

THE THREAT TO FOREST PLANTATIONS BY THE LARGE PINE WEEVIL – THE NEXT STEP TOWARDS INTEGRATED PROTECTION OF PINE REFORESTATIONS

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Title: Uwarunkowania zagrożeń upraw sosnowych przez szeliniaka sosnowca – *Hylobius abietis* (L.) oraz perspektywy rozwoju niechemicznych metod ograniczania szkód [Conditions affecting threat to pine cultures by the large pine weevil *Hylobius abietis* (L.) and prospects for development of non-chemical damage control methods]

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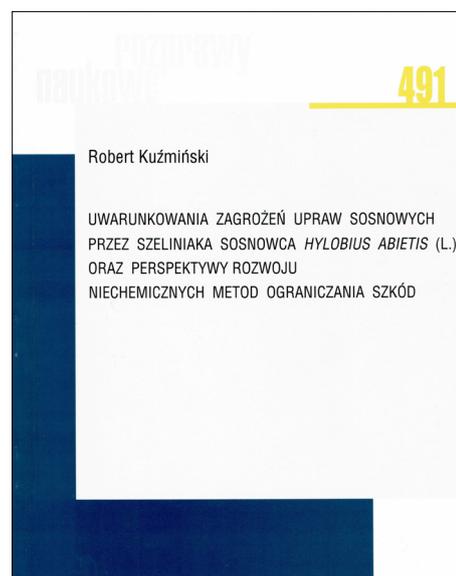
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The large pine weevil is a species investigated in numerous studies conducted for decades practically throughout Europe, particularly in Scandinavia, Great Britain, Ireland, France, Lithuania and Poland. Each year at least 10–20 scientific papers are published on the subject. Thus it may seem that we know almost everything about this pest. Nothing can be further from the truth. The extensive bibliography concerning

the large pine weevil was supplemented in 2017 with another study written by Robert Kuźmiński, a researcher from the Poznań University of Life Sciences. This publication contributes new findings concerning the assessment of threat to pine cultures posed by that pest species. It is a monograph describing a series of field studies conducted by the author in the years 2006–2015 in several forest units of the Regional

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Directorates of the State Forests in Piła, Poznań and Szczecin. It also presents laboratory experiments aiming at the development of non-chemical methods reducing the populations of the large pine weevil in forest cultures.

The principal body of the study (apart from the List of contents and the bibliography) is divided into 8 main chapters, with three of them additionally divided into subchapters. The list of cited literature given at the end includes an exceptionally extensive bibliography comprising 328 publications, in itself being a kind of a database of bibliographical data for those who are starting their investigations into the large pine weevil.

The Introduction chapter is a synthetic characteristic of the large pine weevil, comprising elements of biology and ecology of the species and presenting problems related to its adverse impact and protection methods for forest cultures. Moreover, the author presented the justification and need to undertake such research. The next chapter “Incidence and control of weevils in Poland” analyses the distribution of the species in Poland after WWII, particularly in the period of 1970–2015, as well as the threat to forest cultures by the large pine weevil in individual regional directorates of the State Forests.

Chapter 3, composed of five subchapters, presents a review of control methods protecting cultures against the large pine weevil and it is a critical evaluation of methods applied to protect regenerations given in the historical perspective. Particularly interesting information is provided in the subchapter concerning physical and mechanical methods, in which the author discusses in detail the use of various traps starting from the 18th century, focusing on the examples from Poland. Most of this subchapter presents an analysis of methods applied from the late 1800’s to the 1930’s, supplemented with numerous historical publications cited in the text – which were definitely difficult to find. For this reason this subchapter is a highly valuable compendium of knowledge based on extensive historical material, probably the first study published in Poland. The subchapter on “Chemical methods” describes an almost 100-year history of the use of pesticides comprising various chemicals.

In the next chapter the author presented the aim and scope of two research directions, of which one

concerned e.g. several factors influencing threat to forest cultures posed by the large pine weevil, such as the location of stumps in in cultures, soil preparation methods and fertilisation of felling areas, as well as spatial analysis of beetle damage distribution in cultures. The other direction of research comprised attempts to apply non-chemical methods to reduce beetle damage in pine cultures.

The chapter describing research methodology, divided into several subchapters, comprises concisely described procedures of field studies and laboratory analyses. The largest part of this publication comprises the chapter describing results, again divided into subchapters following the same format as the chapter on methodology. Thanks to the consistent template of both these chapters the entire publication is clear, logical and reader-friendly, making it easy to find results of individual experiments. The author conducted an in-depth analysis of the data concerning stump colonisation by large pine weevils as well as damage caused by these beetles, determining e.g.:

- dependencies between the number of weevils and stump diameter as well as their distribution in felling areas
- the effect of the stand surrounding cultures (mature stand, sapling stand) on colonisation intensity by the large pine weevil in stumps located at the edge of cultures
- spatial distribution of beetle damaged seedlings in the culture
- the effect of soil preparation and fertilisation methods as well as management of felling residue on damage levels in cultures.

Analyses of spatial distribution of seedling damage performed using the ArcGIS software and cluster analysis, presented in this chapter, represent the pioneering approach of the author to this problem. The results are given in a comprehensive manner thanks to their presentation in tables, graphs and other graphical forms, additionally illustrated by photographs.

In the chapter concerning improvement of non-chemical methods to control damage caused by the large pine weevil the author presented results of experiments supplemented with extensive statistical analysis, in which he investigated:

- the effect of mycelium aroma of *Phlebiopsis gigantea*, *Hypholoma fasciculare*, *Heterobasidion*

annosum and *Armillaria ostoyae* growing on stump wood on response by large pine weevil beetles

- biological activity of insecticidal fungi *Beauveria bassiana* and *B. caldonica*, used to infect beetles
- repellent and anti-feeding action of oil preparations obtained from hemp *Cannabis sativa* in relation to large pine weevil beetles.

The next chapter is an exceptionally rich discussion of results. In the first part the author commented on his results concerning the threat to pine cultures posed by the large pine weevil, while the next part provides experimental results concerning the application of various non-chemical methods to reduce damage caused by that species. Moreover, the author conducted a critical analysis of the results citing several publications, both older ones from the 1950's and the most recent published within this decade. The publication is summed up by the recapitulation of the results and conclusions.

This publication is an interesting study concerning conditions affecting threat for forest cultures caused by the large pine weevil. The multifaceted approach to the problem of forest protection against the insect pests needs to be stressed here, as it is in line with the contemporary directions of research. An important part of the study is connected with the diverse aspects of the analyses of stump colonisation rates by the large pine weevil and spatial distribution of damage caused by this pest species. Presented results significantly broaden our knowledge on the role of stumps as the breeding grounds of this pest in terms of forest protection.

The publication is of considerable value, as it contributes greatly to current knowledge in forest entomology and contains much information essential for forest protection practice. In view of the above, the monograph is addressed both to researchers and State Forests employees.