

Assessment of health and vitality of a narrowly distributed habitat in a Mediterranean island,

the case of the endemic *Cedrus brevifolia* forests in Cyprus.

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The habitat type "9590* *Cedrus brevifolia* forests (*Cedrosetum brevifolia*)"

The habitat type "9590* *Cedrus brevifolia* forests (*Cedrosetum brevifolia*)" is an endemic habitat type of Cyprus. The habitat 9590* is included in the Annex I of the Directive 92/43/EEC, where it is characterised as a priority habitat type, which means that sustainable management practices need to be implemented in order to improve its conservation status. The habitat 9590* occupies an area of 290 ha in Pafos forest, which constitutes less than 0.2% of the high forest vegetation in Cyprus. The habitat is distributed in an altitudinal range of 900 m to 1362 m, where the main patch occupies the peak area of Tripylos mountain, while scattered small stands also occur at the surrounding peaks (five additional peaks). The habitat's exclusive and narrow distribution makes it inherently susceptible to many factors threatening its very existence.

➤ This study aimed to clarify how critical biotic factors can constitute a threat to the habitat, and thus specify the nature and the magnitude of their impacts and how these features may vary in space. The biotic factors altering the survival and the reproductive success of trees are key drivers of the ecological and dynamic processes. The present study focused on harmful forest insects such as seed feeders (*Megastigmus schimitscheki*) and bark beetles (*Orthotomicus erosus*).

Seed feeders & Bark beetles

Insect pre-dispersal seed feeders

Conifer seeds are targeted by the highly-specialized wasps of the *Megastigmus* genus (Hymenoptera: Torymidae), which are known to threaten declining and endangered populations of their hosts. Such events have a direct influence on the reproductive success of trees and subsequent regeneration and colonization potentials in natural stands. They can have both demographic and genetic impacts on tree populations by directly eradicating individuals (i.e. embryos within seeds). Insects are considered the most important seed predators during the pre-dispersal phase, while rodents lead to great levels of seed predation during the post-dispersal phase (Turgeon et al. 1994). Hence, both will be taken into account in evaluating the biotic risks of seed loss in *C. brevifolia*. The cedar seed wasp *M. schimitscheki* is native to Turkey, Lebanon and Syria where it feeds on *C. libani*, and to Cyprus where it feeds on *C. brevifolia* (Fig. 1) (Auger-Rozenberg et al. 2012).

Secondary parasites: bark beetles

Bark beetles are generally considered as secondary parasites that target stressed and weakened trees facing climate and water stresses. Most of them reproduce and spend most of their life cycle in the subcortical region of their host trees, feeding on phloem, which results in the death of the tree or some tree parts. Recently, one pine- and cedar-killer bark beetle species, *O. erosus*, has been identified in the native area of the habitat 9590*. There is now a crucial need to estimate its distribution in both in mixed (with *P. brutia*) and pure cedar stands (Fig. 1).

Figure 1. Shape of adult Cyprus cedar tree and examples of the negative impact of *M. schimitscheki* and bark beetles on the trees' ability.



Sampling

To conduct this survey, the vegetation of the habitat type 9590* was divided into four different types according to the composition of the stands (A, B, C and D types), where three sampling plots of 0.1 ha each were established for each type. In the survey of seed feeders, five cedar cones were collected randomly from each plot and extracted seeds were analysed by X-ray radiography. In addition, for monitoring bark beetles, two slit traps with specific dispensers (alcohol- and pheromone-baited) were installed in each sampling plot and were monitored every two weeks during the period of April – November 2017.

Results

Seed predation rates showed variation between the four stand types, from 0% to 18.6%, which is relatively lower than other observations for the same species in other countries (Fig. 2). In addition, the survey of bark beetles showed that the Coleoptera *O. erosus*, *Hylurgus ligniperda* and *Aulonium* sp. (probably *A. ruficorne*, a predator of *O. erosus*) were the most abundant insect species. These three species completed two generations between June – November 2017 (Fig. 3). The abundance of *O. erosus* was found higher than that of *Hylurgus ligniperda* in all types of vegetation during all the surveyed period. *O. erosus* infested both dominant tree species (cedar and pine) while *H. ligniperda* infested only the *P. brutia*.

Figure 2. Seed damages on *Cedrus brevifolia* by the seed wasp *M. schimitscheki* (Hymenoptera: Torymidae)

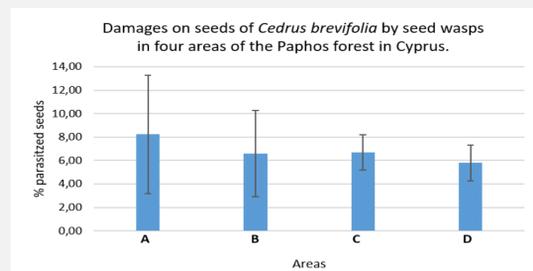
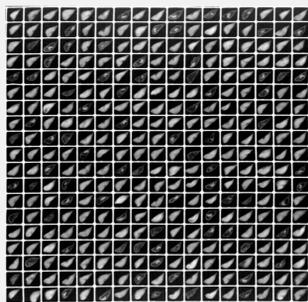
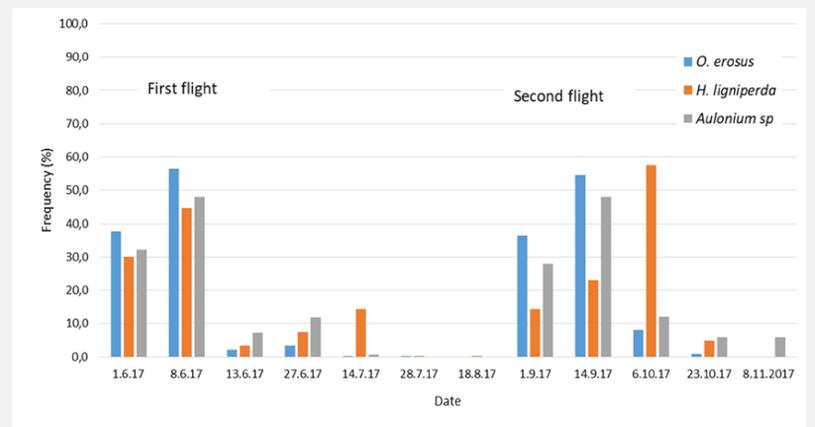


Figure 3. Weekly frequencies of main Coleoptera species trapped in alcohol- and pheromone-baited traps in the Paphos forest in Cyprus



Conclusion

The sustainable management of the narrow endemic habitats in Mediterranean islands is critical nowadays. These habitats are nowadays under the pressure of abiotic and biotic factors due to the climate change, which affects the species richness of such isolated natural communities (island biogeography). Such habitats' resilience also declines due to biotic constraints, with two of them being the reproductive success of trees at seeds pre-dispersal and the attack from secondary parasites bark beetles. Thus a vital need is to strengthen the habitats' health through monitoring and managing the populations of seed feeders and bark beetles by preventive measures, such as mass trapping. It is also important for the control of the biotic threats to be implemented through sound management measures which have positive effects on the habitat's biodiversity and its resilience in general. Thus, the preventive measures, such as mass trapping with aggregation pheromones/ kairomones, are recommended for the secondary pests of *O. erosus* and *H. ligniperda*. On the other hand, management of other potential insect pests such as defoliator Lepidoptera could be implemented by the installation of 20 bat boxes around the habitat's distribution. Inhabitation of bat boxes by bats could contribute to insect regulation, since a single bat usually eats 6,000 to 8,000 insects each night.

Reference

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