustifolia	*Ranunculus sardous*
Typha latifolia	
5. ELEMENTS OF MAQUIS	
Quercus ilex	*Silene gallica*
Myrtus communis	*Daucus carota* s.l. (*D. major*,
Juniperus phoenicea	*D. maximus)*

Prunus avium (wild cherry) is not a characteristic species of the Mediterranean region. But as it is difficult to transport the fruits, these cherry finds were probably from fruit cultivated on the island as well as peach *P. persica.*

Corylus avellana (common hazel) is also not characteristic of the eu-Mediterranean region. It is possible that common hazel was cultivated on the island but it is more probable that hazelnuts were imported from elsewhere, perhaps from Istria, too.

Myrtus communis (myrtle) is a common eu-Mediterranean species, so it probably grew in the natural vegetation of the islands. Myrtle was also cultivated for its fruits, which were used for food, spice, alcoholic drinks, and aromatic oils (Küster 1997). In Roman times, myrtle was a holy plant consecrated to Venus and her temples were surrounded by bushes of myrtle (Hegi 1926). As the Roman

complex at uvala Verige included a temple dedicated to Venus too, myrtle was probably deliberately grown in the surroundings of the temple.

Sambucus nigra (elder) is a nitrophilous plant characteristic of temperate Europe, but it also occurs in the Mediterranean region. This plant was well respected for its medical and nourishing quality, so it is possible that elder was grown in the gardens of the Roman palace. As some of the other taxa found in the samples indicated a nitrophilous and damp habitat, it is also possible that the elder occurred as part of such a flora.

Many weeds and ruderal plants which now grow mainly in *Chenopodietea* vegetation occur in high percentages in the Veli Brijun samples. These weeds probably grew in gardens, vineyards, and plantations of olives and figs, and ruderal plants grew probably near pathways and besides the buildings of the Roman complex.

Roman archaeological remains such as an aqueduct and a thermal complex, as well as the finding of macrofossils of fresh water plants like *Typha angustifolia/ latifolia*, *Alisma plantago-aquatica*, *Ranunculus sardous*, and *Myosoton aquaticum* show that there was extensive fresh water and damp ground at uvala Verige and its surroundings in the Roman period, much more than today.

*Quercus ile*x and *Myrtus communis* are characteristic of the eu-Mediterranean evergreen woods and the maquis which are described in the phytosociological system in the alliance *Quercion ilicis*. *Juniperus phoenicea*, found in 48.7 % of the samples, is today characteristic of communities of bushy garrigues of the order *Cisto-Ericetalia*, a more degraded stage of *Quercetalia ilicis* woods and maquis. The species *Silene gallica* and *Daucus carota* s.l., possible *D. major* and/or *D. maximus*, occur in different vegetation types which are today assigned to the plant communities of the order *Cymbopogo-Brachypodietalia*, which includes dry grasslands and rocky pastures of the eu- and sub-Mediterranean belts of the Croatian coast. These anthropogenic communities appear as the final levels of degradation of woods and maquis (cf. Horvatić 1963; Pavletić 1984; Trinajstić 1995).

The pollen analysis of samples from Lake Palu, on the west coast of Istria, relatively near to the Brijuni islands, has shown that before Roman colonisation the vegetation of western Istria consisted of deciduous thermophilous or mesophilous oak woods and a belt of evergreen woodland mainly with *Quercus ilex* following the shore of the Adriatic Sea, and that strengthened human activity caused an increase of the pollen percentages of various species of *Phillyrea* and of *Juniperus* (Beug 1977). The recent vegetation of Brijuni is characterized mostly by the community *Pistacio-Rhamnetum alaterni* which belongs to the alliance *Quercion ilicis* (Šugar 1991/92, 1994). Therefore, both the present macrofossil and earlier pollen analyses show that an already existing eu-Mediterranean vegetation spread as the result of human activity in the Roman period, and vegetation in many places then degraded into maquis and garrigues. This possibly happened by clearance of woodlands and subsequent intensive grazing which favoured aromatic plants and ones with thorns. By this strong human influence the typical character of the present-day Mediterranean landscape has been formed not only in Istria but also at many places on the Adriatic coast (cf. Beug 1961, 1977, 1982; Brande 1973; Behre 1988; Grüger 1996).

The plant macrofossil analysis did not confirm the existence of saline habitats with halophytes, although they were expected because of the coastal locality and the deposition of plant remains below sea level. This is probably because in Roman times the whole shore of uvala Verige was paved with stone blocks, so there were no suitable conditions in which halophytes could grow.

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