

Hosts and Distribution of Yellow Mistletoe, *Loranthus europaeus* Jacq. in Croatia

Gostitelji in razširjenost navadnega ohmelja, *Loranthus europaeus* Jacq. na Hrvaškem

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Abstract:

Yellow mistletoe, *Loranthus europaeus* Jacq., is a deciduous mistletoe species of the *Loranthaceae* family. To make a list of host species and map the distribution of yellow mistletoe in Croatia, field research was carried out and the herbaria of the Faculty of Forestry and Faculty of Science of the University of Zagreb were examined.

Yellow mistletoe was found on 10 species: *Quercus robur* L., *Q. petraea* (Matt.) Liebl., *Q. cerris* L., *Q. pubescens* Willd., *Q. frainetto* Ten., *Q. rubra* L., *Q. palustris* Muenchh., *Castanea sativa* Mill. and *Carpinus betulus* L. The taxa belonged to the families *Fagaceae* and *Betulaceae*.

L. europaeus was distributed in the continental region of Croatia mostly in natural forests of the autochthonous oak species. On the red oak and pin oak yellow mistletoe occurred in forest cultures and parks. In the north-western part of Croatia it was distributed on the sweet chestnut. It was also found on two localities in natural forests of the common beech, whereas on the common hornbeam it was observed only in the Arboretum Opeka. In the Submediterranean region yellow mistletoe occurred on the downy oak.

1 Introduction

Mistletoes are epiphytic angiosperms living as semi-parasites on trees and shrubs. In Croatia there are three mistletoe species: *Loranthus europaeus* Jacq., *Viscum album* L. and *Arceuthobium oxycedri* (DC.) M. Bieb. Yellow mistletoe, *L. europaeus* is a deciduous, dioecious species of the *Loranthaceae* family. According to KRÜSSMANN (1977) the genus *Loranthus* Jacq. has about 600 species, and according to HEGI (1981) between 450 and 500 species, mostly distributed in tropical region. Most of the species are semi-parasites on dicotyledonous angiosperms, and a smaller number on gymnosperms. *L. europaeus* is the only European species of that genus. As well as other mistletoes, yellow mistletoe is specialized species occurring only on certain hosts. It is a 80 cm high shrub with opposite forky branching,

brown, at the nodes easily breakable twigs. The leaves are 4-6 cm long, opposite, simple, oblong obovate, dark green, with short petioles, entire margin and blunt apex. The flowers are dioecious, entomogamous, light green, male in terminal racemes, female in terminal, loose spikes. It flowers in May and June. The fruit is up to 1 cm big, roundish, yellow, berry-like drupe, which remains sticky even after drying, and is used as bird glue. The fruits ripen in late autumn, and gradually fall off in late winter. The most important vectors of yellow mistletoe are birds. The fruits of this species were noted as food of the mistletoe thrush *Turdus viscivorus* L. and jay, *Garrulus glandarius* L. (CRAMP 1988; CRAMP & PERRINS 1994).

According to HEGI (1981) *L. europaeus* appears on oaks, mostly on downy oak (*Q. pubescens* Willd.), Turkey oak (*Q. cerris* L.), pedunculate oak (*Quercus robur* L.) and sessile oak (*Q. petraea* /Matt./ Liebl.), as well as on the sweet chestnut (*Castanea sativa* Mill.). ANIĆ (1946) stated oaks (without especially naming the species), sweet chestnut and common beech (*Fagus sylvatica* L.) as hosts. Apart from oaks and sweet chestnut KRÜSSMANN (1977) also stated olive tree (*Olea europaea* L.).

In Slovakia yellow-berried mistletoe was observed on: *Q. pubescens*, *Q. cerris*, *Q. petraea*, *Q. robur*, *Q. dalechampii* Ten., *Q. virgiliana* (Ten.) Ten., *Q. rubra* L. and *Betula pendula* Roth. Unconfirmed hosts were: *Acer campestre* L., *Castanea sativa*, *Carpinus betulus* L. and *Crataegus monogyna* Jacq. emend. Lindm. (ELIÁS 1985, 2002).

In Slovenia (KOGELNIK 2002) *L. europaeus* was observed on three autochthonous oaks (*Q. petraea*, *Q. pubescens* and *Q. robur*) and on sweet chestnut.

Research on yellow mistletoe in Croatia was very scarce. One of the pioneer papers was written by ETTINGER (1889), in which he discussed the influence of *L. europaeus* on the lesser increment of pedunculate oak.

The research on the infestation intensity of five deciduous autochthonous oaks with yellow mistletoe in Croatia, for the area managed by Croatian Forest Ltd., Forest Administration Požega was carried out by IDŽOJTIĆ & al. (2005a).

This paper shows the research results of the hosts of yellow mistletoe as well as its distribution in Croatia.

2 Research Methods

To obtain data on yellow mistletoe distribution in Croatia, as well as the list of host species, field research was carried out, and the herbaria of the Faculty of Forestry and Faculty of Science (ZA, ZAHO) of the University of Zagreb were examined.

Apart from the field research in the Submediterranean region of Croatia, during the winters of 2002/03 and 2003/04 the research was carried out in co-operation with Croatian Forests Ltd., who manage 82 % of forests and forest land in Croatia.

Throughout Croatia forest engineers were given forms into which they, for natural stands and forest cultures older than 30 years, in a diagonal survey, put data about infested and non-infested trees, as well as the number of mistletoe shrubs on infested trees. Data about the presence of mistletoe outside the forest were put in another form. The determination of hosts was checked in the field or on the basis of the collected herbarium materials.

For mapping the distribution, MTB grid was used (NIKOLIĆ & al. 1998). The mapping units were fields defined by the degree grid (according to Greenwich): 10' of latitude \times 6' of longitude. In the field research GPS was used. The mapping was carried out by the computer programme ARCVIEW GIS 3.3 (2002). The Croatian borders and MTB grid were uploaded from the web portal: <http://public.srce.hr/botanic/gisbio/gishome.htm>

3 Results

3.1 Hosts

In Croatia yellow mistletoe occurred on 10 species. Most of the hosts were oaks (seven species). Yet another two host species also belong to the *Fagaceae* family, and these were: sweet chestnut and common beech, whereas one species, common hornbeam (*Carpinus betulus*) belongs to the *Betulaceae* family. *L. europaeus* was found on all five autochthonous deciduous oak species in Croatia: pedunculate oak, sessile oak, Turkey oak, downy oak and Hungarian oak (*Q. frainetto* Ten.). Out of the allochthonous oaks two deciduous American species were infected with mistletoe: red oak (*Q. rubra*) and pin oak (*Q. palustris* Muenchh.). Apart from the mentioned species, yellow mistletoe also occurred on the cultivar of the pedunculate oak, *Q. robur* 'Fastigiata'.

3.2 Distribution

L. europaeus was distributed in the continental region of Croatia mostly in natural forests of the pedunculate and sessile oak. On these two oak species yellow mistletoe was found in the area of the following forest administrations (FA) and forest offices (FO): FA Bjelovar (FO: Bjelovar, Garešnica, Sirač, Virovitica, Pakrac, Velika Pisanica, Čazma, Grubišno Polje, Suhopolje, Veliki Grđevac and Vrbovec), FA Karlovac (FO: Draganić, Gvozd, Jastrebarsko, Karlovac, Ozalj, Slunj and Topusko), FA Koprivnica (FO: Ivanec, Križevci, Repaš and Sokolovec), FA Našice (FO: Čeralje, Đurđenovac, Koška, Slatina and Voćin), FA Nova Gradiška (FO: Nova Gradiška, Novska, Okučani, Oriovac, Slavonski Brod and Trnjan), FA Osijek (FO: Batina, Darda, Đakovo, Tikveš and Levanjska Varoš), FA Požega (FO: Čaglin, Kamenska, Kutjevo, Pleternica, Požega and Velika), FA Sisak (FO: Dvor, Lekenik, Petrinja, Rujevac and Sunja) and FA Zagreb (FO: Dugo Selo, Kutina, Novoselec, Popovača, Remetinec, Samobor, Velika Gorica, Zagreb and Zlatar). In the area of the FA Vinkovci yellow mistletoe occurred on the pedunculate oak (the sessile oak is not present in that part of Croatia). In the Lika and Gorski Kotar region (FA Gospić, Ogulin and Delnice), where the sessile oak is distributed, no yellow mistletoe was found.

In natural forests of the continental region *L. europaeus* also occurred on other autochthonous oak species (*Q. cerris*, *Q. frainetto* and *Q. pubescens*). On the Turkey oak it was observed in the FA Osijek, Požega and Vinkovci, whereas on the Hungarian and downy oak it was found in the area of the FA Požega.

On the red oak *L. europaeus* occurred in forest cultures (FA Karlovac, Osijek and Zagreb) and parks, whereas on the pin oak it occurred only in parks. On the sweet chestnut it was distributed in natural forests in the north-western part of Croatia, on the common beech it was found on two localities in natural forests, whereas on the common hornbeam it was observed in the Arboretum Opeka and in the natural forests in eastern Slavonia, FA Osijek. In the Submediterranean region (Istria, National Park Paklenica, Vrpolje-Dugopolje, Trilj), yellow mistletoe occurred on the downy oak.

Figure 1 presents the distribution of yellow-berried mistletoe in Croatia on all the previously mentioned hosts together. The continuous distribution was present in natural forests of autochthonous deciduous oaks in the northern, continental region of Croatia, as well as in the inland region of Istria, where it occurred on the downy oak. Yellow mistletoe was not observed in the Mediterranean region. It was also not present in the large mountain massifs of Kapela, Velebit and Dinara, which separate the continental from the Mediterranean and Submediterranean regions.

4 Discussion and Conclusion

If there are a large number of mistletoe shrubs on a tree, they exhaust the host. However, generally speaking, this mistletoe species does not present a considerable economic problem in Croatia, unlike the subspecies of the white mistletoe *V. album* L. ssp. *abietis* (Wiesb.) Abrom., which is (according to IDŽOJTIĆ & al. 2003, 2005b) a considerable parasite on the silver fir (*Abies alba* Mill.). This is confirmed by research of the infestation intensity of autochthonous oaks in the area of the FA Požega (IDŽOJTIĆ & al. 2005a). In that part of Croatia all five autochthonous deciduous oak species are native. The host with the largest mistletoe infestation was the Hungarian oak (22.7 % of the investigated trees had mistletoe on it, and all the investigated subcompartments were infested). Then the pedunculate and sessile oak followed with an infestation of 13.7 % and 13.3 %, respectively, of the investigated trees. These species also showed a high percentage of infested subcompartments (96 % for the pedunculate oak and 91.5 % for the sessile oak). Out of the investigated downy oak trees 12.5 % had mistletoe, and the Turkey oak was the least infested species, with 3.1 % of trees with mistletoe. The average number of mistletoe shrubs on the infested trees was from 1 for the Turkey oak to up to 2.5 shrubs for the sessile oak, and the largest number of observed shrubs on one tree was 38 (on a sessile oak). In the same research a positive co-relation was established between the host age and the yellow mistletoe infestation, and a negative co-relation between the mean elevation and mistletoe infestation of the sessile oak.

The hosts of *L. europaeus* in Croatia have already been recorded in other European countries. The deciduous autochthonous oaks were the most common hosts of this mistletoe species. The research showed that it was very widespread in Croatia. Apart from following

the distribution range of its host, its distribution depends on the movement of birds as the main vectors, as well as local ecological conditions.

Quercus petraea, *Q. rubra* and *Carpinus betulus* were species which were hosts to both, the yellow mistletoe and the white mistletoe. On the red oak and common hornbeam the infestation with both mistletoe species on the same tree has been observed.

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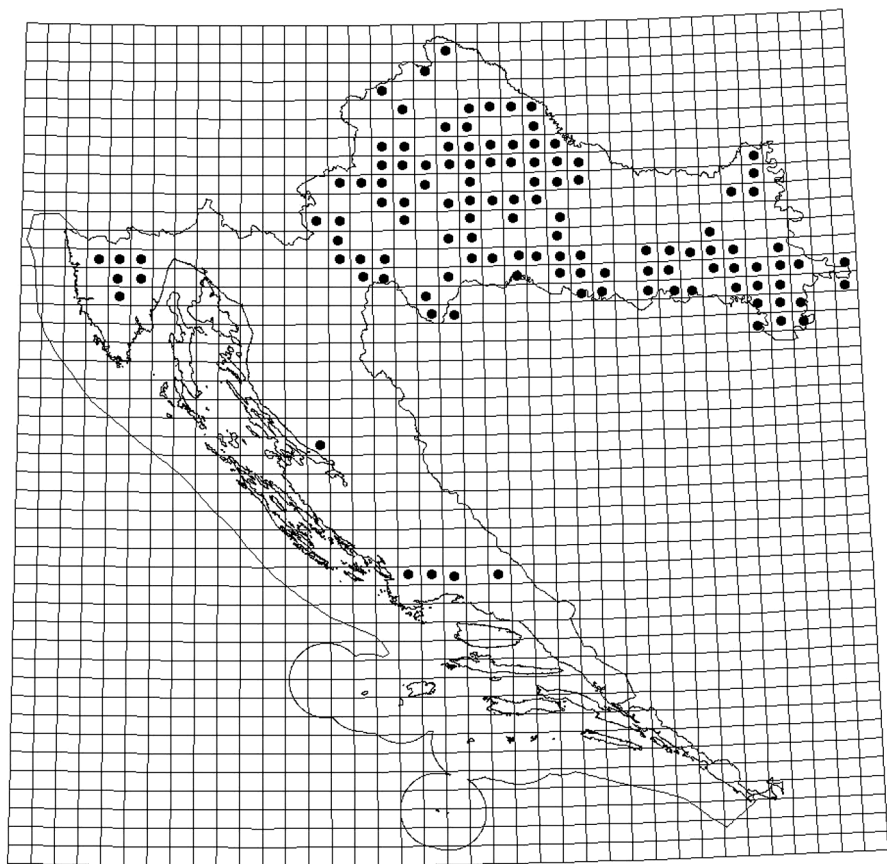


Fig. 1. Distribution of *Loranthus europaeus* in Croatia.