Forestry Department

Food and Agriculture Organization of the United Nations

Forest Health & Biosecurity Working Papers

OVERVIEW OF FOREST PESTS

ROMANIA

January 2007

Forest Resources Development Service
Forest Management Division
Forestry Department

Working Paper FBS/28E
FAO, Rome, Italy

DISCLAIMER

The aim of this document is to give an overview of the forest pest[1] situation in Romania. It is not intended to be a comprehensive review.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

[1] Pest: Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products (FAO, 2004).

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Background

This paper is one of a series of FAO documents on forest-related health and biosecurity issues. The purpose of these papers is to provide early information on on-going activities and programmes, and to stimulate discussion.

In an attempt to quantify the impacts of the many factors that affect the health and vitality of a forest, the Global Forest Resources Assessment 2005 (FRA 2005) asked countries to report on the area of forest affected by disturbances, including forest fires, insects, diseases and other disturbances such as weather-related damage. However, most countries were not able to provide reliable information because they do not systematically monitor these variables.

In order to obtain a more complete picture of forest health, FAO continues to work on several follow-up studies. A review of forest pests in both naturally regenerating forests and planted forests was carried out in 25 countries representing all regions of the world. This *Overview of forest pests* represents one paper resulting from this review. Countries in this present series include Argentina, Belize, Brazil, Chile, China, Cyprus, Colombia, Ghana, Honduras, India, Indonesia, Kenya, Kyrgyz Republic, Malawi, Mauritius, Mexico, Moldova, Mongolia, Morocco, South Africa, Sudan, Thailand, Romania, Russian Federation, Uruguay; this list will be continuously updated.

Comments and feedback are welcome. For further information or if you are interested in participating in this process and providing information on insect pests, diseases and mammals affecting forests and the forest sector in your country, please contact:

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All contributions will be fully acknowledged.

Acknowledgements

Information on factors affecting the health of Romania's forests reported in this paper was obtained via discussions with entomologists of the National Research Institute (ICAS) in Bucharest during June 2004. Information was compiled by W. Ciesla and B. Moore.

ROMANIA

Introduction

Romania is the second largest country in Eastern Europe and is located on the western shore of the Black Sea. It has a total land area of 22.987 million ha, of which approximately 6.4 million ha or 28 percent is forested (FAO, 2006). Other wooded lands cover 258 000 ha (FAO, 2006). The country has about 149 000 ha of planted forests, established primarily with indigenous tree species (FAO, 2006).

The overall health of Romania's forests is considered good however, a number of damaging agents do occur. From 1986 to 2000, an average of 1 900 000 ha/year or 30.6 percent of the country's total forest area suffered some level of damage by insects, disease and other factors. Biotic agents (insects, pathogens) accounted for 84.9 percent of the damage and abiotic factors (wind, snow, hail, etc.) accounted for 15.1 percent of the total damage. Insects accounted for 92.2 percent of the area damaged by biotic agents, with defoliators of broadleaf forests being the most important and widespread pests. Area of forest defoliation during the period averaged 960 000 ha/year (Simionesen *et al.*, 2001).

Episodes of heavy snow and wind in conifer forests in the Carpathian Mountains can cause widespread damage to trees and set the stage for bark beetle outbreaks. For example, during November 1995, windthrow occurred over a large area of the eastern Carpathian Mountains. The damaged material was subsequently attacked by a variety of bark beetle species. Another episode of wind damage occurred in 2002 (Mihalciuc *et al*., 2003). Frost, hail and heavy rains can damage beech and make them susceptible to secondary attacks by the bark fungus *Nectria ditissima.*

Air pollution from industrial sources is known to cause damage in Romania's forests but the impact of gaseous pollutants, such as sulphur dioxide and ozone, is not well understood.

As is the case with naturally regenerating forests, planted forests are also susceptible to damage by heavy snows and winds and exposure to air pollution.

Forest pests and diseases

Naturally regenerating forests

Insects

Indigenous insects

***Apethymus filiformis* (Klug, 1818)**

Other scientific names: *Emphytus abdominalis* Lepeltier, 1823
Hymenoptera: Tenthredinidae
Common names:
Host type: broadleaf
Hosts: *Quercus petraea*

Curculio spp.

Other scientific names:
Coleoptera: Curculionidae
Common names: weevil
Host type: broadleaf
Hosts: Fagaceae

Acorn pests, including weevils (*Curculio* spp.) and acorn worms (*Cydia* spp.) can cause up to 80 percent acorn loss and have serious effects on the success of forest regeneration in Romania.
http://www.forestryimages.org/browse/subimages.cfm?sub=440

Cydia spp.

Other scientific names:
Lepidoptera: Tortricidae
Common names: acorn worm
Host type: broadleaf
Hosts: Fagaceae

Acorn pests, including weevils (*Curculio* spp.) and acorn worms (*Cydia* spp.) can cause up to 80 percent acorn loss and have serious effects on the success of forest regeneration in Romania.

Erannis defoliaria (Clerck, 1759)

Other scientific names: *Hybernia defoliaria* (Clerck)
Lepidoptera: Geometridae
Common names: mottled umber moth
Host type: broadleaf
Hosts: *Quercus* spp.

Erannis defoliaria can cause severe defoliation of trees and successive defoliations over several years can cause growth loss, branch dieback and eventual tree mortality. This insect occurs throughout Europe, from the British Isles, north to Norway, Sweden and Finland, east to Russia and the Republic of Georgia. It was introduced into North America on the Pacific side many years ago.

E. defoliaria has one generation a year. Adults are active in autumn (October). After mating, females, which are wingless, crawl up the host trees and deposit eggs, either singly or in small groups in bark crevasses, under moss or in other sheltered places. Individual females can lay 300-400 eggs. Eggs are the overwintering stage. The larvae hatch in the spring and feed openly on the buds and foliage of host trees. Later they bind leaves together with silken webbing. When the larvae are not actively feeding, they remain inside this shelter. Pupation occurs in the soil.

Since adult females are wingless and incapable of flight, the major agent of dispersal is ballooning of early instar larvae by air currents. This insect could also be spread over long distances by egg masses hidden in logs destined for export.
http://www.invasive.org/browse/subject.cfm?sub=9719

http://www.spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=160&langdisplay=english

***Euproctis chrysorrhoea* Linnaeus, 1758**

Other scientific names: *Arctornis chrysorrhoea* Linnaeus, 1758; *Bombyx phaeorrhoeus* Donovan, 1801; *Euproctis auriflua* Esper; *Euproctis chrysorrha*, *Euproctis chrysorrhoea xanthorrhoea* Oberthür, 1916; *Euproctis phaeorrhoea* Donovan, 1801; *Euproctis xanthorrhoea* Oberthür, 1916; *Liparis chrysorrhoea* Linnaeus, 1758; *Nygmia phaeorrhoea* Donovan, 1801; *Phalaena chrysorrhoea* Linnaeus, 1758
Lepidoptera: Lymantriidae
Common names: browntail moth; brown-tail moth; brown-tailed moth
Host type: broadleaf
Hosts: *Quercus* spp.

The brown tailed moth, *Euproctis chrysorrhoea*, defoliates broadleaf forests in northwestern Romania. Outbreaks occur at about 20 year intervals and last for about three years. This insect has not been a pest in recent years.
http://www.na.fs.fed.us/spfo/pubs/pest_al/browntail/browntail_moth.htm
http://www.invasive.org/browse/subject.cfm?sub=144
http://www.cabicompendium.org/NamesLists/CPC/Full/EUPRCH.htm

***Hylobius abietis* (Linnaeus, 1758)**

Other scientific names: *Hylobitelus abietis* (Linnaeus, 1758); *Curculio abietis* Linnaeus, 1758; *Curculio pini* Marsham, 1802
Coleoptera: Curculionidae
Common names: large pine weevil; large brown trunk beetle; large brown pine weevil; fir tree weevil
Host type: conifer
Hosts: *Pinus* spp.; *Pinus pinaster*; *Pinus sylvestris*; *Picea* spp.; *Pseudotsuga menziesii*

The adult stage of the weevil, *Hylobius abietis*, feeds on the tender bark of conifer seedlings and is a pest of natural regeneration. Adults feed on pines, *Pinus* spp., especially maritime pine, *Pinus pinaster* and Scotch pine, *Pinus sylvestris*, spruce, *Picea* spp., and Douglas-fir, *Pseudotsuga menzeisii*. Other conifers and, occasionally, deciduous trees are also fed upon by adult weevils. Root systems of recently dead conifers and fresh cut conifer stumps, especially pines, are used as breeding sites.
http://www.forestry.gov.uk/fr/INFD-62WKG9
http://www.invasive.org/browse/subject.cfm?sub=4119
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=85&langdisplay=english
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=150
http://www.cabicompendium.org/NamesLists/FC/Full/HYLOAB.htm

***Ips acuminatus* (Gyllenhal)**

Other scientific names: *Bostrichus accuminatus* Gyllenhal; *Bostrichus germinatus* Zetterstedt; *Bostrichus iconographus* Kugelann; *Bostrichus porographus* Eschholz; *Bostrichus quadridentatus* Sturm; *Ips accuminatus* var. *heydeni* Eichoff

Coleoptera: Scolytidae
Common names: eight-toothed spruce bark beetle; engraver beetle
Host type: conifer
Hosts: *Pinus* spp.; *P. sylvestris*; *P. nigra*; *P. cembra*; *P. mugo*; *Abies normanndiana*; *Larix decidua*; *Picea obovata*; *Picea orientalis*

Ips acuminatus prefers to infest branches, twigs and main stems of small trees with thin bark. Pines are the predominant hosts of this insect across its natural range. In Europe and the Near East, Scotch pine (*Pinus sylvestris*), Austrian pine (*Pinus nigra*), Swiss stone pine (*Pinus cembra*) and mugo pine (*Pinus mugo*) are reported hosts. Other conifer hosts in Europe and Asia include *Abies normanndiana*, *Larix decidua*, *Picea obovata* and *Picea orientalis*.

I. acuminatus is generally regarded as a secondary insect that attacks weakened or windthrown trees. When populations build up in weakened or downed material, they can attack relatively healthy trees. In some instances, *Ips accuminatus* can kill large numbers of trees and cause a significant loss of commercial pine volume. Mortality of the upper crown of large trees is a fairly common occurrence.

This beetle produces 1-2 generations per year with adult flight periods in the northern parts of its range or at high altitudes from May to June and from April to August in the southern parts of its range or at low altitudes. Males initiate attacks; they construct nuptial chambers under the bark and are subsequently joined by 5-7 females. After mating, each female constructs a longitudinal egg gallery and deposits eggs in individual niches along each side of the gallery. The young larvae feed in galleries perpendicular to the egg galleries. Larval galleries increase in width as the larvae increase in size. Pupation takes place in round chambers constructed at the ends of the larval galleries
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=78&langdisplay=english
http://www.invasive.org/browse/subject.cfm?sub=4138
http://www.forestpests.org/poland/eighttoothed.html
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=164

***Ips amitinus* (Eichhoff, 1872)**

Other scientific names: *Tomicus amitinus* Eichhoff, 1872; *Ips montanus* Fuchs, 1913
Coleoptera: Scolytidae
Common names: small spruce bark beetle; eight-toothed spruce bark beetle
Host type: conifer
Hosts: *Picea* spp.; *Picea abies*; *Pinus* spp.; *Pinus sylvestris*, *Pinus cembra*; *Pinus mugo*; *Abies alba*; *Larix decidua*

Ips amitinus often breeds in the upper part of weakened trees or trees infested and killed by *Ips typographus*. Galleries are formed by the beetles beneath the bark and there are typically three to seven females in a gallery.

In northern parts of Europe, *Picea abies* and *Pinus sylvestris* are the main hosts while in the central mountain region, other species of *Pinus*, such as *P. cembra* and *P. mugo* are also important hosts. Galleries have also been documented on *Abies alba* and *Larix decidua*.
http://www.eppo.org/QUARANTINE/insects/Ips_amitinus/IPSXAM_ds.pdf

http://www.cabicompendium.org/NamesLists/FC/Full/IPSXAM.htm
http://www.forestpests.org/poland/eighttoothedspr.html
http://www.insectimages.org/browse/subimages.cfm?SUB=4139
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=158

***Ips sexdentatus* (Börner, 1776)**

Other scientific names: *Dermestes sexdentatus* Börner; *Bostrichus pinastri* Bechstein; *Tomicus stenographus* Duftschmidt; *Ips typographus* De Geer
Coleoptera: Scolytidae
Common names: six-toothed bark beetle; twelve-spined ips; pine stenographer beetle; six-spined engraver beetle
Host type: conifer
Hosts: *Pinus* spp.; *P. sylvestris*; *P. nigra*; *P. pinaster*; *P. brutia*; *P. heldrichii*; *Abies alba*; *Abies normanndiana*; *Larix decidua*; *Larix sibirica*; *Picea abies*; *Picea orientalis*; *Pseudotsuga menzeisii*

Ips sexdentatus is considered a secondary pest and attacks trees already suffering stress, either environmental or from other pests. It can kill trees of commercial importance however. Pines are the predominant hosts of this insect across its natural range. In Europe and the Near East, Scotch pine (*Pinus sylvestris*), Austrian pine (*Pinus nigra*), maritime pine (*Pinus pinaster*), Calabrian pine (*Pinus brutia*) and (*Pinus heldrichii*) are reported hosts. Other conifer hosts in Europe and Asia include *Abies alba, Abies normanndiana*, *Larix decidua, Larix sibirica, Picea abies, Picea orientalis* and *Pseudotsuga menzeisii.* *Ips* attacks also introduce blue stain fungi, *Ophiostoma* spp., into host trees, which hasten the death of trees, discolour the wood and can result in loss of lumber grade and value.

Ips sexdentatus prefers to attack large trees with thick bark. This insect typically has two generations per year with adult flight periods from April to May and July to August. In Mediterranean regions of Europe, *I. sexdentatus* can undergo a third generation. Attacks are initiated by the males, who construct nuptial chambers under the bark and are subsequently joined by 2-5 females. After mating, each female constructs a longitudinal egg gallery and deposits eggs in individual niches along each side of the gallery. The young larvae feed in galleries perpendicular to the egg galleries. Larval galleries increase as the larvae increase in body size. Pupation takes place in round chambers constructed at the ends of the larval galleries. Adults require maturation feeding before reaching sexual maturity.

Adult beetles are capable of flying up to 4 km in search of suitable host material and they are also subject to wind dispersal. Transport of unprocessed logs, wood products or wooden packing materials, dunnage or pallets containing bark strips can provide a means of introduction of immature stages and adults.
http://www.eppo.org/QUARANTINE/insects/Ips_sexdentatus/IPSXSE_ds.pdf
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=79&langdisplay=english
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=162
http://www.cabicompendium.org/NamesLists/FC/Full/IPSXSE.htm
http://www.barkbeetles.org/browse/subject.cfm?SUB=887
http://www.forestpests.org/poland/sixtoothedbark.html
http://www.forestpests.org/hungary/weevilsis.html

http://www.barkbeetles.org/exotic/ipsxdnts.html

***Ips typographus* (Linnaeus, 1758)**

Other scientific names: *Dermestes typographus* Linnaeus, 1758; *Bostrichus octodentatus* Paykull, 1800; *Ips japonicus* Niisima, 1909; *Tomicus typographus* (Linnaeus, 1758)
Coleoptera: Scolytidae
Common names: spruce beetle; European spruce bark beetle; spruce engraver beetle; eight-toothed spruce bark beetle
Host type: conifer
Hosts: *Picea* spp.; *P. abies*; *P. orientalis*; *P. yezoensis*; *Pinus* spp.; *Abies* spp.

Ips typographus, considered Europe's most destructive bark beetle, attacks and kills trees every year in Romania. These bark beetles attack trees enmass and overwhelm the defense mechanisms of the trees. They attack both stressed and healthy trees. The males initiate an attack on trees and create a chamber to which they attract several females with pheromones. The females lay eggs in tunnels which they create under the bark. They introduce fungus into the trees on which the larvae feed. There are 1 to 2 life cycles per year depending on climatic conditions and the nutritional condition of the tree.

In Europe, *Picea abies* is the main host but other species of *Picea* (e.g. *P. orientalis*, *P. yezoensis*) serve as hosts in Asia. *I. typographus* will also occasionally breed in species of *Pinus* or *Abies*.
http://www.fao.org/forestry/site/20528/en/rom
http://www.eppo.org/QUARANTINE/insects/Ips_typographus/IPSXTY_ds.pdf
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=58&langdisplay=english
http://www.inspection.gc.ca/english/plaveg/pestrava/ipstyp/ipstype.shtml
http://ceris.purdue.edu/napis/pests/sbb/pstalert/pacanad1.html
http://www.invasive.org/browse/subject.cfm?sub=888
http://www.forestpests.org/poland/europeanspruce.html
http://www.forestpests.org/hungary/weevilsit.html
http://www.bugwood.org/barkbeetles/exotic/htypgrph.html
http://www.wcrl.ars.usda.gov/cec/insects/ipst.htm
http://www.forestry.gov.uk/forestry/HCOU-4U4J4K
http://www.cabicompendium.org/NamesLists/FC/Full/IPSXTY.htm
http://warehouse.pfc.forestry.ca/pfc/5319.pdf

***Lymantria dispar* Linnaeus, 1758**

Other scientific names: *Bombyx dispar*; *Hypogymna dispar*; *Liparis dispar*; *Ocneria dispar*; *Phalaena dispar*; *Porthesia dispar*; *Porthetria dispar*; *Porthetria hadina* Butler; 1881; *Porthetria umbrosa* Butler, 1881
Lepidoptera: Lymantriidae
Common names: gypsy moth; Asian gypsy moth
Host type: broadleaf and conifer
Hosts: *Betula* spp.; *Larix* spp.; *Pinus* spp.; *Populus* spp.; *Quercus* spp.; *Salix* spp.; *Ulnus* spp.; fruit trees

The most important defoliating insect of Romania's broadleaf forests is the European form of the gypsy moth, *Lymantria dispar*. This insect is a pest of mixed oak forests and other broadleaf species. Gypsy moth is most common in low elevation forests in the plains of southern and eastern Romania. It is an important defoliator of naturally regenerating forests in Romania and is also capable of causing severe damage to hybrid poplar plantations.

Gypsy moth populations can occur at low levels for many years without causing significant damage. However at times there are significant outbreaks that cause severe defoliation of trees, which at times causes death. Frequently outbreaks coincide with periods when the trees are under stress. Outbreaks generally occur in stands where primary hosts (*Quercus* spp. and *Populus* spp.) comprise 20 percent of the basal area. They typically last for about three years and collapse when host trees are weakened to the point that they produce little or no foliage for the next generation of larvae in the following spring. High levels of parasitism can also cause outbreaks to collapse. Outbreaks are cyclic and linked to periods of warm, dry weather. A major outbreak, encompassing between 300 000 to 400 000 ha occurred between 1986 and 1988. During 2004, 40 000 ha were infested.

Pathways of entry of gypsy moth include vehicles, camping equipment, nursery stock, ships, and equipment that has been exposed for a period to the outdoors. Adults of Asian strains are capable of flight and thus have strong dispersal ability whereas females of European strains are not capable of flight. Young larvae can move some distance by ballooning from the tops of trees.
http://www.fao.org/forestry/site/20528/en/rom
http://www.fao.org/forestry/site/20528/en/rom
http://www.forestpests.org/subject.html?SUB=165
http://www.issg.org/database/species/ecology.asp?si=96&fr=1&sts=sss
http://www.inspection.gc.ca/english/sci/surv/data/lymdise.shtml
http://www.forestry.ubc.ca/fetch21/FRST308/lab5/lymantria_dispar/gypsy.html
http://www.padil.gov.au/viewPest.aspx?id=342
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=342
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=11&langdisplay=english
http://www.aphis.usda.gov/lpa/pubs/fsheet_faq_notice/fs_phasiangm.html

Lymantria monacha (Linnaeus, 1758) *ss*

Other scientific names: *Psilura monacha* Linnaeus; *Liparis monacha* Linnaeus; *Ocneria monacha* Linnaeus; *Phalaena monacha* Linnaeus; *Porthetria monacha* Linnaeus; *Bombyx monacha* Linnaeus, 1758; *Noctua heteroclita* Müller, 1764; *Bombyx eremita* Hübner, 1808; *Bombyx nigra* Freyer, 1833; *Liparis monacha* var. *oethiops* De Selys-Longchamps, 1857; *Psilura transiens* Thierry Mieg, 1886; *Lymantria transiens* Lambillion, 1909; *Lymantria monacha flaviventer* Kruilikovsky; *Lymantria monacha gracilis* Kruilikovsky; *Lymantria fasciata* Hannemann, 1916; *Lymantria kusnezovi* Kulossow, 1928; *Lymantria brunnea* Stipan, 1933; *Lymantria monacha chosenibia* Bryk; *Lymantria monacha matuta* Bryk ; *Lymantria monacha idae* Bryk; *Lymantria monacha lateralis* Bryk; *Lymantria monacha eremita*; *Lymantria monacha nigra*
Lepidoptera: Lymantriidae

Common names: nun moth; tussock moth; black arches moth; black arched tussock moth
Host type: conifer and broadleaf
Hosts: *Picea* spp.; *Picea abies*; *Pinus* spp.; *Abies* spp.; *Larix* spp.; *Fagus* spp.; *Carpinous* spp.; *Betula* spp.; *Acer* spp.; *Fraxinus* spp.; *Malus* spp.; *Prunus* spp.; *Quercus* spp.

Lymantria monacha is a major pest of coniferous and deciduous trees in Europe and Asia. In Romania, the nun moth is of particular concern in forests of *Picea abies*. However, the last recorded outbreak in the country occurred during the 1950s. Nun moth larvae feed on and kill primarily conifers (*Picea*, *Pinus*, *Abies*, and *Larix* spp.) but can also defoliate broadleaf trees and shrubs (*Fagus*, *Carpinous*, *Betula*, *Acer*, *Fraxinus*, *Malus*, *Prunus*, and *Quercus* spp.). The gypsy moth, *Lymantria dispar*, is a closely related species.

Nun moth has a high potential to be transported via commerce because females may deposit eggs in crevices on containers, pallets, and ships.
http://www.cabicompendium.org/NamesLists/FC/Full/LYMAMO.htm
http://www.inspection.gc.ca/english/sci/surv/data/lymmone.shtml
http://warehouse.pfc.forestry.ca/pfc/20008.pdf
http://www.na.fs.fed.us/spfo/pubs/pest_al/nunmoth/nun_moth.shtm
http://tncweeds.ucdavis.edu/products/gallery/lymmo1.html
http://www.affa.gov.au/content/output.cfm?ObjectID=D2C48F86-BA1A-11A1-A2200060A1B01691
http://www.forestryimages.org/browse/subimages.cfm?SUB=4059
http://www.forestpests.org/poland/nunmoth.html
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=304

***Malacosoma neustria* (Linnaeus, 1758)**

Other scientific names: *Phalaena neustria* Linnaeus, 1758; *Bombyx neustria* Linnaeus, 1758; *Malacosoma flavescens* Grünberg, 1912; *Malacosoma mauginii* Turati, 1924; *Malacosoma neustrium* (Linnaeus, 1758); *Trichoclia neustria* (Linnaeus, 1758); *Clisiocampa neustria* (Linnaeus, 1758); *Gastropacha neustria* (Linnaeus, 1758); *Lasiocampa neustria* (Linnaeus, 1758)
Lepidoptera: Lasiocampidae
Common names: tent caterpillar; common lackey moth; common province rose; lackey caterpillar; European lackey moth
Host type: broadleaf
Hosts: *Quercus* spp.

A tent caterpillar, *Malacosoma neustria*, defoliates oak forests in southern Romania but infestations tend to be localized.
http://www.forestryimages.org/browse/subimages.cfm?SUB=12131
http://www.cabicompendium.org/NamesLists/FC/Full/MALANE.htm
http://ukmoths.org.uk/show.php?bf=1634

***Operophtera brumata* Linnaeus, 1758**

Other scientific names: *Cheimatobia brumata* Linnaeus; *Phalaena brumata* Linnaeus
Lepidoptera: Geometridae

Common names: winter moth; common winter moth; European winter moth; small winter moth
Host type: broadleaf
Hosts: *Quercus* spp.

Operophtera brumata feeds on a variety of deciduous trees and shrubs including apricot, cherry, apple, plum, blueberry, crabapple, sweet chestnut, red currant and black currant, oaks, maples, basswood and white elm. In Romania, *Quercus* spp. are particularly susceptible.

Young larvae tunnel into and feed inside buds, especially on fruit trees (apple, blueberry, cherry, and crabapple) in the early spring before bud break. These caterpillars move from bud to bud as they feed. Delayed bud opening due to cool weather conditions can lead to bud death as the caterpillars have longer time to feed. Older larvae feed in the expanding leaf clusters and are capable of creating defoliation in high populations. Sometimes the larvae occur in great numbers, reaching pest status and occasionally completely defoliating small trees.
http://www.inra.fr/hyppz/RAVAGEUR/6opebru.htm
http://www.invasive.org/browse/subimages.cfm?sub=8671
http://ukmoths.org.uk/show.php?bf=1799
http://www.umassgreeninfo.org/fact_sheets/defoliators/winter_moth.pdf
http://www.massnrc.org/pests/pestFAQsheets/winter%20moth.html

***Orthosia cruda* (Denis & Schiffermüller, 1775)**

Other scientific names:
Lepidoptera: Noctuidae
Common names: small quaker
Host type: broadleaf
Hosts: *Quercus* spp.; *Salix* spp.

The larvae of *Orthosia cruda* feed in the early summer on a number of deciduous trees, including oak and willow.
http://ukmoths.org.uk/show.php?bf=2182

***Pityogenes chalcographus* (Linnaeus, 1761)**

Other scientific names: *Ips chalcographus* Linnaeus; *Tomicus chalcographus* Linnaeus; *Dermestes chalcographus* Linnaeus, 1761; *Bostrichus xylographus* Sahlberg, 1836; *Bostrichus bicolor* Chevrolat, 1838; *Ips spinosus* DeGeer, 1775; *Scolytus sexdentatus* Olivier, 1795
Coleoptera: Scolytidae
Common names: six-dentated bark beetle; spruce wood engraver; six-toothed spruce bark beetle; smaller European spruce bark beetle
Host type: conifer
Hosts: *Picea abies*; *Pinus sylvestris*; *Abies* spp.

Pityogenes chalcographus is one of the most dangerous pests of Norway spruce (*Picea abies*). It frequently occurs on Scots pine (*Pinus sylvestris*) and sporadically on firs and other conifers. It often occurs together with *Ips typographus* and infests the upper part of

trees, while *I. typographus* attacks the middle and lower parts. This species is of a high importance in young stands weakened by defoliators. At high population densities, *P. chalcographus* also attacks healthy trees, therefore preparing breeding material for *I. typographus*. It can infest small-sized timber and windthrows. This species prefers sites only slightly exposed to the sunshine.
http://www.cabicompendium.org/NamesLists/FC/Full/PITYCH.htm
http://www.bugwood.org/barkbeetles/exotic/pityogns.html
http://www.invasive.org/browse/subject.cfm?sub=4147
http://www.forestpests.org/poland/smallereuro.html
http://www.bugwood.org/hungary/weevilspc.html
http://www.barkbeetles.org/exotic/pityogns.html
http://www.wcrl.ars.usda.gov/cec/insects/pitychal.htm
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=476

***Semasia rufimitrana* Herrich-Schäffer**

Other scientific names:
Lepidoptera: Tortricidae
Common names: leaf roller
Host type: conifer
Hosts: *Abies alba*

The leaf roller, *Semasia rufitrana*, causes localized defoliation of *Abies alba*. The last recorded outbreak of this insect took place during the 1970s.

Stereonychus fraxini

Other scientific names:
Coleoptera: Curculionidae
Common names:
Host type: broadleaf
Hosts: *Fraxinus excelsa*

A weevil, *Stereonychus fraxini*, is a pest of ash, *Fraxinus excelsa*. Both the larvae and adults feed on the foliage. This insect is a pest in forests where 40 percent or more of the forest is comprised of ash.

***Thaumetopoea processionea* (Linnaeus, 1758)**

Other scientific names:
Lepidoptera: Notodontidae
Common names: oak processionary moth
Host type: broadleaf
Hosts: *Quercus* spp.; *Q. robur*; *Q. petraea*; *Q. cerris*

Thaumetopoea processionea is a native species of central and southern Europe, where it is widely distributed, but its range has been expanding northwards, presumably in response to climate change. It is now firmly established in northern France and the Netherlands, and has been reported from southern Sweden.

Oak processionary moth is a major defoliator of oak in Europe. The larvae (caterpillars) feed on the foliage of many species of oaks, including *Quercus robur*, *Q. petraea* and *Q. cerris*. Hornbeam, hazel, beech, sweet chestnut and birch are also reported to be attacked, although mainly when growing next to severely defoliated oaks.

Larvae of the oak processionary moth are also a risk to human health. The larvae are covered in thousands of much smaller irritant hairs (setae) that contain a toxin. Contact with these small hairs, or their inhalation can result in severe skin irritation and allergic reactions.

Eggs are laid from July to early September. Each female lays between 100 and 200 eggs on twigs and small branches in the canopy. Larvae can be found from April to June. The larvae feed together in groups and, when not feeding, they congregate in communal nests made of white silk webbing spun up under a branch or on the trunk. The larvae typically follow one another head-to-tail in long processions to and from the nest and from one feeding position to another, which gives rise to the common name.
http://ukmoths.org.uk/show.php?bf=2022
http://www.invasive.org/browse/subimages.cfm?sub=13403
http://www.forestresearch.gov.uk/fr/INFD-6URJCF
http://www.forestresearch.gov.uk/pdf/fr_advice_note_oak_processionary_moth.pdf/$FILE/fr_advice_note_oak_processionary_moth.pdf

Tomicus minor (Hartig, 1834)

Other scientific names: *Blastophagus minor* (Hartig, 1834); *Hylesinus minor* (Hartig, 1834); *Hylurgus minor* (Hartig, 1834); *Myelophilus minor* (Hartig, 1834); *Hylastes minor* (Hartig, 1834); *Blastophagus corsicus* (Eggers); *Dendroctonus minor* Hartig, 1834; *Myelophilus corsicus* Eggers, 1911
Coleoptera: Scolytidae
Common names: lesser pine shoot beetle; small pine engraver; minor pith borer
Host type: conifer
Hosts: *Pinus* spp.; *P. sylvestris*; *P. nigra*; *P. pinaster*; *Picea* spp.; *Larix* spp.

Tomicus minor occurs throughout Europe and Asia and has therefore adapted to a wide range of climates and host species. *Tomicus minor* attacks pines, *Pinus* spp. and, to a lesser degree, species of spruce, *Picea spp.* and larch, *Larix* spp. in Europe. Different species of *Pinus* vary in their susceptibility to this pest. In Europe, Scotch pine, *Pinus sylvestris*, is particularly susceptible to *T. minor*. *Pinus nigra* and *Pinus pinaster* have also been reported as hosts.

In Europe, this species attacks defoliated and stressed pines, and may contribute to tree death. *Tomicus minor* is regarded as a major pest of pine plantations throughout Europe. Because adults feed on young pine shoots, tree growth can be significantly reduced. Characteristically, *T. minor* is considered to be a secondary pest, but when populations reach epidemic levels, it may attack healthy trees. To successfully attack live trees, 200-300 egg galleries per square meter are required. Besides direct damage as a result of feeding, *T. minor* transmits the blue stain fungus, *Ophiostoma minus*, which discolours and lowers the value of some wood products.

Tomicus minor is capable of flight, and dispersal typically occurs in spring when beetles emerge from shoots in which they have overwintered. Adults are also subject to wind dispersal. Long distance spread is facilitated by wood products containing bark strips via international trade.
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=115&langdisplay=english
http://www.barkbeetles.org/browse/subject.cfm?SUB=4160
http://www.forestryimages.org/browse/subimages.cfm?sub=4160
http://www.forestpests.org/poland/lesserpineshoot.html
http://www.forestpests.org/hungary/weevilstm.html
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=456
http://www.cabicompendium.org/NamesLists/FC/Full/IPSXMI.htm

***Tomicus piniperda* (Linnaeus)**

Other scientific names: *Blastophagus major* Eggers; *Blastophagus piniperda* Linneaus; *Bostrichus testaceus* Fabricius; *Dermestes piniperda* Linneaus
Coleoptera: Scolytidae
Common names: common pine shoot beetle
Host type: conifer
Hosts: *Pinus* spp.; *P. sylvestris*; *P. radiata*; *P. mugo*; *P. nigra*; *Picea* spp.; *Abies* spp.; *Larix* spp.

Tomicus piniperda attacks various species of pines, *Pinus* spp. In Europe, Scotch pine (*Pinus sylvestris*), Monterey pine (*Pinus radiata*), mugo pine (*Pinus mugo*) and Austrian pine (*Pinus nigra*) are typical species attacked. When populations are high, adults may breed in spruce, fir, and larch logs that occur in stands mixed with pine. In Mongolia, *T. piniperda* attacks pine trees damaged by high winds and snow and subsequent broods will attack standing trees. Various species of blue stain fungi are associated with this bark beetle.

The most severe damage caused by *T. piniperda* is the destruction of shoots during maturation feeding. When shoot feeding is severe, tree height and diameter growth are reduced. The pine shoot beetle may also attack stressed pine trees by breeding under the bark at the base of the trees. The beetles can cause severe decline in the health of the trees, and in some cases, kill the trees when high populations exist.

Tomicus piniperda completes one generation per year throughout its native range of Europe and Asia. Overwintering adults initiate flight on the first warm days of spring. Adults quickly colonize either recently cut pine stumps, logs, or, at times, infest the trunks of severely weakened trees.

Females initiate gallery construction and one male joins each female. After mating, females construct individual vertical egg galleries within the inner bark and outer sapwood. Egg galleries extend 10-25 cm in length. Females lay eggs singly in niches that are cut into both sides of the egg gallery. After hatching, larvae construct horizontal feeding galleries that are 4-9 cm in length. Most larvae complete development, pupate, and transform to adults in May and June.

The newly formed adults tunnel through the outer bark, creating circular exit holes about 2mm in diameter. They then fly to the crowns of living, healthy pine trees of all ages, but

prefer the taller trees in any particular area. Adults feed primarily inside lateral shoots, mostly in the upper half of the crown from May through October. During this period of maturation-feeding, each adult may destroy 1 to 6 shoots.

Adult beetles are strong fliers. Transport of wood products, wooden packing materials, dunnage or pallets containing bark strips can provide a means for introduction of immature stages and adults.
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=86&langdisplay=english
http://www.barkbeetles.org/browse/subject.cfm?SUB=980
http://www.invasive.org/publications/aphis/fspsb.pdf
http://www.forestpests.org/poland/commonpine.html
http://www.forestpests.org/hungary/weevilstp.html
http://www.barkbeetles.org/exotic/tmcspnpe.html
http://www.na.fs.fed.us/spfo/pubs/pest_al/shootbeetle/shootbeetle.htm
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=457
http://creatures.ifas.ufl.edu/trees/beetles/pine_shoot_beetle.htm

Tortrix viridana Linnaeus, 1758

Other scientific names: *Phalaena viridana* Linnaeus; *Phalaena tortrix viridana* Linnaeus, 1758; *Tortrix viridana coeruleana* Sorhagen, 1881; *Tortrix suttneriana* Denis & Schiffermüller, 1775; *Tortrix viridana* (f.) *flavana* Zincken, 1821; *Tortrix viridana* f. *pflegeriana* Vlach, 1942
Lepidoptera: Tortricidae
Common names: European oak leaf roller, oak leaf roller, green oak leaf roller, green oak tortrix, pea-green oak curl moth
Host type: broadleaf
Hosts: *Quercus* spp.

The oak leaf roller, *Tortrix viridana*, another forest defoliator, reaches outbreak levels in the same forest regions as does the gypsy moth but outbreaks are more localized and defoliation can be more intense. Repeated defoliation can cause growth loss, dieback and tree death and alter species composition in favour of non-host species. Outbreak cycles are poorly defined and chronic infestations can occur. Several species of caterpillars of the family Geometridae are often associated with oak leaf roller including *Erannis defoliaria* and *Operophtera brumata*.
http://www.fao.org/forestry/site/20528/en/rom
http://www.invasive.org/browse/subimages.cfm?sub=9319
http://www.cabicompendium.org/NamesLists/FC/Full/TORTVI.htm
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=162&langdisplay=english

Yponomeuta rorellus Hübner, 1796

Other scientific names:
Lepidoptera: Yponomeutoidae
Common names: small ermine moth; willow ermine
Host type: broadleaf
Hosts: *Salix* spp.; *Salix alba*; *Populus* spp.

Yponomeuta rorellus is an important defoliator of willows and poplars. *Salix alba* is particularly affected in Romania.
http://www.fao.org/docrep/004/AC489F/AC489F06d.htm

Introduced insects

***Hyphantria cunea* Drury**

Other scientific names: *Hyphantria textor* (Harris)
Lepidoptera: Arctiidae
Common names: fall webworm; mulberry moth; black-headed webworm; red-headed webworm; American white moth
Host type: broadleaf
Hosts: *Betula* spp.; *Salix* spp.; *Prunus virginiana* var. *demissa*; *Populus deltoides*

The only introduced forest insect of any consequence in Romania is the North American fall webworm, *Hyphantria cunea* which is a major pest of trees in Europe and Asia. This insect is a late summer, tent-making defoliator of broadleaf trees and shrubs including birch, willow, western chokecherry, and cottonwood. Fruit and nut trees are also common hosts.

The larvae are gregarious defoliators which share and continually expand the web under which they shelter. In severe infestations, larvae may defoliate entire trees. Young larvae feed upon the upper and lower leaf surfaces, leaving the veins. Larger larvae will consume the whole leaf.

Fall webworm is primarily a pest of open, roadside or orchard trees and is not often found in forests.However, shade trees and ornamentals can be heavily defoliated and the presence of the large, numerous, unsightly webs can make them aesthetically detracting. The extensive tents or webs, for which the insect is named, may be numerous on one or more trees at a locality. Persistent infestations of individual trees may cause limb and branch dieback.
http://www.bugwood.org/factsheets/webworm.html
http://www.forestryimages.org/browse/subthumb.cfm?sub=158
http://www.forestry.ubc.ca/fetch21/FRST308/lab5/hyphantria_cunea/webworm.html
http://warehouse.pfc.forestry.ca/pfc/2201.pdf
http://www.cabicompendium.org/NamesLists/FC/Full/HYPHCU.htm
http://ohioline.osu.edu/hyg-fact/2000/2026.html

Diseases

Indigenous diseases

Several fungi are pests of Romania's forests but in comparison to insects are relatively minor.

***Microsphaera abbreviata* Peck (1876)**

Other scientific names:
Ascomycota: Erysiphaceae

Common names: powdery mildew; powdery oak mildew
Host type: broadleaf
Hosts: *Quercus* spp.

A leaf fungus, *Microsphaera abbreviata*, affects oak regeneration in Romania on an average of 20 950 ha annually.
http://www.forestryimages.org/browse/subimages.cfm?sub=12129

***Nectria* sp. (Fr.) Fr.**

Other scientific names:
Ascomycota: Nectriaceae
Common names: nectria canker
Host type: broadleaf
Hosts: *Fagus sylvatica*

A bark infesting fungus, *Nectria* sp., is known to infest beech (*Fagus sylvatica*) in Romania.
http://www.ipmimages.org/browse/subimages.cfm?SUB=13345

Introduced diseases

There are no reports of introduced pathogens affecting Romania's naturally regenerating forests.

Other pests

Indigenous other pests

There are no reports of indigenous other pests (i.e. mites, nematodes, mammals, etc.) affecting Romania's naturally regenerating forests.

Introduced other pests

There are no reports of introduced other pests (i.e. mites, nematodes, mammals, etc.) affecting Romania's naturally regenerating forests.

Diebacks and other conditions

Dieback and decline of several tree species, caused by a complex of interacting factors began to appear in Romania during the mid 1980s, a time when a regional forest decline appeared in many European forests. In Romania, oaks were most severely affected however beech and silver fir also displayed symptoms of decline. Decline occurred on 241 500 ha or 3.9 percent of the forest area during this period. Of this total, 203 100 ha or 3.3 percent of the forest area was oak decline (Simionesen *et al*., 2001). Romanian oak decline is believed to be the result of successive warm, dry summers. Many of the declining trees were subsequently attacked by wood-boring beetles. The occurrence of oak decline has decreased with a return to cooler, wetter summers.

Planted forests

Most of Romania's forest plantations are established with indigenous species. Therefore, the plantations are susceptible to many of the same insects that affect the country's naturally regenerating forests.

Insects

Indigenous insects

Diprion pini (Linnaeus)

Other scientific names:
Hymenoptera: Diprionidae
Common names: common pine sawfly
Host type: conifer
Hosts: *Pinus* spp.; *Pinus sylvestris*; *Pinus nigra*

Diprion pini is known to defoliate pine plantations in Romania. *Diprion pini* feeds on needles of all age classes causing often a serious defoliation in pine stands.
http://www.ento.vt.edu/~sharov/insect/sawflies.html
http://www.invasive.org/browse/subject.cfm?sub=7054
http://www.metla.fi/silvafennica/full/sf39/sf394467.pdf

Lymantria dispar Linnaeus, 1758

Other scientific names: *Bombyx dispar*; *Hypogymna dispar*; *Liparis dispar*; *Ocneria dispar*; *Phalaena dispar*; *Porthesia dispar*; *Porthetria dispar*; *Porthetria hadina* Butler; 1881; *Porthetria umbrosa* Butler, 1881
Lepidoptera: Lymantriidae
Common names: gypsy moth
Host type: broadleaf and conifer
Hosts: *Betula* spp.; *Larix* spp.; *Pinus* spp.; *Populus* spp.; *Quercus* spp.; *Salix* spp.; *Ulnus* spp.; fruit trees

The most important defoliating insect of Romania's broadleaf forests is the European form of the gypsy moth, *Lymantria dispar*. This insect is a pest of mixed oak forests and other broadleaf species. Gypsy moth is most common in low elevation forests in the plains of southern and eastern Romania. It is an important defoliator of naturally regenerating forests in Romania and is also capable of causing severe damage to hybrid poplar plantations.

Gypsy moth populations can occur at low levels for many years without causing significant damage. However at times there are significant outbreaks that cause severe defoliation of trees, which at times causes death. Frequently outbreaks coincide with periods when the trees are under stress. Outbreaks generally occur in stands where primary hosts (*Quercus* spp. and *Populus* spp.) comprise 20 percent of the basal area. They typically last for about three years and collapse when host trees are weakened to the point that they produce little or no foliage for the next generation of larvae in the following spring. High levels of parasitism can also cause outbreaks to collapse.

Outbreaks are cyclic and linked to periods of warm, dry weather. A major outbreak, encompassing between 300 000 to 400 000 ha occurred between 1986 and 1988. During 2004, 40 000 ha were infested.

Pathways of entry of gypsy moth include vehicles, camping equipment, nursery stock, ships, and equipment that has been exposed for a period to the outdoors. Adults of Asian strains are capable of flight and thus have strong dispersal ability whereas females of European strains are not capable of flight. Young larvae can move some distance by ballooning from the tops of trees.
http://www.fao.org/forestry/site/20528/en/rom
http://www.forestpests.org/subject.html?SUB=165
http://www.issg.org/database/species/ecology.asp?si=96&fr=1&sts=sss
http://www.inspection.gc.ca/english/sci/surv/data/lymdise.shtml
http://www.forestry.ubc.ca/fetch21/FRST308/lab5/lymantria_dispar/gypsy.html
http://www.padil.gov.au/viewPest.aspx?id=342
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=342
http://spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=11&langdisplay=english
http://www.aphis.usda.gov/lpa/pubs/fsheet_faq_notice/fs_phasiangm.html

***Neodiprion sertifier* Linnaeus, 1758**

Other scientific names: *Diprion sertifer*; *Lophyrus rufus* Panz.; *Pteronus sertifer*; *Tenthredo sertifera* (Geoffroy 1785)
Hymenoptera: Diprionidae
Common names: European pine sawfly; fox-coloured sawfly
Host type: conifer
Hosts: *Pinus* spp.; *Pinus sylvestris*

Neodiprion sertifier is known to defoliate pine plantations in Romania. It attacks most species of two-needled pines, however in Europe, Scots pine (*Pinus sylvestris*), is the preferred host plant. In general, all age classes may be attacked. Pine sawfly feeds on second-year and older needles usually leaving current year needles intact. As a result, even after severe damage only weak trees die. Weakened trees however are susceptible to other secondary pests.
http://www.ento.vt.edu/~sharov/insect/sawflies.html
http://zoologie.forst.tu-muenchen.de/PHERODIP/pherodip.html
http://zoologie.forst.tu-muenchen.de/PHERODIP/DIPRIONIDAE/NEODIPRIONSERTIFER/neodiprion.sertifer.html

Introduced insects

There are no reports of introduced insects affecting Romania's planted forests.

Diseases

Indigenous diseases

Several species of fungi attack seedlings grown in nurseries. Oak seedlings are susceptible to the leaf fungus, *Microsphaeria abbreviata*.

***Microsphaera abbreviata* Peck (1876)**

Other scientific names:
Ascomycota: Erysiphaceae
Common names: powdery mildew; powdery oak mildew
Host type: broadleaf
Hosts: *Quercus* spp.

A leaf fungus, *Microsphaera abbreviata*, affects oak regeneration in Romania on an average of 20 950 ha annually.
http://www.forestryimages.org/browse/subimages.cfm?sub=12129

Introduced diseases

There are no reports of introduced pathogens affecting Romania's planted forests.

Other pests

Indigenous other pests

There are no reports of indigenous other pests (i.e. mites, nematodes, mammals, etc.) affecting Romania's planted forests.

Introduced other pests

There are no reports of introduced other pests (i.e. mites, nematodes, mammals, etc.) affecting Romania's planted forests.

Diebacks and other conditions

No records were available for diebacks or other conditions affecting Romania's planted forests.

Capacity for forest health protection

Government level

Two groups in Romania's central government are assigned responsibility for regulation, management and protection of Romania's forests: the Ministry of Agriculture, Forestry and Rural Development and the National Forest Administration; and an independent autonomous agency known as RomSilva. The Ministry has a regulatory function and ensures that management and protection of forests of all ownerships are conducted within the framework of existing laws and regulations. RomSilva has direct responsibility for all management activities on state-owned forest lands. The most recent forest law, known as Forest Code (Law 26/24), passed in April 1996, includes provisions that authorize RomSilva to compile annual statistics, conduct evaluations, control and prevention using

biological and integrated pest control on all forest lands. Costs of these activities are borne by RomSilva on state-owned lands. On private lands, landowners are expected to pay for the costs of activities related to forest protection.

Forest research, including research on forest insects and diseases, is the responsibility of the Forest Management and Research Institute (ICAS) with headquarters in Bucharest and several field stations throughout the country. ICAS is part of RomSilva but enjoys a certain level of autonomy. Research entomologists and pathologists assigned to ICAS spend about 60 percent of their time on research and 40 percent of their time on technical assistance to RomSilva forest protection specialists.

Monitoring and detection

Detection of abnormally high levels of pest activity is the responsibility of local RomSilva foresters and forest workers. When a pest is detected, forest protection specialists assigned to local management units are notified and they conduct an assessment of the problem. Some insects of special concern are monitored annually with pheromone traps. Each year, for example, a large network of traps is deployed throughout Romania's conifer forests to monitor population fluctuations of nun moth (*Lymantria monacha*). Similar traps are used to monitor oak leaf roller (*Tortrix viridana*) and to provide an "early warning" of outbreaks of gypsy moth (*Lymantria dispar*). Pheromone traps are also used to monitor several species of bark beetles.

Sampling systems, usually based on egg mass counts, have been developed to predict damage expected by some of Romania's important forest defoliators. Data obtained from these systems, in combination with socio-economic factors, are used to establish a basis for control. Sampling for egg masses of gypsy moth consists of establishing a series of 10-tree sample plots, at least one per management unit, over a forest for which data are required. Field crews tally all egg masses on each sample tree and record tree diameter and species. A sub-sample of egg masses is sent to the local ICAS forest protection research entomologist for determination of egg viability. The number of eggs/egg mass, level of parasitism and the number of infertile eggs is determined and an estimate of the number of viable eggs is made. A table, which lists the number of eggs required for 100 percent defoliation, by tree species, diameter class and outbreak phase has been developed. Foresters consult this table and compute the expected percent defoliation. Plot data are summarized according to five classes of defoliation: very light, light, moderate, heavy and severe. These classes are transferred to forest maps and colour coded showing the location of affected areas.

Data management

Statistical data on forest insect and disease occurrence is compiled annually for each local forest management unit and submitted to the regional directorates, who aggregate these data and submit regional reports to RomSilva headquarters in Bucharest. These data are summarized in periodic reports compiled by ICAS. Since 1966, reports of forest insect and disease conditions have been summarized in four reports: 1954-64; 1965-75; 1976-85; and 1986-2000. These reports consist largely of data tables that show the forest area infested by pest agent, administrative unit and year (Simionesen *et al*., 2001).

Pest management

A variety of pest management tactics are used to reduce pest losses. Preventative measures include encouraging growth of mixed species stands, maintaining proper stocking levels, establishment of nesting sites for insectivorous birds, and protection of nests of mound-building ants (*Formica* spp.) which are known predators of many insect pests.

Direct control is used primarily against forest defoliators with emphasis on the use of biological insecticides such as the bacterium *Bacillus thuringiensis*. A virus of the tent caterpillar (*Malacosoma neustria*) has been identified and made available in small quantities for ground application.

During the period 1986-2000, prevention and suppression activities were conducted on an average of 514 600 ha/year or about 8 percent of the total forest area. Almost half (49.3 percent) of this effort was dedicated to prevention and control of bark beetles in conifer forests and 45.5 percent was directed toward control of forest defoliators. During the years 1988-89, some 219 000 ha were treated for control of gypsy moth (Simionesen *et al*., 2001).

Private landowners

RomSilva conducts forest pest management activities on all forest lands. On private lands, landowners are expected to pay for the costs of activities related to forest protection. Presently, the large private landowners (i.e. communities and monasteries) do pay their share of the costs of pest control operations. Small landowners are not charged for these services.

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Simionesen, A., Lupu, D. Badea, O. Mihalciuic, V. Vladulensa A. & Fulicea, T. 2001. Starea de Sănatate a Pădurilor din România in intervalui 1986-2000. Regia National a Pădurilor, 934 pp. (In Romanian with English abstract)

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OSN = Other Scientific Name (other names, synonyms, other combinations, etc. that have been used for this species)

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Six-dentated bark beetle, 9
Six-spined engraver beetle, 5
Six-toothed bark beetle, 5
Six-toothed spruce bark beetle, 9
Small ermine moth, 13
Small pine engraver, 11
Small quaker, 9
Small spruce bark beetle, 4
Small winter moth, 9
Smaller European spruce bark beetle, 9
Spruce beetle, 6
Spruce engraver beetle, 6
Spruce wood engraver, 9
Stereonychus fraxini
Hosts
Fraxinus excelsa, 10
Tent caterpillar, 8
Tenthredinidae, 1
Tenthredo sertifera[OSN], 17
Thaumetopoea processionea
Hosts
Quercus, 10
Quercus cerris, 10
Quercus petraea, 10
Quercus robur, 10
Tomicus amitinus[OSN], 4
Tomicus chalcographus[OSN], 9
Tomicus minor
Hosts
Larix, 11
Picea, 11
Pinus, 11
Pinus nigra, 11
Pinus pinaster, 11
Pinus sylvestris, 11
Tomicus piniperda
Hosts
Abies, 12
Larix, 12
Picea, 12
Pinus, 12
Pinus mugo, 12

Pinus nigra, 12
Pinus radiata, 12
Pinus sylvestris, 12
Tomicus stenographus[OSN], 5
Tomicus typographus[OSN], 6
Tortricidae, 2, 10, 13
Tortrix suttneriana[OSN], 13
Tortrix viridana
Hosts
Quercus, 13
Tortrix viridana (f.) *flavana*[OSN], 13
Tortrix viridana coeruleana[OSN], 13
Tortrix viridana f. *pflegeriana*[OSN], 13
Trichoclia neustria[OSN], 8
Tussock moth, 8
Twelve-spined ips, 5
Ulnus
Insects
Lymantria dispar, 6, 16
Weevil, 2
Willow ermine, 13
Winter moth, 9
Yponomeuta rorellus
Hosts
Populus, 13
Salix, 13
Salix alba, 13
Yponomeutoidae, 13