

FLORISTIC CHARACTERISTICS OF PHOENICIAN JUNIPER *MACCHIA* (ASS. *PISTACIO LENTISCI* – *JUNIPERETUM* *PHOENICEAE* TRINAJSTIĆ 1987) IN CENTRAL AND SOUTHERN DALMATIA (CROATIA)

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Kovačić, S., Jasprica, N. & Ruščić, M.: Floristic characteristics of Phoenician juniper *macchia* (ass. *Pistacio lentisci* – *Juniperetum phoeniceae* Trinajstić 1987) in Central and Southern Dalmatia (Croatia). Nat. Croat., Vol. 10, No. 2, 73–81, 2001, Zagreb.

Areas where the Phoenician juniper (*Juniperus phoenicea*) is very abundant, as well as communities in which this species is dominant, represent a special form of forest community, commonly developed as xerothermic *macchia* known as *Pistacio lentisci* – *Juniperetum phoeniceae* and included in the *Oleo-Ceratonion* alliance. This association represents an important progressive stage in the succession towards evergreen vegetation, developed mostly after forest fires. In this paper, we analysed the floristic characteristics of the *Pistacio lentisci* – *Juniperetum phoeniceae* association on the islands of Čiovo, Šolta, Brač, Hvar, Korčula and Lopud, including the peninsula of Pelješac and the Dubrovnik coastal regions (Dubrovačko primorje). In the southern localities this association is still in its initial phase of development, while the Central Dalmatian results indicates a succession of vegetation towards the development of a *Quercus ilicis* – *Pinetum halepensis* forest community.

Key words: flora, vegetation, forest fire, Dalmatia, Croatia

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Površine na kojima se obilno razvija somina (*Juniperus phoenicea*), te sastojine u kojima ta vrsta dominira, predstavljaju posebnu šumsku zajednicu razvijenu u obliku kserotermne makije *Pistacio lentisci* – *Juniperetum phoeniceae*, priključene svezi *Oleo-Ceratonion*. Ta asocijacija predstavlja značajan progresijski stadij sukcesije vazdazelene vegetacije, najčešće nakon šumskih požara. U ovome su radu analizirane florističke značajke makije somine na otocima Čiovu, Šolti, Braču, Hvaru, Korčuli i

Lopudu, te na poluotoku Pelješcu i u Dubrovačkom primorju. Na području južne Dalmacije ta je asocijacija još u inicijalnoj fazi razvoja, dok rezultati istraživanja na području srednjodalmatinskih otoka ukazuju na sukcesiju vegetacije u smjeru razvitka šumske zajednice *Quercus ilicis* – *Pinetum halepensis*.

Ključne riječi: flora, vegetacija, šumski požar, Dalmacija, Hrvatska

INTRODUCTION

The evergreen forest community *Pistacio lentisci* – *Juniperetum phoeniceae* Trinajstić 1987 was first described on the basis of 9 phytocoenological relevés (average of 32 species) in Croatia: 6 relevés (23 species) from the island of Unije near Lošinj and 3 relevés (22 species) from the isle of Veliki Pržnjak near Korčula (TRINAJSTIĆ, 1987). Syntaxonically, this xerothermic *macchia* with sparse growths of holm oak (*Quercus ilex*) belongs to the *Oleo-Ceratonion* alliance. Most frequently, it covers large uniform surfaces and includes a relatively small number of species. Phytogeographically, it is a part of the narrowly Mediterranean vegetation zone of the Mediterranean region.

The research results that were published later on and which were based upon 6 relevés (total of 26 species) from the island of Mljet (TRINAJSTIĆ, 1995), 1 relevé (11 species) from the island of Murter (PANDŽA, 1995) and 6 relevés (38 species) from the coasts of Mali Ston Bay (TRINAJSTIĆ, 1995), point towards a broad distribution of this association in the Croatian coastal region. During research carried out into the fire-devastated southern Adriatic coastal and island region (1998–2000), we established the existence of Phoenician juniper *macchia* in these regions as well. Here the islands of Central Dalmatia are also included, where this *macchia* covers large areas between the belts of halophytic vegetation and some form of forest (or *garrigue*) vegetation. The results of this research are given in this paper.

MATERIAL AND METHODS

The floristic characteristics of the *Pistacio-Juniperetum phoeniceae* association shown in Tab. 1 are based upon 20 phytocoenological relevés taken from the coastal regions and islands of Central and Southern Dalmatia. The relevés were made at the following localities (Fig. 1):

1. Island of **Lopud** – Šunj Bay; exposition SE, inclination 20°, right along the sea.
2. Dubrovnik coastal region (**Dubrovačko primorje**) – Budima Bay near the settlement of Banići; exposition S, inclination 20°.
3. Dubrovnik coastal region (Dubrovačko primorje) – Smokvina Bay near the settlement of Doli; exposition SE, inclination 20°.
4. **Pelješac** peninsula – 1 km southeast of Zamaslina in the Mali Ston Bay; exposition NW, inclination 25°.
5. Pelješac peninsula – 1 km southeast of Trstenik; exposition S, inclination 25°.
6. Pelješac peninsula – Borje, 5 km southeast of Orebić; exposition S, inclination 20°.

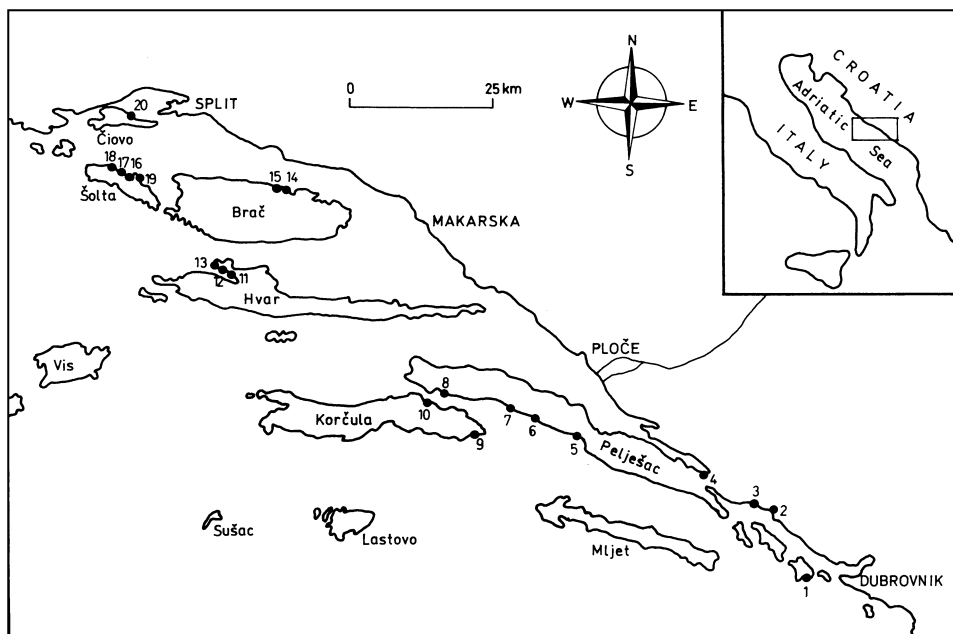


Fig. 1. Position of the investigated localities in the map of Dalmatia (Croatia): 1 – Šunj Bay (island of **Lopud**); 2 – Budima Bay (**Dubrovačko primorje**); 3 – Smokvina Bay (Dubrovačko primorje); 4 – Zamaslina (**Pelješac** peninsula); 5 – Trstenik (Pelješac peninsula); 6 – Borje (Pelješac peninsula); 7 – Postup (Pelješac peninsula); 8 – Kučište (Pelješac peninsula); 9 – Lumbarda (island of **Korčula**); 10 – Račišće (island of Korčula); 11 – Starigrad 1 (island of **Hvar**); 12 – Starigrad 2 (island of Hvar); 13 – Starigrad 3 (island of Hvar); 14 – Pučišća 1 (island of **Brač**); 15 – Pučišća 2 (island of Brač); 16 – Rogač 1 (island of **Šolta**); 17 – Rogač 2 (island of Šolta); 18 – Rogač 3 (island of Šolta); 19 – Rogač 4 (island of Šolta); 20 – Slatine (island of **Čiovo**).

7. Pelješac peninsula – Postup, 3 km southeast of Orebić; exposition S, inclination 20°.
8. Pelješac peninsula – Kučište, 3 km northwest of Orebić; exposition SW, inclination 20°.
9. Island of **Korčula** – Lumbarda, northwest of Pržina Bay; exposition S, inclination 20°.
10. Island of Korčula – Račišće, 3 km northeast of the city of Korčula; exposition NW, inclination 20°.
11. Island of **Hvar** – 3.5 km north of the city of Starigrad; exposition SW, inclination 20°, rocky ground called *škrape*.
12. Island of Hvar – 4.2 km north of the city of Starigrad; exposition SW, inclination 15°, 10 m from the shoreline.
13. Island of Hvar – 4 km north of the city of Starigrad; exposition SW, inclination 25°, 7 m from the shoreline.

14. Island of **Brač** – 1.2 km northwest of Pučišća (behind the lantern); exposition N, inclination 35°, 20 m from the shoreline.
15. Island of Brač – 1.5 km northwest of Pučišća (behind the lantern); exposition NE, inclination 35°, 20 m from the shoreline.
16. Island of **Šolta** – 2 km northwest of Rogač (Gradina region); exposition N, inclination 35°, dense *macchia* on rocky-boulder ground, 20 m from the shoreline.
17. Island of Šolta – 2.4 km northwest of Rogač; exposition N, inclination 40°, strong wind and insolation.
18. Island of Šolta – 3 km northwest of Rogač; exposition N, inclination 40°, high *macchia*, 15 m from the shoreline.
19. Island of Šolta – 1.5 km northeast of Rogač (region of so called »Bad« behind the lantern); exposition NE, inclination 50°, strong wind, 10 m from the shoreline.
20. Island of **Čiovo** – 2 km east of the settlement Slatine; exposition NE, inclination 45°, 15 m from the shoreline.

We applied the classical methods of the Zürich-Montpellier school (BRAUN-BLANQUET, 1964) while analysing this community. The nomenclature of species and lower taxa follows PIGNATTI (1982).

RESULTS AND DISCUSSION

Tab. 1. Ass. *Pistacio lentisci* – *Juniperetum phoeniceae* Trinajstić 1987

Croatian southern coastal region with islands

According to TRINAJSTIĆ (1995), the *Pistacio-Juniperetum phoeniceae* community covers large surface areas throughout the entire southern coastal region of Croatia. It represents a significant stage in the progressive succession towards evergreen forest vegetation, frequently after forest fires. We confirmed this to be true following our research on the developing vegetation of the Pelješac peninsula and of the island of Korčula (1998 – 2000), and also in some other localities. The overall floristic characteristics of the localities under research (1–10) are modest: ranging from 15 to 25 (average 19) species per relevé, which indicates an initial phase of development of the communities, not long after a forest fire. As *Quercus ilex* does not appear in any of the relevés, we can conclude that there are no nearby acorn sources as yet capable of furthering the development of new holm oak populations. In the areas researched, most of the species are ornithochorous and/or have the ability to sprout growth from shoots. It is also known (TRINAJSTIĆ, 1993) that fire practically aids the Aleppo pine (*Pinus halepensis*): fire helps this species to renew itself and spread to entirely new areas.

There are 7 species that display the greatest constancy in that area (appearing in 100% of the relevés): *Juniperus phoenicea*, *Pistacia lentiscus*, *Myrtus communis*, *Olea*

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sylvestris, *Rubia peregrina*, *Smilax aspera* and *Coronilla emerus* subsp. *emeroides*. Compared to research done previously in southern Adriatic localities, three new species were noted for the community *Pistacio-Juniperetum phoeniceae*: *Calicotome spinosa* on the island of Lopud and in the Dubrovnik coastal region, *Phyllirea angustifolia* above Trstenik and *Pistacia terebinthus* at Kučište, both on the Pelješac peninsula.

Central Dalmatian islands

In the investigated areas of the Central Dalmatian islands (Čiovo, Šolta, Brač and Hvar, relevés 11–20), the community *Pistacio-Juniperetum phoeniceae* shows a different structure of floristic composition than in southern localities. The overall floristic characteristics are still not extensive, however, they are significantly greater than those found in the southern localities. There is a larger number of species with greatest constancy in the relevés (total 17): *Juniperus phoenicea*, *Pistacia lentiscus*, *Myrtus communis*, *Pinus halepensis* (juv.), *Smilax aspera*, *Rubia peregrina*, *Coronilla emerus* subsp. *emeroides*, *Juniperus oxycedrus*, *Asparagus acutifolius*, *Phyllirea media*, *Arbutus unedo*, *Quercus ilex*, *Brachypodium retusum*, *Cistus incanus*, *Helichrysum italicum*, *Dactylis hispanica*, *Dorycnium hirsutum* and *Tamus communis*. Ranging from 22 to 30 (average 27) species per relevé, these results indicate a succession of vegetation towards the development of the *Quercus ilex* – *Pinetum halepensis* Loisel 1971 forest community, with holm oak and Aleppo pine appearing in 100% of the relevés. Compared to the research done to date, 12 new species were noted in the Central Dalmatian islands for *Pistacio-Juniperetum phoeniceae* community: *Cyclamen repandum* and *Geranium purpureum* on Brač and Šolta, *Cistus monspeliensis* on Šolta, *Gladiolus illyricus* in 1 relevé on Brač and 3 relevés on Šolta, *Helictotrichon convolutum* and *Satureja montana* on Hvar, and *Briza maxima*, *Bromus erectus*, *Euphorbia spinosa*, *Galium lucidum*, *Koeleria splendens* and *Salvia officinalis* on the island of Čiovo.

CONCLUSION

Following the previous research done on the islands of Unije, Veliki Pržnjak, Murter and Mljet, as well as on the coasts of Mali Ston Bay, the association *Pistacio lentisci* – *Juniperetum phoeniceae* Trinajstić 1987 was established at a number of Croatian islands and coastal localities in Central and Southern Dalmatia. There was a total of 56 plant species noted in a Tab. 1, 27 of which were companions mostly belonging to 5 different orders. We found 11 species characteristic of the *Oleo-Ceratonion* alliance and 18 for the order (*Quercetalia ilicis*) and the class (*Quercetalia ilicis*). A total of 7 species showed the greatest percent of presence (appearance in 100% relevés). The average number of species for all phytocenological relevés is 23. A total of 15 new species for this community was noted, while 7 of the previously noted species were found to be absent. While ass. *Pistacio lentisci* – *Juniperetum phoeniceae* in the Southern localities is still in the initial phase of development, not long after a forest fire, the Central Dalmatian results indicates a succession of this vegetation towards the development of the *Quercus ilex* – *Pinetum halepensis* forest community.

ACKNOWLEDGEMENTS

Prof. Ivo Trinajstić is gratefully acknowledged for his valuable comments and suggestions on the manuscript, and Ms. Biserka Simatović for her linguistic assistance.

Received February 16, 2001

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SAŽETAK

Florističke osobine makije somine (ass. *Pistacio lentisci* – *Juniperetum phoeniceae* Trinajstić 1987) u središnjoj i južnoj Dalmaciji (Hrvatska)

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Slijedeći prijašnja fitocenološka istraživanja s otoka Unija, Velikog Pržnjaka, Murtera i Mljeta, te priobalja Malostonskog zaljeva, zajednica makije somine (as. *Pistacio lentisci* – *Juniperetum phoeniceae* Trinajstić 1987) utvrđena je i na 20 otočnih i priobalnih lokaliteta srednje i južne Dalmacije. Taj tip makije karakterizira jednoličnost i razmjerno malen broj biljnih vrsta. Zauzima velike površine, najčešće na padinama južne ekspozicije između pojasa halofitske vegetacije grebenjača i nekog od oblika šumske vegetacije ili vegetacije bušika, a značajan je progresijski stadij u sukcesiji vazdazelene šumske vegetacije, često nakon šumskih požara. Na ukupno 20 istraživanih lokaliteta na kojima raste makija somine utvrđeno je 56 vrsta vaskularne flore, od kojih je 27 pratilica iz pet različitih redova (*Cisto* – *Ericetalia*, *Rosmarinetalia*, *Cymbopogo* – *Brachypodietalia*, *Scorzonero* – *Chrysopogonetalia* i *Quercetalia pubescentis*).

Vrsta karakterističnih za svezu *Oleo-Ceratonion* ima 11, a za za red (*Quercetalia ilicis*), odnosno razred (*Quercetea ilicis*) 18. S najvećim stupnjem stalnosti (u svih 100% snimaka) pojavljuje se ukupno 7 vrsta, dok je prosječni broj vrsta po fitocenološkoj snimci 23. Utvrđeno je ukupno 15 vrsta novih za zajednicu, a nije zabilježeno 7 prije navođenih vrsta. Analizirajući južnodalmatinske i srednjodalmatinske lokalitete odvojeno, zamijećena je razlika u sastavu pripadajućih fitocenoloških snimaka. U snimcima sa srednjodalmatinskih otoka zabilježen je veći broj biljnih vrsta (prosječno 27) nego u snimcima koji potječu iz južne Dalmacije (prosječno 19). Također, na srednjodalmatinskim lokalitetima redovito se pojavljuju hrast česvina (*Quercus ilex*) koji potpuno izostaje na južnojadranskom području, te alepski bor (*Pinus halepensis* – juv.), zabilježen u 50% snimaka s južnojadranskog područja. Takvi rezultati ukazuju na to da je makija somine na južnodalmatinskom području još u početnoj fazi razvitka, nedugo nakon šumskih požara, dok je na srednjodalmatinskim otocima već nastupila sukcesija toga tipa vegetacije u smjeru razvitka nove, vazdazelene šumske zajednice hrasta česvine i alepskoga bora (as. *Quercus ilicis* – *Pinetum halepensis*).