NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

EDUCATION AND RESEARCH INSTITUTE OF FORESTRY AND LANDSCAPE-PARK MANAGEMENT

Methodical recommendations for performance practical and independent works of the discipline «Pest management in Forests of eastern Europe» for Masters' students major in Forestry

Kyiv – 2022

УДК 630*4(4-11)

Наведено методичні поради для виконання практичних та індивідуальних робіт для студентів спеціальності 205 «Лісове господарство» освітнього ступеня «Магістр»

Рекомендовано до друку вченою радою Навчально-наукового інституту лісового і садово-паркового господарства НУБіП України (протокол № 13 від 5 вересня 2022 року)

Рецензенти: професор кафедри лісівництва,
доктор с.-г. наук, професор Зібцев Сергій Вікторович
доцент кафедри відтворення лісів та лісових меліорацій, кандидат с.-г. наук, доцент Соваков Олександр Вікторович

Навчальне видання
Методичні рекомендації для виконання практичних та індивідуальних робіт з дисципліни «Pest Management in Forests of Eastern Europe» для студентів спеціальності 205 «Лісове господарство» освітнього ступеня «Магістр»

Укладачі: Токарєва Ольга Вікторівна,
Пузріна Наталія Василівна,
Лакида Марина Олексіївна

Видання здійснено за авторським редагуванням

Підписано до друку Формат 60x84 1/16

Ум. друк. акр._____ Обл.-вид. акр.____

Наклад 100 прим. Зам. № _____

CONTENT

INTRODACTION

Insects, diseases and other pests have considerable impacts on forests. They can adversely affect tree growth and the yield of wood and non-wood products. Damage caused by forest pests can significantly reduce wildlife habitat thereby reducing local biodiversity and species richness. They can alter natural forest landscapes by decimating one or more tree species. Some pests have necessitated changes in management regimes often forcing forest managers to switch to alternative tree species in plantations. Pathogens may also limit the sites on which species can be grown successfully outside their natural range Insects and diseases claim more timber each year than any other forest menace. Some of this loss is a natural part of the forest's natural cycle; however, forest health can decline if this natural cycle is thrown out of balance. We value and rely on forests for a wide variety of resources that can be threatened by forest pests, and therefore it is important to monitor forest health and intervene when those resources are at risk. Proper forest management, early detection, and protective measures can prevent or reduce the effects of insect and disease problems; while more intensive management and control options are available when required.

Forest pest management can be difficult for a number of reasons. To make a forest profitable one cannot afford the cost-intensive control options that are frequently utilized for other agricultural crops. In fact, complete control or eradication of forest pests is, with few exceptions, difficult or impossible to achieve. Trees are grown on vast acreages making monitoring difficult, access problematic, and management of pests very expensive. Unlike an annual crop that matures within a single growing season and may only be exposed to a few pests or environmental stressors, trees are long-lived and exposed to many stress agents over the course of their lifetime. They are also very large organisms, so close examination of an entire tree including its leaves, branches, roots, and internal structures, is impossible.

Chemical applications that require thorough coverage over the entire plant are limited to young trees or small cultivars. Trees are the largest organisms in forest communities, and any treatments or

control options may adversely affect other organisms in the vicinity. Injury to non-target organisms is a major concern in forest health management. Finally, there are relatively fewer chemical control options available for forestry use than in agriculture or landscape management. Because of these difficulties, forest managers must use an Integrated Pest Management approach when dealing with forest pests and other stress agents.

Pest Management covers the management and control of common forest pests in stands, nurseries. Basic scientific information is presented on forest ecosystems and pest life cycles.

Sanitary logging is a very important instrument to stop or at least reduce the further outbreak of bark beetles and other threats to forests. Due to young and medium coniferous forests, bark beetles, windthrows and other threats to forests can easily spread.

Each work begins with a set of learning objectives that will help you focus on what you should get out of each chapter. There are questions after each work.

At the end of these methodical recommendations, provide supplemental information and glossary. Terms throughout the manual text that are bold and italicized can be found in the glossary. Species of pests in Latin are italicized.

Training manual would be useful to Master's student, anyone interested in learning more about forest pest management.

PRACTICAL WORK 1
VARIOUS TYPES OF FOREST PESTS

The purpose of practical work. To learn different types of forest pests.

Theoretical provisions.

Forests are complex ecosystems that provide a variety of valuable products, such as timber, fuelwood, non-wood forest products, that contribute to the livelihoods of rural communities. They also provide vital ecosystem services, such as combating desertification, protecting watersheds, maintaining biodiversity, deposit of carbon sequestration and play an important role in preserving social and cultural values. It is critically important to protect forest resources from disturbances such as fire, pollution, invasive species, insects and diseases.

While they are integral components of forest ecosystems, pests have considerable influence on the health of forests and plants outside forests. They can adversely affect forest plants survival, growth and vigour, the yield and quality of wood and non-wood products, wildlife habitat, human recreation, aesthetics and cultural values.

Pest management should be aimed that the risks and impacts of unwanted disturbances are minimized. Measures to protect forests from pests are an integral part of sustainable forest use. Effective pest management in forest requires reliable information about the pests, their biology, ecology, and distribution, their impacts on natural ecosystems and possible methods of control.

Forest pests are biotic disturbances, meaning that the source of illness to a tree or a forest is a living organism. For an understanding description all pests have been classified into the categories.

Forest pests are living organism (plants, animals and pathogenic agents) detrimental to the forest health. Forest pests include: weeds, insects, diseases, rodents, nematodes.

A ***weed*** is a plant considered undesirable and non-typical in forest.

Insects*.** Represent the wider portion of forest pests. ***Insects have segmented bodies, jointed legs, and exoskeletons.

Forest pathogens are represented by living factors not classified as animals such as: bacteria, fungi, viruses and they cause forest diseases.

Other forest pests. Are represented by non-insect pests such as certain nematodes and other small parasites that can spread diseases among trees being hosted on a number of beetles or other insects. The definition also includes: mites, parasites, mammals, birds, plants.

According to Global review of forest pest and diseases by Food and Agriculture organization of the United Nations almost 77 % of the forest pests reported from the overview countries were insect pest species. All regions reported significantly more insect pests than other pest types. Sixteen percent of the pest species were pathogens and the remaining 7 percent were other pests. Insects tend to be easier to trap than other pests and easier to identify as the cause of tree damage, although identification still requires specialized training and expertise.

The impacts of pathogenic diseases on forest trees, such as destruction of internal wood, reductions in growth, or delayed regeneration, are often subtle and difficult to detect. It can be difficult to determine the causative agent of these impacts. Likewise, the impacts of other pests such as nematodes, mites, mammals and parasitic plants on forest trees are not easy to detect. Over 73 % of pests in planted forests and 91 % in naturally regenerated forests were indigenous species. Almost 62 % of forest pests were recorded on broadleaf tree species, over 30 % on conifers and almost 8 % on both host types. In all regions, pests were recorded more often on broadleaf trees than conifers.

Task. Read the regulations (supplement A, B, and C). Describe different types of forest pests and fill the table 1 and 2. Do next steps:

1. Provide examples and describe five species of weeds, insects, rodents, fungi, nematodes.
2. Give example of consequences of pest activity.

Table 1. Pest in the forest

Pests	Species
1. Insects	1.
	2.
	3.
	4.
	5.
2. Fungi	1.
	2.
	3.
	4.
	5.
3. Viruses	1.
	2.
	3.
	4.
	5.
4. Bacteria	1.
	2.
	3.
	4.
	5.
5. Weeds	1.
	2.
	3.
	4.
	5.
6. Rodent	1.
	2.
	3.
	4.
	5.
7. Nematodes	1.
	2.
	3.
	4.
	5.

Table 2. Consequences of pest activity (foto)

Foto 1. Sucking damage and deformed leaves	Foto 2. Discolored leaves
Foto 3. The chewed and skeletonized leaves	Foto 4. Galls
Foto 5. Leaf miners damage	Foto 6. Leafroller damages
Foto 7. Punctures	Foto 8. Trunk damage insects
Foto 9. Insects of forest crops	Foto 10. Root damage insects

References:

[4, 8, 9, 19, 22, 23]

Questions:

1. What are ecosystem services provided by forest?
2. What consequences of pest activity do you know?
3. What the most popular pests in forest do you know?
4. Give the examples of biotic, abiotic and anthropogenic factors.
5. What is the great aim of Pest management?
6. Give a global review of forest pests.
7. Give the examples of the other forest pests.
8. Why it is difficult to detect impacts of pathogenic diseases on forest trees?
9. How many were indigenous species of pests recorded in planted forests and in naturally regenerated forests?
10. How many were forest pests recorded on broadleaf tree species and conifers?

PRACTICAL WORK 2
PESTS ON THE DIFFERENT PARTS OF TREES

The purpose of practical work. To learn pests on (in) different parts of trees.

Theoretical provisions.

Trees are susceptible to pests. The diseases and insects can reduce productivity, wood quality, decorativeness and attractiveness or kill the tree. Many environmental factors can cause a tree to be stressed. Pest outbreaks are often seasonal, regional, and species specific.

Drought, overwatering, and damage to stem or roots are the most common causes. Stem damage invites infection by creating points of entry for pathogens. Root damage creates points of entry for pathogens and reduces the trees ability to collect water that puts the tree under stress, thus making it more susceptible to infection.

Drought, whether from lack of rainfall, from overwatering, or from root damage; reduces the ability of a tree to isolate infections and prevent their spread through the tree.

The parts of a tree can be broken down into the roots, trunk, bark, branches, crown, leaves, and periodically flowers and/or fruit. Each part of a tree has a different function from the roots soaking up vital water and nutrients to the fruit continuing the growth of the species.

Crown is a part of the tree that consists of the leaves and the branches at the top of a tree.

Leaves are food factories of the tree. The leaves contain chlorophyll which gives leaves their green color and is responsible for photosynthesis. During photosynthesis, leaves use energy from the sun to convert carbon dioxide from the atmosphere and water from the soil into sugar and oxygen. The sugar (which is the tree's food) is either used or stored in the branches, in the trunk, or in the roots. The oxygen is released into the atmosphere.

Trunk (Stem) is supports the leaves and the branches of the tree and contains the xylem, the cambium, the phloem, and the heartwood.

Heartwood is inner core of dead wood that supports the tree. As a tree grows, older xylem cells in the centre of the tree become inactive and die, forming the heartwood.

The ***roots*** of a tree are the contact point between the soil and the tree. They absorb the water and nutrients that the xylem carries to the rest of the tree. These roots are generally large, numerous, and underground. They help to support the tree, as it grows because trees can become very large and heavy.

In botany, a ***fruit*** is the seed-bearing structure in flowering plants that is formed from the ovary after flowering. It can be cones, acorns, juicy fruits, berries and seeds. Symptoms of fruit diseases are mummification, rot, rust, spots, mold

Ornamental plants are plants that are grown for decorative purposes in gardens and landscape design projects. Ornamental trees also suffer from pests.

Commonly, ornamental garden plants are grown for the display of aesthetic features including: flowers, leaves, scent, overall foliage texture, fruit, stem and bark, and aesthetic form. In some cases, unusual features may be considered to be of interest.

Task. Read plant, fungi, insects, bacteria taxonomy (supplement D, E, F, G). Describe types of pests on different parts of trees (including ornamental plants) and fill the table 3.

Table 3. Ecological groups of forest plant pests

Parts of tree	Insects	Nematodes	Diseases	Rot	Fungi
Reproductive plant part					
Fruit					
Leaves					
Needles					
Bark					
Bast wood					
Root					

Do next step:

1. Provide examples and describe pests on (in) fruit, leaves, and needles, reproductive plant parts, in bark, bast wood, and rood.

2. Describe which groups of pests can complement each other.

References:

[2, 7, 14, 21]

Questions:

1. Give the damage classes for foliage (needle/leaf).
2. What is the concept of pathological process in plants?
3. Identify stress factors for root.
4. How are logging residues should be removed?
5. Explain the negative impact of tapping on the forest.
6. Explain the negative impact of cattle grazing on the forest.
7. What does an excess of nutrients in the soil lead to woody plants?
8. What is the harmfulness of early autumn and late spring frosts?
9. How does penetration of the pathogen happen into the plant?
10. How it possible to warn spread of pests to fruit?
11. Make a list of woody ornamental plant diseases in the conditions of a particular region.
12. Make a list of woody ornamental plant insects in the conditions of a particular region.
13. What factors can limit pest populations in the garden?
14. What meaning of plant resistance?
15. Give overview of plant selection.
16. What stuff includes cultural controls?
17. What stuff includes mechanical and physical control?
18. What stuff includes biological control?
19. Give classifications of pesticides.
20. Give toxicity categories of pesticides.

PRACTICAL WORK 3
CLASSIFICATION OF INSECTS

The purpose of practical work. To learn classification of insects.

Theoretical provisions.

Insects are the most numerous group of the animal world, numbering about a million species. They have inhabited almost all living environments: terrestrial and aerial, soil, water, organisms of other creatures.

Depending on the nature of damage, phytophagous insects are divided into several groups. It is appropriate to divide into groups, depending on the organs and parts of plants damaged by phytophagous insects. According to this feature, the following groups of phytophagous insects are distinguished: needle- and leaf-eating, trunk and root beetles, insects of the aerial part of woody plants, etc. Damage by phytophagous insects causes a significant weakening of plants, a decrease in their decorativeness, bending of branches and trunks, dry tops, and sometimes drying. When the needles are completely eaten, coniferous woody plants, as a rule, dry up.

Deciduous woody plants in favourable conditions, if they eat leaves once, renew them in the same year, however, when phytophagous insects eat leaves for several years, the plants begin to wither and dry up.

Regarding insects, the following systematic categories (taxa) are widely used: Classis → Subclassis → Iinfraclassis → Divisio → Superordo → Ordo → Subordo → Superfamilia → Familia → Subfamilia → Tribus → Genus → Subgenus → Species.

The class of insects is divided into two subclasses – *Apterygota a*nd *Pterygota*, into two divisions – *Hemimetabola* and *Holometabola*.

With few exceptions, insects begin life as eggs. The change in form eggs through to adults in insects is termed metamorphosis. More advanced insects are described as having incomplete metamorphosis. Insects with incomplete metamorphosis (*Hemimetabola*) change shape gradually as they grow (Fig. 1).

There are three stages of growth: the egg, nymph, and adult. Grasshoppers, termites, bugs, and lice are all of part of this group. Insects with complete metamorphosis (*Holometabola*) go through four stages of growth. None of the stages look at all like the others. These stages are referred to as egg, larva, pupa, and adult. Fleas, flies, beetles, bees, and moths all belong to this group (Fig. 2).

Insects have an exoskeleton, a hard outer layer made mostly of chitin which protects and supports the body. The insect body is divided into three parts: the head, thorax, and abdomen. The head is specialized for sensory input and food intake; the thorax, which is the anchor point for the legs and wings (if present), is specialized for locomotion; and the abdomen for digestion, respiration, excretion, and reproduction. Although the general function of the three body regions is the same across all insect species, there are major differences in basic structure, with wings, legs, antennae, and mouthparts being highly variable from group to group.

The body of insects is clearly divided into three parts: head, chest and abdomen.

Externally, the body of the coma is covered with a cuticle, which changes the role of the external skeleton and usually forms a hard carapace (in vertebrates, internal carapaces). The cuticle protects insects from adverse conditions, prevents evaporation of water from the body, serves as a place of attachment of the middle of skeletal muscles, and increases resistance to deformation.

Tasks. Read classification of the insects (supplement H) and their stages of development (supplement I). Describe types of insects on different parts of trees and fill the table 4. Do next step:

1. Give the classification of the insect orders that damage plants (references to sources are required).
2. Get acquainted in detail with *Orthoptera*, *Coleoptera*, *Trysanoptera*, *Hemiptera*, *Lepidoptera*, *Hymenoptera*, *Diptera*, give the main signs of their manifestation and prognosis.

Describe body parts of insect (Fig. 3).

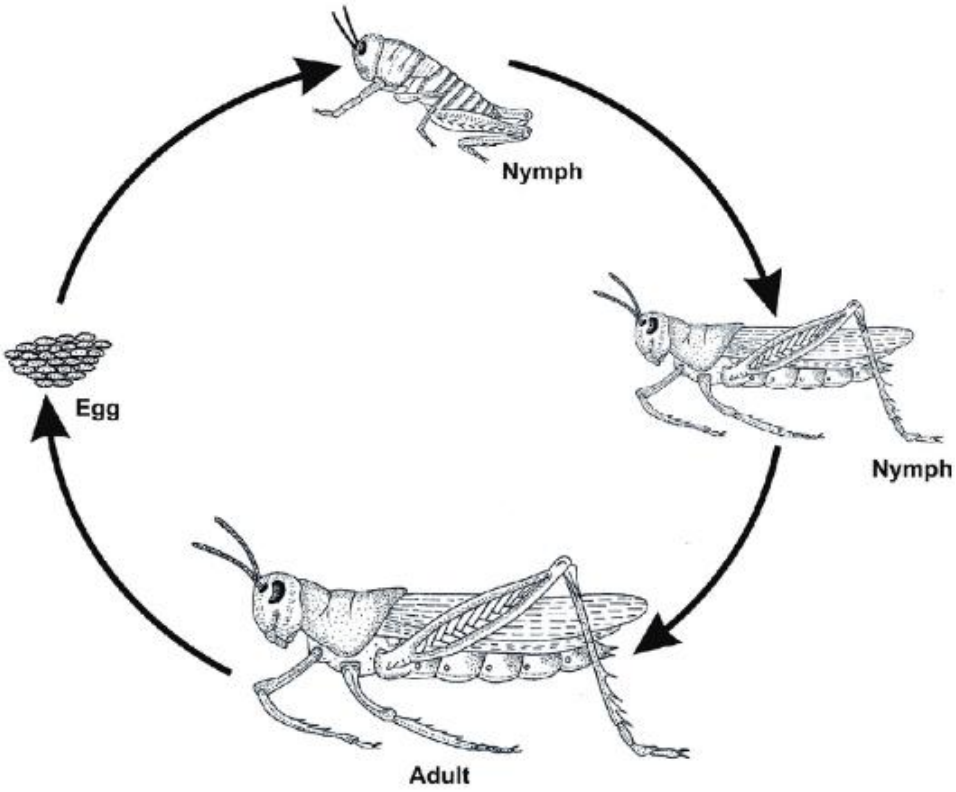


Figure 1. Hemimetabola

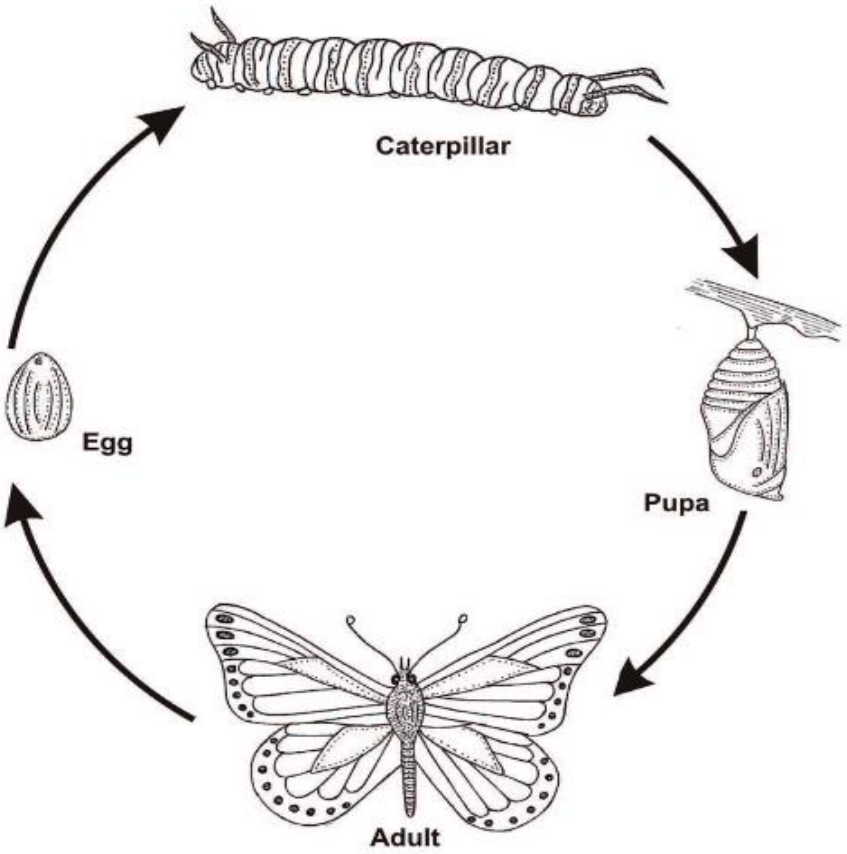


Figure 2. Holometabola

Table 4. Insects on different parts of forest plants

Order	Parts of tree						
	Reproductive plant part	Fruit	Leaves	Needles	Bark	Bast wood	Root
Orthoptera							
Coleoptera							
Trysanoptera							
Hemiptera							
Lepidoptera							
Hymenoptera							
Diptera							

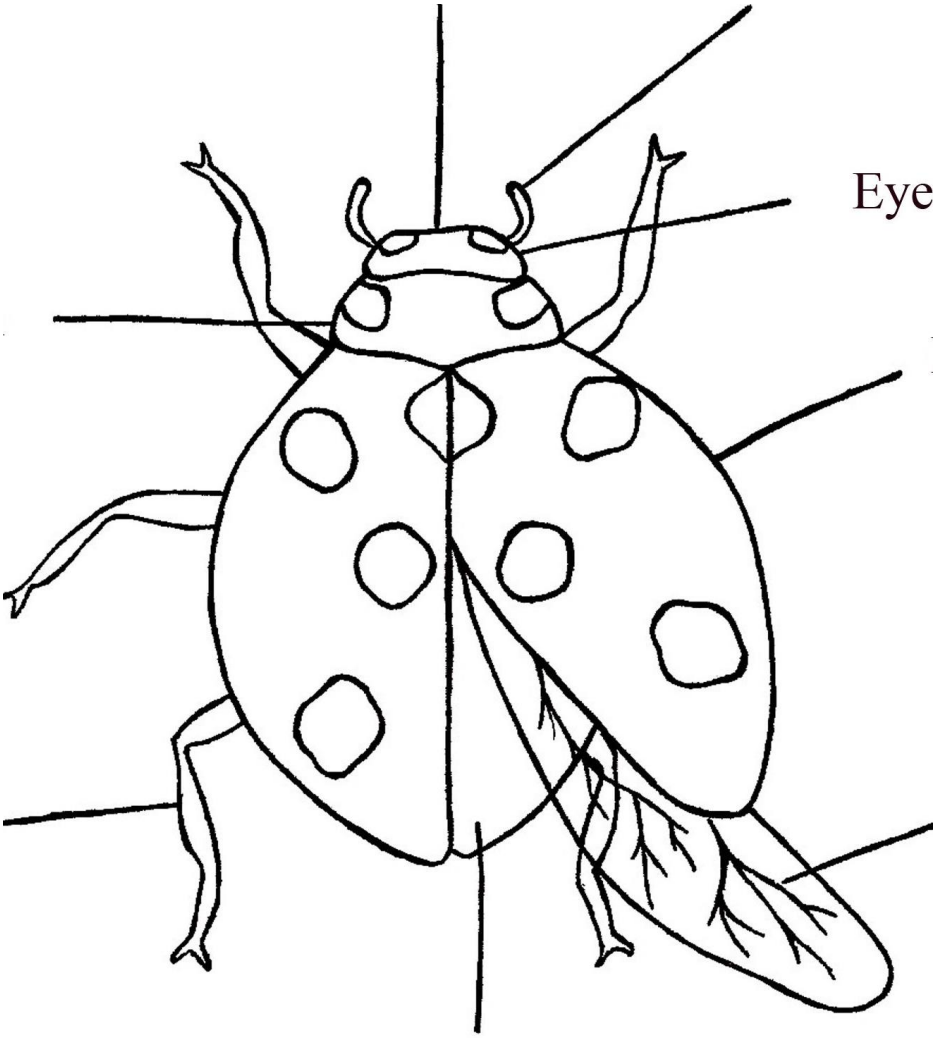


Figure 3. Body parts of insect

References:

[2, 27, 28, 29, 30,32]

Questions:

1. Define the species and population of insects.
2. What main series refer to insects with incomplete transformation?
3. What main series refer to insects with complete transformation?
4. Give examples of *Hemimetabola* and *Holometabola.*
5. What are the main characteristics of representatives of the order *Coleoptera*?
6. What are the main characteristics of representatives of the *Lepidoptera* order?
7. What are the main characteristics of representatives of the *Hymenoptera* order?
8. What are the main characteristics of representatives of the *Diptera* order?
9. What are the main characteristics of representatives of the *Hemiptera* order?
10. What are the main characteristics of representatives of the *Orthoptera* order?

PRACTICAL WORK 4
INSECTS OF THE ABOVE GROUND AND UNDERGROUND PARTS OF THE PLANTS

The purpose of practical work. To learn insects of the above ground and underground parts of the plants.

Theoretical provisions.

Outbreaks of needle- and leaf-eating insects mass reproduction are periodically repeated on large areas. Most of these insects belong to the order *Lepidoptera*: *Dendrolimus pini* L., *Malacosoma neustria* L., *Lymanthria (Ocneria) monacha* L., *Lymanthria (Ocneria) dispar* L., *Euproctis chrysorrhoea* L., *Dasychira pudibunda* L., *Leucoma salicis* L., *Panolis flammea* Schiff., *Bupalus piniarius* L., *Boarmia bistortata* Goeze, *Operophthera brumata* L., *Erannis defoliaria* CL., *Zeiraphera diniana* Gn., *Phalera bucephala* L., *Notodonta anceps* Goeze., *Tortrix viridana* L., *Archips crataegana* Hb., *Aporia crataegi* L., *Hyphantria cunea* Drury., *Acrocercops brongniardella* F., *Cnetocampa processionea* L. Some of pest insects belong to the order of *Hymenoptera*: *Diprion pini* L., *Neodiprion sertifer* Geofforoy and *Coleoptera*: *Chrysomela populi* L.

Leaf pest insects. Pest insect species are the following species: *Aphis pomi De Geer*, *Viteus vitifoliae, Phylloxera coccinea, Tetraneura ulmi, Tetraneura coerulescens, Hyalopterus pruni, Eriosoma lanigerum, Eriosoma ulmi* L., *Lachnus roboris* L., The most common among *Chrysomelidae* are: *Melasoma tremulae, Agelastica alni, Haltica quercetorum* Foudr, *Melasoma aenea* L., *Melasoma populi,* в'язовий листоїд *Galerucella luteola* Muell. Найпоширенішими видами з родини наривники *Meloidae* є шпанська мушка (майка) *Lytta vesicatoria* L. From the *Cynipidae* family are: *Diplolepis quercus-folii* L., *Andricus foecundatris* Hart. From the *Diaspididae* family are: *Lepidosaphes ulmi* L., *Diaspidiotus perniciosus* Comst., *Parthenolecanium corni* Bouche.

Insects of buds and shoots of conifers. The most common include representatives of *Lepidoptera* family: *Evetria buoliana* Schiff., *Evetria duplana* Hb., *Evetrla lurionana* Hb., *Evetria*

resinella L. Also *Pyralidae* famaly*: Dioryctria abietella v. pinetella* Rodz.

Root pests are one of the most common and harmful groups of insects. They cause great damage in nurseries and young plants. In old plantations, the damage is much less. Pests of the roots include the larvae of chafer, wireworms, cabbageworms, false wireworms, caterpillars of gnawing scoops, larvae of some weevils, etc. The most common and harmful among them are the larvae of chafer.

Chafers belong to the *Scarabaeidae* family. The most dangerous are *Melolontha hippocastani* F., *Melolontha melolontha* L., *Polyphylla fullo* L., *Anoxia pilosa* F., *Amphimallon solstitialis* L.

Task. Describe insects of the above ground and underground parts of the plants and fill the table 5. Do next step:

1. Provide the examples of needle- and leaf-eating insects.
2. Provide the examples of insects of buds and shoots.
3. Provide the examples of root insects.

Table 5. Insects of the above ground and underground parts of the plants

Insects	Above ground	Underground parts
Needle-eating		
Leaf-eating		
Bud and shoot pests		
Root pests		

References:

[2, 27, 28, 29, 30,32]

Questions:

1. Give the examples of needle-eating insects
2. Give the examples of leaf-eating insects.
2. Give the examples of bud and shoot insects.
3. Give the examples of root insects.

PRACTICAL WORK 5.
TRUNK INSECTS

The purpose of practical work. To learn trunk insects.

Theoretical provisions.

Most bark beetles settle in the bark, bast or surface layer of the sapwood of trees (fig. 4). Some species drill deep passages in wood. Bark beetles live in families: one male and several females (polygamy), and one male and one female (monogamy).

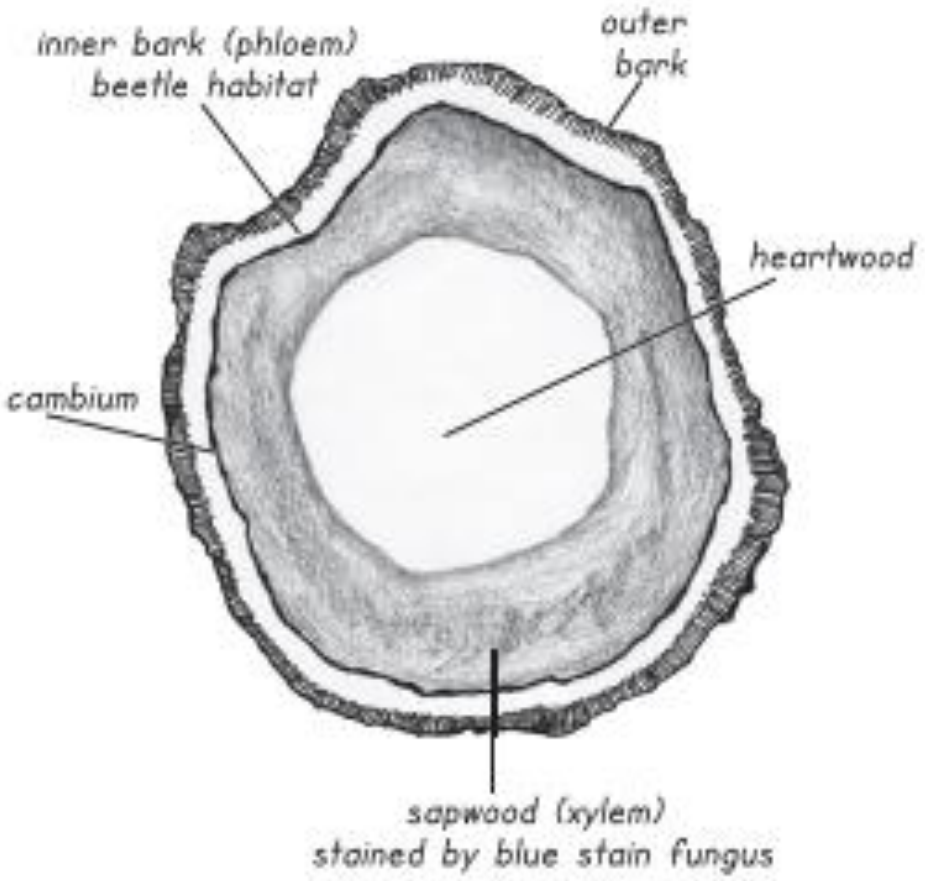


Figure 4. Wood cross section

Polygamous bark beetles, while drilling, first gnaw through the entrance channel, and then the nuptial chamber (fig. 5). From it, each female does a separate mother gallery in the form of a straight or curved channel. On the sides of the passage, she gnaws out small recesses – egg chambers, in each of which she lays an egg.

The larvae that hatch from the eggs bore the larval passages. Having finished feeding, the larvae arrange pupal cradles and pupate where the course ends. Young beetles, after emerging from the pupae, gnaw through a hole in the bark and fly out.

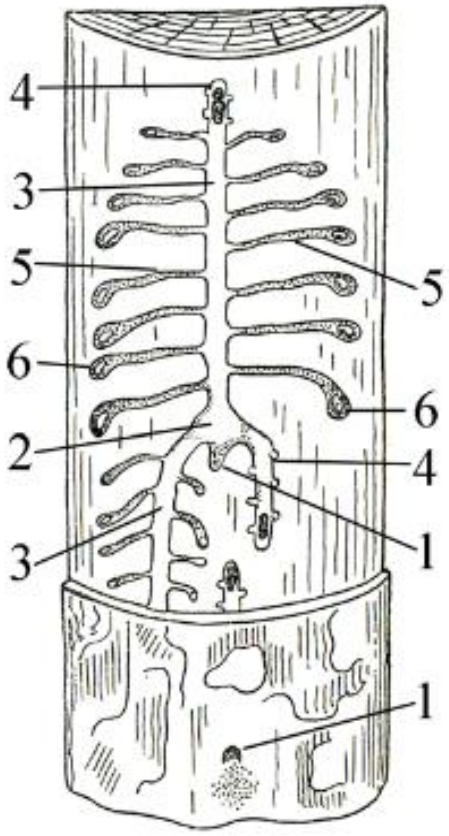


Figure 5. Bark beetle gallery
1. Entrance hole. 2. Nuptial chamber. 3. Moter gallery.
4. Egg galleries. 5. Larval galleries. 6. Larvae.

The galleries of monogamous bark beetles differ from the galleries of polygamous ones in that they do not have a nuptial chamber and have only one mother gallery

The trunk harmful insects include insects from the subfamily *Curculionidae*, the family *Cerambycidae*, *Buprestidae*, *Siricidae*, *Cossidae*, *Aeqoriidae* and some others.

In most species, the larvae lay under the bark and in the wood. Larvae of bark beetles and adults lead a hidden lifestyle under the bark and even in wood, where, making their way, they feed and reproduce. By gnawing through the grooves in the sapwood and sapwood of the trunk, pests cause significant physiological damage to trees, contributing to their death. Spring and summer

phenological groups of stem pests are distinguished according to the terms of development. Insects that belong to the spring phenological group inhabit trees in April-May, and their young generation flies out at the end of June-July. Pests of the summer phenological group inhabit trees in June-August, their offspring, as a rule, remain to winter under the bark or in the wood and finish development the following year or even later.

Bark beetles on conifers: *Tomicus piniperda* L., *Tomicus minor* Hartig, *Ips sexdentatus* Boerner, *Trypodendron lineatum* Ol., *Ips acuminatus* Qum., *Ips typographus* L., *Ips dublicatus* S., *Pityogenes chalcographus* L., *Dendroctonus micans* Kug.

Bark beetles on hardwoods: *Scolytus intricatus* Ratz., *Xyleborus dispar* Fabr., *Scolytus scolytus* F., *Scolytus ratceburgi* Jans., *Hylesinus crenatys* F., *Hylesinus fraxini* Panz., *Monochamus galloprovincialis* Ol., *Acanthocinus aedilis* L., *Spondylis buprestoides* L., *Monochamus sutor* L., *Phaenops cyanea* Fr., *Anthaxia quadripunctata* L., *Cossus cossus* L., *Zeuzera pyrina* L.

Task. Describe cycles of trunk insect development and fill the table 6. Do next step:

1. Provide the examples of trunk insects of deciduous tree species.
2. Provide the examples of trunk insects of coniferous tree species.

Table 6. Trunk insects of deciduous and coniferous tree species

Tree species	Trunk insects

References:

[2, 27, 28, 29, 30,32]

Questions:

1. What pests of trunk and branches do you know?
2. Which parts of wood cross section do you know?
3. What damage do pests of trunks and branches cause to trees?
4. Name the features of trunk pests of *Lepidoptera*.
3. Name the features of trunk pests of *Hymenoptera*.
4. 5. Name the features of trunk pests of a number of *Coleoptera*.
6. Give a detailed life cycle of *Dendroctonus micans*.
7. Give a detailed life cycle of *Xyleborus dispar*.
8. Give a detailed life cycle of *Tomicus minor*.
9. Give a detailed life cycle of *Tomicus piniperda*.
10. What parts of bark beetle gallery do you know?
11. What different between polygamy and monogamy?
12. Who is in the larval stages?

PRACTICAL WORK 6
CLASSIFICATION OF DISEASES

The purpose of practical work. To learn viral and bacterial diseases.

Theoretical provisions.

A disease is a violation of the normal metabolism of cells, organs and the whole plant, caused by the influence of a pathogen or adverse environmental conditions and can lead to a decrease in the productivity of woody plants or to their complete death.

There are infectious and non-infectious types of diseases of woody plants. Non-infectious diseases are caused by unfavorable environmental conditions due to sharp fluctuations and violations of the regime of humidity, air and soil temperature, insufficient lighting and soil nutrition, exposure to poisonous substances, inconsistency in plant nutrition conditions.

Infectious diseases caused by fungi (mycoses), bacteria (bacteriosis), viruses (viruses), mycoplasmas, flower parasites and nematodes. The most common are fungal diseases of plants (mycosis).

Most plant diseases – around 85 percent – are caused by fungal or fungal-like organisms. However, other serious diseases of food and feed crops are caused by viral and bacterial organisms. Certain nematodes also cause plant disease. Some plant diseases are classified as “abiotic”, or diseases that are non-infectious and include damage from air pollution, nutritional deficiencies or toxicities, and grow under less than optimal conditions.

Viruses and bacteria come in different shapes and sites, but bacteria are usually about 100 times bigger.

Virus (fig. 5), infectious agent of small size and simple composition that can multiply only in living cells of animals, plants, or bacteria. ***Viruses*** are intracellular (inside cells) pathogenic particles that infect other living organisms. The name is from a Latin word meaning “slimy liquid” or “poison”.

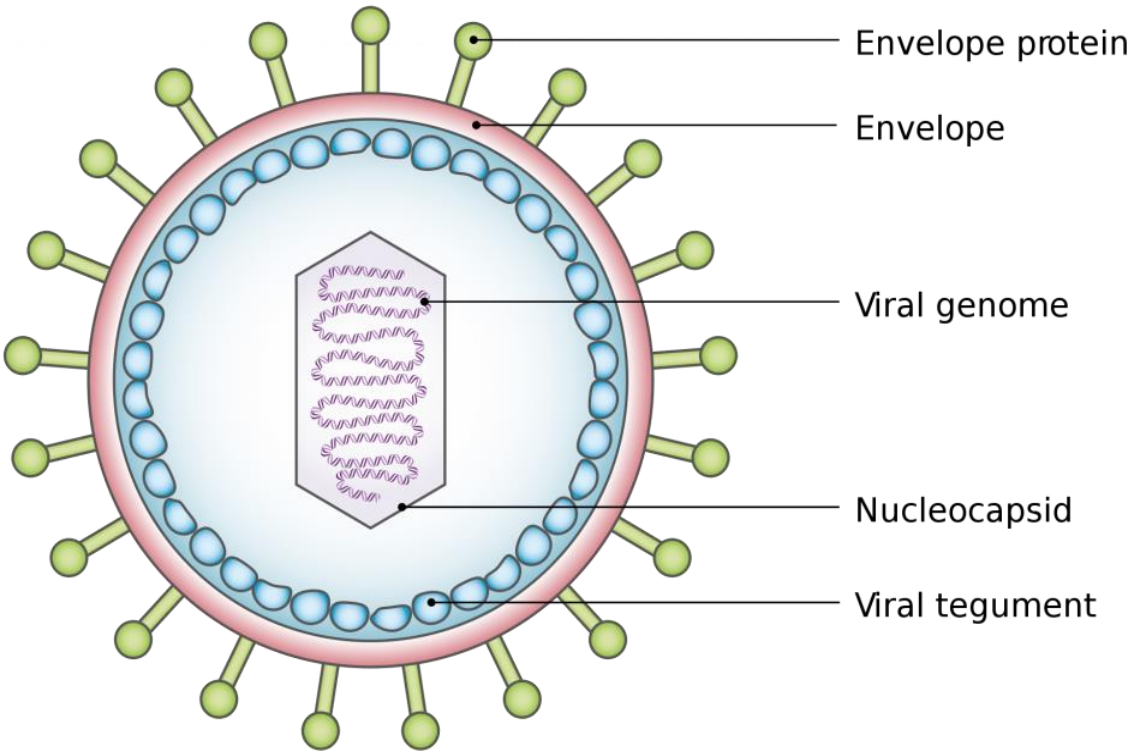


Figure 5. Virus cell anatomy

Bacteria (fig. 6) are microscopic, single-celled prokaryotic organisms, without a defined nucleus, that reproduce asexually by binary fission (one cell splitting into two). They occur singly or in colonies of cells. Bacteria are classified into two main groups based on cell wall structure, which can be determined by a simple staining procedure called the Gram stain. Gram-negative bacteria stain red or pink and Gram-positive bacteria stain purple. The difference in colour is directly related to the chemical composition and structure of their cell walls. The cells can be rod-shaped, spherical, spiral-shaped or filamentous. Only a few of the latter are known to cause diseases in plants. Most bacteria are motile and have whip-like flagella that propel them through films of water.

Bacteria only become active and cause problems when factors are conducive for them to multiply. They are able to multiply quickly. Some factors conducive to infection include:

- high humidity;
- crowding; poor air circulation;
- plant stress caused by over-watering, under-watering, or irregular watering;

- poor soil health;
- deficient or excess nutrients.

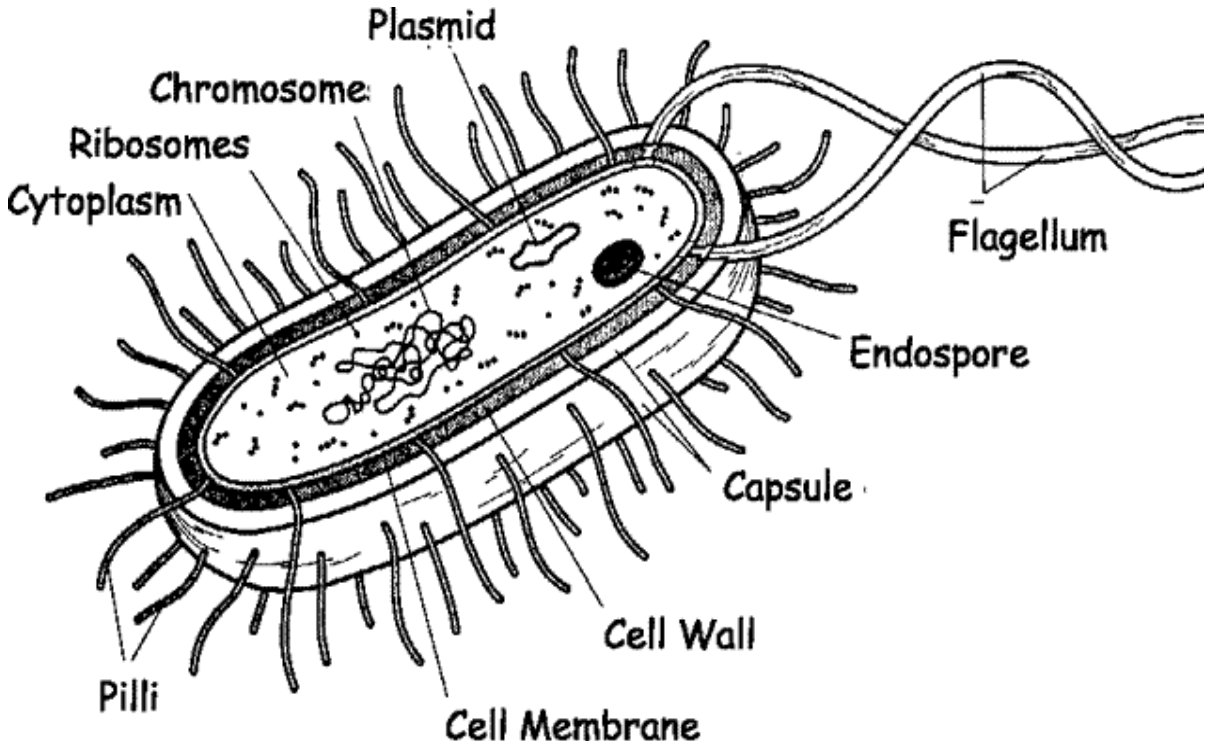


Figure 6. Bacteria cell anatomy

The biggest difference between these two groups is that bacteria are considered living things and are made of cells, whereas viruses are not (and are not made of cells).

Bacteria are unicellular organisms. They are ubiquitous on Earth.

Viruses are not in the organism classification scheme, as they are not considered living things. They are not made of cells like organisms; instead, they are generally composed of a protein coat surrounding genetic material – deoxyribonucleic acid (DNA) or ribonucleic acid (RNA). They nor can they reproduce independently.

Viruses are generally parasitic in some way. Most tend to damage their hosts. Some bacteria do this, but many do not.

Bacteria reproduce by binary fission, while viruses must use host cells to create more viruses.

Viruses will even attack bacteria.

The most common are the following consequences of diseases:

- dying of a plant or its individual parts, wilting.

- complete or partial destruction of individual parts plants (rot, spots, ulcers, pustules, frostbite cracks).

- accumulation of fungy mycelium and spores (mummification, plaques).

- change in the shape of plant parts (deformation, curliness, curvature of branches, fasciation).

- change in color of plant parts (mosaic, chlorosis).

- neoplasms on the affected organs of plants ("witches brooms", growths, tumors).

- discharge in places of damage and damage to plants (gum and resin discharge).

Task. Describe types of bacterial diseases and fill the table 4. Do next step:

1. Describe different types of diseases. Describe signs and symptoms bacterial disease. Describe viral disease symptoms.

4. Provide examples and describe 5 types of bacterial diseases.

5. Provide examples and describe 5 types of viral diseases.

Table 4. Bacterial and viral diseases

Diseases	Species
Bacterial	1. 2. 3. 4. 5.
Viral	1. 2. 3. 4. 5.

References:

[10, 26, 34, 35]

Questions:

1. Define the term "plant disease".
2. What is the difference between "types" and "symptoms" of woody plant diseases?
3. List the groups of types of diseases and give their main characteristics.
4. What is the prevalence, harmfulness and harm of diseases of woody plants? Explain these concepts by a concrete example.
5. Explain the essence and importance of diagnosing plant diseases.
6. Give some examples of morphological changes in a diseased plant.
7. What do you know about teratological phenomena in woody plants?
8. Give specific examples of infectious and non-infectious diseases.
9. List and describe the main causes of non-communicable diseases.
10. What are the features of the fight against non-communicable forest diseases?

PRACTICAL WORK 7
CLASSIFICATION OF FUNGI

The purpose of practical work. To learn different types of fungi.

Theoretical provisions.

The term fungus was directly adopted from the Latin word “fungus”. The scientific study of fungi is believed to have originated in 1836 with Miles Joseph Berkeley's publication. Earlier, taxonomists contemplated that fungi were closely related to plants, based on their similar morphology and growth habitat. Later, it was realized that fungi are a separate kingdom. Around 144,000 species of fungi have so far been formally described. But it can be 2,2–3,8 million species and therefore, the actual number is far from it was described.

Traditionally, fungal species have been distinguished by different approaches and concepts based on morphology, physiology, biochemistry or reactions to chemical tests. Classification based on phenotypic characters is the most common traditional method used in defining fungi.

Most of the organelles present in fungal cells are similar to those of other eukaryotes. Fungal nuclei are usually small (< 2 μm diameter). Fungi have been found to possess between 6 and 21 chromosomes. Many fungi (*Ascomycota*) have a life cycle that is predominantly haploid, while others (*Basidiomycota*) have a long dikaryotic phase.

Chytridiomycota is the simplest and most primitive *Eumycota*, or true fungi. They produce gametes and diploid zoospores that swim with the help of a single flagellum.

The ecological habitat and cell structure of chytrids have much in common with protists. Chytrids usually live in aquatic environments, although some species live on land. Some species thrive as parasites on plants, insects, or amphibians, while others are saprobes.

The zygomycetes are a relatively small group of fungi belonging to the phylum *Zygomycota*. They include the familiar bread mold, which rapidly propagates on the surfaces of breads,

fruits, and vegetables. Most species are saprobes, living off decaying organic material; a few are parasites, particularly of insects.

The majority of known fungi belong to the phylum *Ascomycota*, which is characterized by the formation of an ascus (plural, asci), a sac-like structure that contains haploid ascospores.

Many ascomycetes are of commercial importance. Some play a beneficial role, such as the yeasts used in baking, brewing, and wine fermentation. Other ascomycetes parasitize plants and animals, including humans.

The fungi in the phylum *Basidiomycota* are easily recognizable under a light microscope by their club-shaped fruiting bodies called basidia (singular, basidium), which are the swollen terminal cell of a hypha. The basidia, which are the reproductive organs of these fungi, are often contained within the familiar mushroom, commonly seen in fields after rain. These mushroom-producing basidiomyces are sometimes referred to as “gill fungi” because of the presence of gill-like structures on the underside of the cap. The “gills” are actually compacted hyphae on which the basidia are borne. This group also includes shelf fungus, which cling to the bark of trees like small shelves. In addition, the basidiomycota includes smuts and rusts, which are important plant pathogens; toadstools, and shelf fungi stacked on tree trunks. Most edible fungi belong to the phylum *Basidiomycota**.***

Imperfect fungi are those that do not display a sexual phase. They are classified in the form phylum *Deuteromycota*.

They form visible mycelia with a fuzzy appearance and are commonly known as mold.

Task. Describe different types of fungi. Fill the table 4. Do next step:

1. Provide examples and describe 5 species of *Chytridiomycota*.
2. Provide examples and describe 5 species of *Zygomycota*.
3. Provide examples and describe 5 species of *Ascomycota*.
4. Provide examples and describe 5 species of *Basidiomycota*.
5. Provide examples and describe 5 species of *Deuteromycota*.

6. Sign the main parts of a fungus (fig. 7).

Table 4. Species of fungi

Phylum	Species
Chytridiomycota	1. 2. 3. 4. 5.
Zygomycota	1. 2. 3. 4. 5.
Ascomycota	1. 2. 3. 4. 5.
Basidiomycota	1. 2. 3. 4. 5.
Deuteromycota	1. 2. 3. 4. 5.

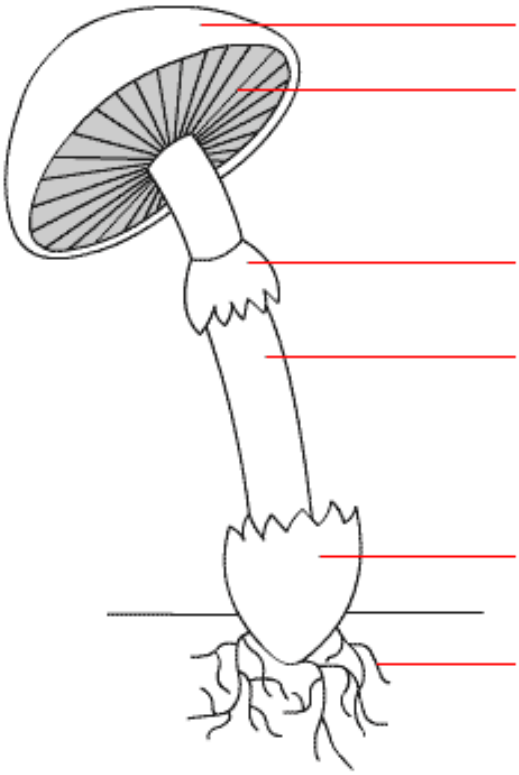


Figure 7. Parts of a fungus

References:

[10, 26, 34, 35]

Questions:

1. What is the importance of fungi in forest ecosystems?
2. What characteristic cause that places fungi in a different kingdom?
3. When was the first scientific study of fungi originated?
4. How fungi are divided according to the method of nutrition?
5. How many species of fungi have so far been formally described?
6. How many actual number of fungi species are in the world?
7. How many chromosomes have been found in fungi?
8. Describe a life cycle of different phyla of fungi.
9. Describe fungal reproduction.
10. What common phyla of fungi in the forests?
11. What part of fungus do you know?
12. What types of fungi cause stem rot?
13. What types of fungi cause root rot?

PRACTICAL WORK 8
SPREAD OF WOODY PLANT ROTS

The purpose of practical work. To learn rots of woody plants.

Theoretical provisions.

Rots are caused by some species of fungi. Rot diseases are characterized by plant decomposition and putrefaction. The decay may be hard, dry, spongy, watery, mushy, or slimy and may affect any plant part.

Diseases that infect underground plant parts are prevalent on both herbaceous and woody ornamental plants. They can be caused by fungi, bacteria or soil-borne nematodes. Infections that lead to disintegration of underground tissues are difficult to manage because they are not visible. The symptoms are thus typically expressed late in the stage of extensive infestation when disease has progressed beyond control. Lastly, management is difficult because soil treatments are ineffective. Some of the more severe pathogens are those that can persist for long periods without a living host. These survive in a dormant state or as resistant structures capable of surviving in the environment until they meet their next susceptible host.

Rhizoctonia and *Phytophthora* are fungi rots. These two fungi can attack the root systems of many different plants. *Rhizoctonia* prefers drier soil conditions, but in the greenhouse it can produce an aerial web blight that infects foliage under high humidity. Below ground, *Rhizoctonia* may infect roots and stems and produce reddish cankers. *Phytophthora* is a water mold fungus that can be active in conditions of free moisture or of flooding. Both fungi can produce damping-off disease, a name given to conditions where tender seedlings die from root and stem soil line infections. Bulb rots occur on plants with underground storage organs. Because these organs are often sites for storage reserves and are high in carbohydrates, they are especially susceptible to underground rots. Often the initiation of a bulb rot is due to a wound created by an insect or by mechanical means. This opportunity lowers the plant’s defence and allows for colonization by bacteria or fungi.

Bacteria can only enter the host tissue through wounds, but bacterial soft rots can be very destructive. These may originate in the leaves where bacteria enter and migrate to the bulb or rhizome or directly at the storage organ. Often a foul smell accompanies a bacterial soft rot infection.

Crown and collar rots occur at the soil line where the plant emerges. In this zone, the plants must be able to withstand the freeze-and-thaw cycle as well as the mechanical abrasion of soil particles. When wounds are produced, fungi and bacteria can invade the host tissue. A crown rot is typically associated with herbaceous plants. The tissue may turn brown to black in the localized area around the soil line. The discoloration may migrate upward and downward around the outside of the tissue from the point of infection. Eventually, when the pathogen has almost completely encircled the stem, the plant will begin to show wilting and dieback symptoms. Collar rots are typically associated with the woody stems of trees and shrubs at the soil line. Poorly drained soils and nutrient deficient soils can lead to plants being more susceptible to collar rots. As the pathogen enters a host tissue at the soil line, it may grow down into the roots where it can cause extensive damage. Control of these types of diseases is very difficult.

Phellinus pini is a fungal plant pathogen that causes tree disease commonly known as "red ring rot" or "white speck". This disease extremely common in the conifers, decays tree trunks, rendering them useless for lumber. *Phellinus pini* most often affects Scots pine, but it can develop on larch, yew, fir, pseudotuse, cedar. It is a rot of the heartwood. Signs of the fungus include shelf-shaped fruiting bodies protruding from the trunks of trees. Spores produced on fruiting bodies are blown by the wind and go on to infect other trees. Fruiting bodies are found at a height of up to 8 meters.

Fomitopsis pinicola is a stem decay fungus common on softwood and hardwood trees. The species is common throughout temperate Europe and Asia. It causes yellowish-brown core and sapwood trunk rot. It occurs on dead or severely weakened trunks of spruce and other conifers, as well as on deciduous tree species.

Growing trees become infected with basidiospores due to mechanical damage, even minor.

Phaeolus schweinitzii causes butt rot on conifers such as Douglas-fir, spruce, fir, hemlock, pine, and larch. It is native to North America and Eurasia The fruiting bodies appearing in late summer or fall. They are yellow with darker brown centres, with orange to pale margins on young specimens. They may grow beyond 25 cm in diameter. As the fruiting bodies age, the pore surface turns from yellow to greenish yellow, the top becomes darker, and the yellow-brown flesh becomes harder and more wood-like. The pores bruise brown. The spores are white, elliptical, smooth. This fungus causes brown rot, which degrades the cellulose. Infection with the causative agent of rot occurs through the roots and mycelium when in contact with diseased trees. From diseased roots, the rot passes into the trunk and rises along it to a height of 2 m.

Fomes fomentarius is a species of fungal plant pathogen found in Europe, Asia, Africa and North America. The species produces very large polypore fruit bodies which are shaped like a horse's hoof and vary in colour from a silvery grey to almost black, though they are normally brown. It grows on the side of various species of tree, which it infects through broken bark, causing rot. The species typically continues to live on trees long after they have died, changing from a parasite to a decomposer. It suppresses the white "marble" core and sapwood stem rot. The fungus affects the trunks of beech, ash, birch, aspen, poplar, willow, hornbeam, alder, cherry, maple and many other deciduous species. Trees are infected with basidiospores due to frost cracks, mechanical damage to the trunk and places of broken bough.

Laetiporus sulphureus is a species of bracket fungus found in Europe and North America. Its fruit bodies grow as striking golden-yellow shelf-like structures on tree trunks and branches. Old fruitbodies fade to pale beige or pale grey. The undersurface of the fruit body is made up of tubelike pores. Fruit bodies are annual, flat, collected in groups. *Laetiporus sulphureus* is a saprophyte and occasionally a weak parasite, causing brown cubical rot in the heartwood of trees on which it grows. This fungus is found on the trunks of oak, ash, beech, willow, acacia, maple, cherry, walnut, larch, fir, spruce, cedar and other woody plants.

Phellinus igniarius lives by saprotrophic nutrition, in which the lignin and cellulose of a host tree is degraded and is a cause of white rot. The fungus forms perennial fruiting bodies that grow as woody-hard, hoof or disc-shaped brackets from the bark of the infested living tree or dead log. The tree species is often willow but it may be commonly found on birch, aspen, hornbeam and alder and other broad leafed trees. Unlike most fungi it has a hard woody consistency and may persist for many years, building a new surface layer each year. At first, the affected wood turns brown, and then acquires a yellow-white color. The fungus causes central rot of trunks and thick branches.

Daedalea quercina is found in Europe, Asia, Northern Africa and Australasia. This fungus causes dark brown core-synchymal stem rot of oak. The fungus affects old trunks of common oak with mechanical damage, but it is most often found on stumps and felled processed wood of oak, chestnut, alder and beech. Trees are infected with basidiospores through wounds and broken branches.

Fomitopsis betulina is a common bracket fungus and grows almost exclusively on birch trees. The brackets grow on the bark of the tree, and these fruit bodies can last for more than a year. The fungus causes red-brown core and sap rot of birch. The fungus is widespread and affects only birch trunks. First, the core part of the trunk is destroyed, then the sapwood.

Armillaria mellea is a plant pathogen. It causes white sapwood or root rot of coniferous and deciduous tree species. The symptoms of infection appear in the crowns of infected trees as discoloured foliage, reduced growth, dieback of the branches and death. It is found on more than 200 species of woody and shrubby plants in all parts of the world. The mushrooms are edible. *Armillaria mellea* grows typically on hardwoods but may be found around and on other living and dead wood or in open areas.

Heterobasidion annosum causes one of the most destructive diseases of conifers. The disease caused by the fungus is named root rot. Also *Heterobasidion annosum* leads core or core-sapwood rot of conifers. The fungus affects Scots pine, spruce, larch, Weymouth pine, and fir. It is occasionally found on some soft-leaved tree species of plants, for example, on the bank, aspen, aspen.

Agrobacterium radiobacter is the causal agent of crown gall disease (the formation of tumours) in over 140 plant species. It is a rod-shaped soil bacterium. The pathogen affects apple, pear, plum, cherry and some other tree species. Infection of the roots occurs in the soil when they are damaged by rodents and insects, as well as during transplanting when the roots are cut with non-disinfected tools. When affected by the causative agent, wounds and tumors of various sizes appear on the roots, which are formed as a result of the growth of parenchymal tissue of the secondary cortex. Over time, the tumors become woody.

Tasks. Describe root and stem rot of woody plants. Do next step:

1. Give the classification of woody plant rot by etiology, color, location and structure.
2. Get acquainted in detail with the causative agents of root rot, give the main signs of their manifestation and prognosis.
3. Get acquainted in detail with the causative agents of stem rot, give the main signs of their manifestation and prognosis.

References:

[10, 26, 34, 35]

Questions:

1. What plant parts can be affected by fungi or bacterial rots?
2. Give a brief description *Phellinus pini.*
3. Give a brief description *Fomitopsis pinicola* and *betulina.*
4. Give a brief description *Phaeolus schweinitzii.*
5. Give a brief description *Fomes fomentarius.*
6. Give a brief description *Laetiporus sulphureus.*
7. Give a brief description *Phellinus igniarius.*
8. Give a brief description *Daedalea quercina.*
9. Give a brief description *Armillaria mellea.*
10. Give a brief description *Agrobacterium radiobacter.*
11. Give a brief description *Heterobasidion annosum.*

PRACTICAL WORK 9
CLASSIFICATION OF WEEDS

The purpose of practical work. To learn classification of weeds.

Theoretical provisions.

Thanks to wide inter-row spaces and open canopy in the early phases of establishment, forest nurseries and plantations represent ideal places of floristically rich and diverse weed flora. Weeds have an exceptional capacity of adaptation to environmental conditions because most produce vast quantities of seeds, which enable great expansion.

Although the geographic weed distribution and composition depends mainly on climate factors, the vegetation within each climate region is differentiated under the effect of edaphic factors. The soil physical and chemical properties, as well as climate conditions, have the primary significance for both cultivated plants and weeds.

However, all weeds do not have equal significance. When considering weed control attributes, perennial weeds present are far greater challenge due to difficulties employing mechanical means, because perennials are often stimulated to grow and disperse even more intensively.

The problem of forestry weeds came to the fore in recent years as more and more attention has been paid to establishing and restoring forests. In afforested areas, luxuriate development of weed vegetation, can imperil the survival and development of young seedlings. Harmful effects of weeds are reflected not only in the subtraction of basic living conditions such as humidity, light and nutrients already undergo a poor growth and receiving of seedlings.

Compared to cultivated plants, weedy plants show considerable plasticity in relation to numerous ecological factors. One of the most important weed traits is the expressed adaptation ability. Another important weed trait is the pronounced resistance to unfavourable environmental conditions (drought, moisture, wind etc.). Many weeds are resistant to plant diseases and pests. In addition, one of the weed traits is the periodicity of germination.

Very often weed seeds do not germinate at once, but rather in different time periods, and it is hard to control weeds simultaneously. In addition, many weeds produce an enormous quantity of seed, which makes it easier for them to spread and expand in space.

Many of invasive weeds species are exotic, but many native species also proliferate when given disturbed soils and protected environments. Once such weeds are introduced, they are very costly to eradicate and can inflict serious harm on forest sites.

Annual weeds that live only for a season or a year and complete their life cycle in that season or year are called as annual weeds. These are small herbs with shallow roots and weak stem. Produces seeds in profusion and the mode of propagation is commonly through seeds. After seeding the annuals die away and the seeds germinate and start the next generation in the next season or year following. Most common field weeds are annuals.

Biennials weeds complete the vegetative growth in the first season, flower and set seeds in the succeeding season and then die. These are found mainly in non-cropped areas.

Perennials live for more than two years and may live almost indefinitely. They adapted to withstand adverse conditions. They propagate not only through seeds but also by underground stem, root, rhizomes, tubers etc.

An ***invasive species*** can be any kind of living organism – an amphibian (like the cane toad), plant, insect, fish, fungus, bacteria, or even an organism's seeds or eggs – that is not native to an ecosystem and causes harm. They can harm the environment, the economy, or even human health. Species that grow and reproduce quickly, and spread aggressively, with potential to cause harm, are given the label "invasive".

There are numerous measures and procedures for weed control in forestry today, but in order to fight weeds successfully, they should consist of different care and control measures.

There are the six classifications of weed control measures: preventive, mechanical, physical, mulches, biological weed control, herbicides.

There is the Law of Ukraine on plant quarantine which determines the general legal, organizational, financial and

economic basis of plant quarantine, activities of the state bodies, enterprises, institutions, organizations, officials and citizens aimed at preventing the entry and spreading of dangerous pests, plant diseases and weeds which are not present in the territory of Ukraine.

Tasks. Describe classification of weeds and invasive species. Fill the table 5 and 6. Do next step:

1. Provide examples and describe 5 species of annual weeds, biennials, perennials (shallow rooted perennials, deep rooted perennials).

4. Provide examples and describe 5 invasive species.

5. Describe effectiveness of treatments.

Table 5. Species of weeds or invasive plants

Plants	Species
Annual weeds	1. 2. 3. 4. 5.
Biennials weeds	1. 2. 3. 4. 5.
Perennial weeds	1. 2. 3. 4. 5.
Invasive species	1. 2. 3. 4. 5.

Table 6. Effectiveness of weed treatments

Treatment alternatives	Plants				Potential environmental impacts
	Annual	Biennials	Perennial	Wood species	
Herbicides					
Cutting					
Cultivation					
Mulches					

References:

[6, 14, 16, 17, 24]

Questions:

1. What is the concept of weeds in forestry?
2. Give the properties of weed species.
3. List and describe highly invasive plant species of Ukraine.
4. Give a foundation of weed control in forestry.
5. What are the treatment alternatives of weed types?
6. Haw to use pesticides to control pest population.
7. Explain the negative impact of chemical care and application of pesticides on the forest.
8. List the features of annual, biennials, perennials weeds.
9. Provide a brief description of the Law of Ukraine on plant quarantine.
10. Give the definition of plant quarantine, special quarantine regime and quarantine object.
11. What type of weed treatments do you know?
12. What effectiveness of weed treatments?
13. What potential environmental impacts due to different weed treatment alternatives?
14. Give examples of herbicides.
15. What is mulches?
16. What different between annual and perennial weeds?

PRACTICAL WORK 10
INSECTS AND DESEASES OF THE MAIN TREE SPECIES

The purpose of practical work. To learn insects and diseases of the main tree species

Theoretical provisions.

The forests of Ukraine are formed by more than 30 types of tree species, among which the dominant *Pinus silvestris*, *Quercus robur*, *Fagus silvatica*, *Picea abies*, *Betula pendula*, *Alnus glutinosa*, *Fraxinus excelsior*, *Carpinus betulus*, *Abies alba*.

Young plants grown in nurseries are very sensitive to adverse external conditions and susceptible to infectious diseases. Minor damage can lead to drying out or damage by pathogens. Pathogens of seedlings affect roots, stems, cotyledons, needles, and leaves.

Diseases of needles and leaves are common in nurseries, plantings of green zones, protective and decorative plantings. They are diverse in character and origin. Diseases of needles and leaves are caused by fungi, bacteria, viruses and non-parasitic factors. The most common diseases are shutte, powdery mildew, spotting, leaf deformation, etc. These diseases are especially dangerous for young plants and often lead to their death. With mild damage, seedlings or young plants weaken, reduce growth, which often contributes to the development of even more dangerous diseases.

In adulthood, the harmfulness of diseases of leaves or needles is less; have little effect on growth, but create a constant threat of accumulation of infection to damage young plants in nurseries. The disease of the leaves is especially widespread after damage to plants by phytophagous insects or due to adverse climatic factors.

Diseases of branches and trunks are very diverse. They affect trees and shrubs of different ages - from young seedlings to old specimens of trees, among them necrotic and vascular diseases are very common.

Task. Describe possible insects and diseases of the main tree species and fill the table 8. Do next step:

1. Brief description of the main tree species.

2. Characteristics of insects with the cycle of their seasonal development.

2.1. What part of the tree is affected?

2.2. The main measures of struggle.

3. Characteristics of diseases (viral, bacterial, fungal) with the cycle of their seasonal development.

3.1. What part of the tree is affected?

3.2. The main measures of struggle.

References:

[6, 17, 26–35]

Questions:

1. Give examples of the most common pests of *Quercus robur* L.
2. What parts of *Quercus robur* L. are affected?
3. Give examples of the most common pests of *Pinus sylvestris* L.
4. What parts of *Pinus sylvestris* L. are affected?
5. Give examples of the most common pests of *Betula pendula* Roth.
6. What parts of *Betula pendula* Roth. are affected?
7. Give examples of the most common pests of *Acer platanoides* L.
8. What parts of *Acer platanoides* L. are affected?
9. Give examples of the most common pests of *Aesculus hippocastanum* L.
10. What are the consequences of the activities of *Quercus robur L.* pests?
11. What are the consequences of the activities of *Pinus sylvestris* L. pests?
12. What are the consequences of the activities of *Betula pendula* Roth. pests?
13. What are the consequences of the activities of *Acer platanoides* L. pests?
14. What are the consequences of the activities of *Aesculus hippocastanum* L. pests?

Table 8. Insects and diseases that parasitize and destroy the main tree species in East Europe

Parts of tree	Insects	Nematodes	Diseases	Rot	Fungi
***Quercus robur* L.**					
Reproductive plant part					
Fruit					
Leaves					
Bark					
Bast wood					
Root					
***Pinus sylvestris* L.**					
Reproductive plant part					
Fruit					
Needles					
Bark					
Bast wood					
Root					
***Betula pendula* Roth.**					
Reproductive plant part					
Fruit					
Leaves					
Bark					
Bast wood					
Root					
***Acer platanoides* L.**					
Reproductive plant part					
Fruit					
Leaves					
Bark					
Bast wood					
Root					
***Aesculus hippocastanum* L.**					
Reproductive plant part					
Fruit					
Leaves					
Bark					
Bast wood					
Root					

INDIVIDUAL WORK 1
METHODS OF INTEGRATED PEST MANAGEMENT

The purpose of practical work. To study methods of Integrated Pest Management

Integrated Pest Management (IPM) is an environmentally friendly and cost effective approach that utilizes a variety of preventative measures, cultural controls, and direct control measures to promote plant health. No single activity in an IPM program is effective on its own; rather, all of the components of the program contribute to plant health and when used together, effectively keep pest problems below a tolerable threshold. The first and most important step in establishing and maintaining a healthy forest is proper forest management. Planting the appropriate tree species for the site, managing competing vegetation, maintaining appropriate stocking, minimizing injury and stress, and adhering to sound silvicultural methods is the first step in preventing disease and insect problems, and minimizing the impacts of stress agents. In urban forests, proper tree care including water, fertilization, pruning, mulching, and correct species selection will promote long-lived trees that provide many benefits. An important component of proper forest management and tree care is monitoring the health of the forest and trees within it. Because of the difficulties encountered when managing forest health problems (as discussed above), it is best to detect and mitigate problems early and when they occur at small, localized levels. When an outbreak or epidemic occurs, foresters are often left with very few effective control options. An awareness of the health of your forest, the health of trees in the surrounding area, past predisposing factors, and any changes in the forest community that could throw the natural cycle out of balance is critical to prevent widespread and severe damage by pests. Foresters have a variety of methods at their disposal to prevent, manage, and control pest problems.

The following approaches can all be used as part of an integrated pest management program:

1) Exclusion, otherwise known as quarantine, targets the introduction of forest pests. Quarantines may be difficult to

establish, but are usually the cheapest method of pest control. Quarantines are only effective when the pest is not already present in an area, and when natural or artificial boundaries can be established that can effectively prevent introductions. Internal quarantines are utilized to keep a pest inside of the area where the pest is already established. Laws and regulations forbid the export of potentially infested material out of the quarantine zone without certification. External quarantines are enacted in areas free of a certain pest and prevent the importation of potentially infested materials into the pest-free zone. Quarantines can be enacted at city, state, regional, and international levels, but can also be utilized on much smaller scales. For instance, growers can inspect seedlings at the time of planting for disease or insect problems carried in on nursery stock, and effectively exclude those pests from becoming introduced into the stand. Use of soil-less planting media in containerized nursery stock may prevent the introduction of soil-borne pathogens, and use of only local seeds and plant materials can avoid the establishment of non-native pests.

2) Eradication is utilized when a quarantine has failed. The ultimate goal of eradication is to completely eliminate the pest from an area so that an external quarantine can be established. But complete eradication is only possible when pest populations are small, or when the pest is highly sensitive to control measures. In forestry, this is rarely the case, so eradication is also referred to as sanitation. Sanitation seeks to reduce the pest population below acceptable levels, but usually does not result in complete elimination of the pest. Sanitation and eradication can be achieved through fumigation, crop rotation, destruction of infested/infected plants or plant parts, and destruction of potential hosts.

3) Protection is utilized to protect susceptible plants from attack, injury, or disease when a pest is present. Also known as prophylactic treatments, protective measures must be in place before the tree is attacked by the pathogen or insect. Typically, prophylactic treatments consist of a protectant pesticide that is sprayed onto the surface of the plant to prevent an infestation/infection from occurring. Protectant pesticides, because they reside on the plant surface, tend to wash off over time and must therefore be applied periodically while the pest is present.

However, some protectant pesticides have systemic properties that allow the chemical to be taken up into the plants vascular system where it may provide long-lasting protection. Protectant pesticides tend to be very effective, but are also among the most expensive control measures because of the need to constantly apply them, and the most likely to cause environmental damage or harm to non-target organisms. Because protectant pesticides need to be applied often and in large quantities, there is also an increased risk that the pest population will develop resistance to the chemical.

4) Cures, or therapeutic treatments, are available in certain cases that limit the damage to a tree that has become infected/infested by a pest, and may potentially eradicate that pest from the plant so further damage does not result. Cures cannot heal the tree, but they may allow recovery if the pest population is incapacitated, reduced, or eliminated. Therapeutic treatments usually come in the form of systemic pesticides that are injected into or taken up by the plant; translocation of the pesticide throughout the infested/infected plant is necessary for adequate control. The benefit of cures is that they can be applied only when needed (after the plant has been attacked), as opposed to prophylactic measures which must be continually applied to prevent an attack from occurring in the first place. This makes them more environmentally friendly, potentially more cost effective (over the long term), and reduces the risk of resistance development in the pest population. However, there are relatively few therapeutic options available in forestry, and they tend to be reserved for high-value trees (landscape trees and ornamentals) because of their high cost per plant.

5) Incomplete Resistance, also known as horizontal resistance or polygenic resistance, is a type of resistance that does not prevent infection/infestation from occurring, but limits the number of attacks or the extent of damage that occurs to the host. Trees with incomplete resistance may not be attacked by beetles as frequently as highly susceptible tree species, may have fewer infections by pathogens, or may have less severe symptoms/signs resulting from those attacks. Incomplete resistance is controlled by many plant genes; each gene partially contributes to plant defenses, but alone they provide little protection. Overall, incomplete resistance is the

best possible control option available if it is sufficient to keep damage below acceptable thresholds. The protection it provides is inexpensive, long-lasting, and durable. However, it does permit some damage to occur, and it is difficult to develop this type of resistance. Because many genes are involved, it can take many years (or generations) of plant breeding to achieve desirable results.

6) Complete resistance, also known as vertical resistance or monogenic resistance, is a type of resistance that either prevents infection/infestation completely, or prevents any damage from occurring after an attack occurs. Complete resistance is controlled by a single plant gene that confers 100 percent protection to the plant from a specific pest. Obviously this type of resistance is highly desirable, and can actually be developed quickly through genetic engineering. Occasionally, completely resistant individuals can be found in nature, and used to develop resistant plant varieties. However, initial development of a completely resistant plant variety can be very expensive. In addition, because complete resistance is only controlled by one gene, there is an increased risk that the pest population will evolve mechanisms to overcome that resistance, in which case the variety would become completely susceptible.

7) Avoidance is perhaps the cheapest and most effective option available to control pest problems, but there are few applications of avoidance available in forestry. The key to avoidance is to make the host unavailable or the environment unsuitable for pest attacks. For instance, plants can be planted earlier/later in the growing season to avoid the time of year when spores from a pathogen are produced. But because trees are long lived organisms, this type of avoidance is difficult to achieve in forestry. However, examples of avoidance include planting trees in microclimates where the environment is not suitable for infections to occur, or delayed planting of seedlings to allow pest populations to dissipate from a stand.

Tasks: Describe Damages couse insect and diseases, fill the table (supplement J and K). Implement recommendations for

1. Chemical pest control in the forest.
2. Cultural pest control in the forest.
3. Biological pest control in the forest.
4. Physical (mechanical) pest control in the forest.

References:

[1, 3, 5, 12, 15, 17, 18, 20]

Questions:

1. What are the main measures of integrated pest management?
2. Define ways of cultural pest control.
3. Define ways of mechanical method of IPM.
4. Define ways of chemical method of IPM.
5. Define ways of biological method of IPM.
6. Describe managing pasts with healthy soils.
7. Give a foundation of integrated pest management.
8. What do you reckon, what better to plant: mixed or pure forest?
9. Forest pathological surveys of areas for infection by stem pests.
10. Forest pathological examinations of plantations for the population of coniferous and leaf-eating pests.
11. Where are sites where borers are most likely to enter a tree?
12. Describe beneficial insects in the forest.
13. What birds and bats do you know for pest suppression?
14. List plants that attract beneficial insects.
15. What rules of introducing beneficial insects do you know?
16. Haw to control pests due to bats?
17. Haw to control pests due to birds?
18. Haw to attract of natural insect predators?

INDIVIDUAL WORK 2. THE CROWN CANOPY CLASSES, LEAF DEFOLIATION AND DISCOLORATION

The purpose of practical work. To make evaluate of the crown canopy trees.

Climate and weather fluctuations and changes are the most important environmental drivers of tree canopy defoliation, an indicator of forest health.

The crown canopy classes (after Kraft) are used as a criterion for selecting the trees, but only if the trees lack significant mechanical injuries. Social status is a measure of the height of a tree relative to the surrounding trees. Information on social status is useful as an aid to interpreting crown condition and increment data for the individual trees. Five classes of social status are recognized:

– dominant, including free-standing trees with upper crown above the general level of the canopy;

– codominant, which includes trees with crowns forming the general upper level of the canopy;

– subdominant, which includes trees extending into the canopy and receiving some light from above, but shorter than the dominant and codominant classes;

– suppressed, including trees with crowns below the general level of the canopy, receiving little direct light from above;

– dying trees.

Suppressed trees should not be equated with dying trees as, in a mixed-age stand, they represent potential future generations of trees.

Defoliation is defined as needle/leaf loss in the assessable crown when compared to a reference tree. Defoliation is observed regardless of the cause of foliage loss (for example, it includes damage by insects).

In order to evaluate the state of the crown, the needle/leaf losses are allocated to one of the five damage classes. These classes are “0” (0–10 % defoliation), “1” (10–25 % defoliation) and so on. A tree with more than 60 % and up to 100 % defoliation, which is still alive, is coded as “3”. The code “4” is reserved for dead trees.

The second important damage characteristic is foliar discolouration, i.e. in most cases, a yellowing of the needles or leaves. The percentage of discoloured needles is estimated in one of five classes.

The needle (leaf) loss classes and discolouration classes are plotted against each other to determine the final damage classes.

Tasks. Give the examples of defoliation and discoloration classes, and fill the table 9. Do next step:

1. Evaluate trees by Kraft classes. Show the crown canopy classes on the examples.
2. Study of defoliation classes. Establishing the dependence of the presence of pests and defoliation classes. Show the the examples of defoliation classes.
3. Study of discoloration classes. Establishing the dependence of the presence of pests and discoloration classes. Show examples of discoloration classes.

Table 8. Examples of defoliation and discoloration classes

Classes	Definition, %	Defoliation (foto)	Discoloration (foto)
0	0–1		
1	2–25		
2	26–60		
3	61–99		
4	100		

References:

[11, 13, 16, 19, 25]

Questions:

1. List and describe the crown canopy classes by Kraft.
2. How do you understand the terms "Leaf defoliation" and "Leaf discoloration"?
3. Describe the stages of "Leaf defoliation".
4. Describe the stages of "Leaf discoloration".
5. Describe the final damage classes for foliage (needle/leaf).

MAIN USED TERMS

Abdomen – the abdomen is the posterior section of the body (comprised of head, thorax, and abdomen) and encloses the gut and reproductive organs.

Abiotic – of or pertaining to the nonliving.

Acervulus – a small subcuticular or subepidermal cushionlike asexual fruiting body, without a covering of fungus tissue, producing conidia in a moist mass which escapes through a break in the host tissue.

Aeciospore – one of several kinds of spores prodirced by a rust fungus. Formed in and released from a fruiting structure called an aecium.

Afforestation – a set of measures to establish a forest on land, which has not been registered as a forest in the National Immovable Property Cadastre Information System.

Age of forest stand – biological age of trees of the dominant tree species of a forest stand. If trees of the dominant tree species in the forest stand are of different age, the age of the forest stand shall be determined according to the biological age of the cluster of trees that has the greatest wood supplies.

Alternate host – another host plant species required to complete development of an insect or pathogen.

Alternate host – one or the other of the two unlike host plants parasitized by a heteroecious fungus such as a typical rust fungus, i.e., either the white pine or gooseberry host of the white pine blister rust fungus.

Anthracnose – a type of plant disease which typically is a leaf and twig blight. Common on many hardwoods.

Apothecium – a cup or saucerlike sexual fruiting body which produces ascospores.

Ascogenous stage – the ascospore producing stage of an Ascomycete.

Ascomycete – a large group of fungi which are characterized by the free cell formation of spores, usually eight in number, in a saclike structure called an ascus.

Ascospore – a spore produced in the sexual or perfect fruiting body of an *Ascomycete*.

Asexual stage (imperfect stage) – either a vegetative stage or a reproductive stage in the life cycle of a fungus in which nuclear fusion is absent and in which reproductive spores are produced by mitosis or simple nuclear division.

Autoecious – pertaining to a fungus which completes its life cycle on one host.

Basal area of a forest stand is the total of basal areas of the first level (a cluster of the highest trees of a forest stand the height of which from the average height of trees of the level differs by not more than 20 per cent) tree trunks (in square metres) growing in the area of one hectare, at the height of 1.3 m from the root collar.

Basal cup – the cup-like remnant of a dwarf mistletoe infection which remains visible long after the disintegration of an aerial shoot.

Basic material is individual trees, a forest stand, parents of a tree family (trees from which progeny is obtained by controlled or open pollination of one identified parent used as a female, with the pollen of one parent or several identified or unidentified parents), a seed orchard, a clone (trees obtained from a single individual by vegetative propagation), or a clonal mixture (a mixture of individual clones in specific proportions).

Basidiomycete – a large group of fungi that are characterized by the production of spores, usually four, on a basidium.

Basidiospore – the spore produced by the sexual stage of the *Basidiomycetes*.

Basidium – a cell, usually terminal, in which nuclear fusion and meiosis occur and each of the four haploid nuclei pass into one of four forming spores.

Biocide – a wide spectrum poison which kills a great number and variety of organisms.

Biogeocenosis – an interrelated complex of living and inert components associated with each other by material and energy exchange; one of the most complex systems in nature.

Biotic – of or pertaining to living organisms.

Bivoltine is organisms that have two broods per year.

Blight – a general term for a plant disease causing rapid death or dieback.

Brood – all the individuals that hatch at one time from eggs laid by one series of parents. For a population of any species, it refers to all the offspring hatched at about the same time.

Broom – an abnormally dense mass of host branches and foliage in which the typical host growth pattern is lost.

Brown rot – a light to dark brown decay of wood that is friable and rectangularly checked in the advance stage. Caused by fungi that attack mainly the cellulose and associated carbohydrates. The residue is chiefly lignin.

Butt rot – a rot characteristically confined to the butt or lower trunk of a tree.

Cambium – the layer of cells that lies between and gives rise bycell division to the secondary xylem (wood) and the secondary phloem (inner bark).

Canker – a definite, relatively localized, necrotic lesion primarily of the bark and cambium.

Chlamydospore – a thick-walled asexual resting spore typically formed by many soilborne fungi.

Chlorosis – an abnormal yellowing of the foilage.

Chlorotic – abnormally yellow.

Chronic – pertaining to a condition that is of long duration.

Clear felling – a type of performance of the final felling. By such felling, the basal area of a forest stand or part thereof is reduced, within a year from its commencement, to the extent that it becomes smaller than the critical basal area.

Colonize – to establish an infection within a host or part of a host.

Conidia – an asexual spore of a fungus typically produced terminally on a specialized hyphae termed a conidiophore.

Conidiophore – a specialized hyphae which produces asexual spores called conidia.

Conk – the large, often bracket-like fruiting bodies of wood destroying fungi.

Cortex – the primary tissue of a first-year stem or root found between the epidermis and the primary vascular bundle.

Cover crop – a crop, natural or introduced, that is grown alternately with the main crop. Used to prevent erosion and improve soil characteristics.

Crawler – the active first-instar larva of a scale insect.

Cull factor – a calculated percentage of the amount of merchantable wood lost from a tree as a result of decay or other defect.

Cull – a seedling which is rejected because it does not meet certain specifications.

Cultivar – a variety, selected for one or more outstanding characteristics that is being cultivated and usually reproduced by asexual means to preserve genetic makeup.

Cultural practices – a general term for those routine nursery operations required to help seedling growth, i.e., plowing, watering, weeding, etc.

Damping-off – the killing of the seedling by microorganisms before emergence or the collapse of the seedling stem at ground level after emergence.

Decay – the decomposition of plant tissue by fungi and other microorganisms.

Decline – the gradual reduction in health and vigor as a tree is in the process of slowly dying.

Deforestation – human-induced conversion of a forest into another type of land use

Deforestation felling – a type of felling in a forest to implement activities due to which the type of land use is changed.

Deformations – curvature of branches and trunks, curliness of leaves, formation of blown fruits.

Diapause – is the delay in development in response to regular and recurring periods of adverse environmental conditions.

Dieback – the progressive dying, from the tip downward, of twigs, branches, or tops.

Dieback is the progressive dying of stems and branches from the tip downward.

Disease – a violation of normal metabolism in the plant under the influence of phytopathogens (viruses, bacteria, fungi) or adverse environmental conditions.

Disease – unfavorable change of the function or form of a plant from normal, caused by a pathogenic agent or unfavorable environment.

Dominant tree species – a species of trees that has the greatest wood supplies in the first level of a forest stand.

Echinulate – having many small spines or prickles.

Ectoparasite – a parasite (in particular, a nematode) which lives outside its host.

Elements of forest structure of biological significance – components of a forest that are important for the protection, distribution of biotopes and species, or provision of ecological functions.

Elytra – the anterior leathery or chitinous wing covers of beetles.

Endemic – a pest population that is at its usual normal balanced level within a region to which it is indigenous.

Endemic – native to the country or region.

Endoparasite – a parasite (in particular, a nematode) which lives inside its host.

Entrance court – the point of invasion of a disease organism into its host.

Epidemic – pertaining to pest populations that expand to a level causing disturbances of the normal relationships in the forest association, often to the point of causing economic loss. Epidemic is pertaining to a disease that has built up rapidly and reached injurious levels.

Epidermis – the outermost layer of cells on the primary plant body.

Exotic – introduced from another country or area.

Exudate – matter that oozes out or is secreted out.

Facultative saprophyte – an organism which is normally parasitic but which is capable of living as a saprophyte.

Fallow – cultivated land allowed lying idle or unplanted during the growing season.

Family – Single or group of genera that closely or uniformly resemble each other in general appearance and technical character.

Final felling – a type of felling to cut a forest stand at once or by several turns after reaching the final felling age or the final felling diameter.

Final felling age – the lowest age of the dominant tree species of a forest stand that must be reached in order to commence felling of the forest in the final felling.

Flaccid – deficient in turgor, limp, or flabby.

Flags – conspicuous dead branches with foliage remaining on because of rapid killing by adverse abiotic conditions, insects, or disease agents.

Fore wings – are the anterior pair (closer to the head).

Forecast – prediction of the level of spread and development of insects, mites, nematodes, rodents, weeds and plant diseases.

Forest damage – partial or complete loss of the growth potential of a forest stand due to the impact of pests, diseases, animals, humans, wind, snow, fire, and other similar factors.

Forest infrastructure – objects built or arranged in a forest for the purposes of forest management and protection, as well as recreation.

Forest inventory – obtaining of information regarding a forest and adjacent marshes, forest infrastructure objects, overflowing clearings, marshes and glades that are part of the forest and in the ownership or possession of the specific forest, and documentation of the obtained information.

Forest land – land covered by a forest, land under forest infrastructure objects, as well as overflowing clearings, marshes, and glades that are part of the forest and adjacent marshes.

Forest protection – measures for prevention or reduction of forest damage and consequences thereof.

Forest reproductive material – a seed unit (cones, fruits, and seeds obtained therefrom and intended for the growing of planting stock), parts of plants, or planting stock (from seed units, parts of plants, or plants from natural regeneration) of the tree species and their hybrids which are important for forestry purposes and intended for reforestation or afforestation.

Forest stand – a forest with uniform forest growth conditions, composition of tree species and age.

Frass – solid excrement of insects; wood residue left by boring insects.

Fruiting body – any of a number of kinds of reproductive structures that produce spores.

Fumigation – to apply vapor or gas to, especially for the purpose of disinfecting or destroying pests.

Fungi imperfecti – grouping of miscellaneous fungi which lack a known sexual stage and which are classified, therefore, according to the characteristics of their asexual stages.

Fungicide – chemical which is toxic to fungi.

Fungus mat – dense, leathery mass of fungus mycelium often formed in decayed wood by certain wood rotting fungi.

Gall – enlarged, swollen growth of plant tissue, a pronounced swelling on a woody plant caused by certain fungi, bacteria, insects, or nematodes.

Gallery – a passage, burrow, or mine excavated by an insect in plant tissue for feeding, oviposition, or exit.

Geniculate – bent abruptly at an angle, like a knee.

Genus – a group of species that have fundamental traits in common but that differ in other, lesser characteristics.

Germinate – to begin growth from a seed or spore.

Girdle – to destroy or remove the tissue, particularly living tissue in a rough ring around a stem branch or root.

Head – is the anterior section of the insect's body (comprised of head, thorax, and abdomen) and includes the mouth, eyes, and antennae (if present).

Heart rot – a decay characteristically confined to the heartwood.

Heteroecious – pertaining to a fungus that must pass a part of its life cycle on each of two different unrelated hosts, i.e., some rust fungi.

Hind wings – are the posterior pair (furthest from the head).

Honeydew – sugary liquid excretion of aphids and scales.

Host – a plant or animal on or in which a pathogen or insect exists.

Host range – all hosts which a particular pathogen attacks.

Host specific – a term used to describe certain disease organisms that attack only certain species of hosts.

Host – the plant on or in which a pathogen exists.

Host-specific – a term used to describe those pathogens that attack only certain species of hosts.

Hyaline – transparent, having no color.

Hypha – one of the filamentous threads that make up the fungus body.

Hypocotyl – that part of the axis of a developing embryo just below the cotyledons.

Hysterothecium – a specialized fruiting body of needle cast fungi that produces ascospores, is usually elongate, covered, and opens at maturity by a long slit.

Imperfect stage – that part of the life cycle of fungi in which only conidia and no sexual spores are produced.

Incipient rot – the early stage of wood decay in which the wood is invaded and may show discoloration but is not otherwise visibly altered.

Indigenous – native to a particular region or environment.

Infect – to invade and cause a disease.

Infest – to be present within an area in such numbers as to be a disease hazard.

Inoculate – to place a pathogen on or in a host in a position in which it is capable of causing a disease.

Inoculum – the spores, mycelium, sclerotia, or other propagules of a pathogen that initially infect a host or crop.

Integrated plant protection – comprehensive application of methods for long-term regulation of development and spread of pests to an intangible economic level based on the forecast, economic thresholds of harmfulness, action of beneficial organisms, energy saving and environmental technologies that provide reliable plant protection and ecological balance.

Intracellular – lying or growing within the cells.

Landscape felling – a type of felling to ensure the visibility and accessibility of landscape elements.

Larva – immature form of an insect such as a caterpillar, grub, or maggot, insects that undergo complete metamorphosis, like *Lepidoptera* whose larvae are called caterpillars, the larval stage follows hatching from an egg and precedes pupation. Compare to nymph. During the larval stage, the organism feeds and undergoes a series of molts until it is ready to pupate in order to metamorphosis in to the adult stage.

Latent infection – an established infection which does not show its presence.

Leaf spot – a leaf disease characterized by numerous distinct lesions.

Lesion – a defined necrotic area.

Macroconidia – the larger of two types of conidia produced by certain fungi, such as Fnsarium species.

Maggot – a legless larva without a well-defined head.

Methods of plant protection – methods by which plant protection is carried out (organizational and economic, agrotechnical, selection, physical, biological, chemical and others).

Microconidia – the smaller of the two types of conidia produced by certain fungi.

Microsclerotium – a very small (microscopic) sclerotium.

Mined foliage – needles or leaves in which the inner leaf tissues are eaten by insects.

Moribund – being in a dying state.

Mummification – replacement of plant organs with mycelium of the fungus.

Mycelial fans – similar in structure to mycelial felts but fan-shaped.

Mycelial felt – a mass of fungus filaments that are arranged in a flat plane and resemble a thin felt-like paper or cloth.

Mycelium – a mass of hyphae that form the vegetative filamentous body of a fungus.

Necrosis – death of plant cells usually resulting in darkening of the tissue.

Nymph – immature form of an insect resembling the adult except for incomplete wing development.

Nymph – in insects, which undergo incomplete metamorphosis. The nymph stage follows hatching from an egg and precedes the adult stage. During the nymph stage, the organism feeds and undergoes a series of molts until it is ready to metamorphosis in to the adult stage.

Obligate parasite – a parasite incapable of existing independent of live host tissue.

Oospore – the sexually produced resting spore of the water molds.

Other felling – a type of felling which is used if felling is necessary for the establishment and maintenance of the forest

infrastructure and delimiting boundaries, removal of dangerous trees, preservation of natural values.

Outgrowths (galls, caps, suvelvali) – pathological growth of plant organs with the formation of tumors.

Parasite – an organism living on, in, or with another living organism for obtaining food.

Parasite – an organism living on and nourished by another living organism.

Parts of plants – stem, leaf and root cuttings, explants or embryos for micropropagation, buds, layers, roots, scions, sets and any parts of a plant intended for the production of planting stock.

Pathoentomological surveillance is carried out to control the emergence, development and spread of forest pests and diseases, their foci, the condition of plantations, reviews and forecasts to assess possible threats and timely planning, effective organization and implementation of forest protection measures.

Pathogen – an organism that causes a disease.

Pathogenic – capable of causing a disease.

Perennial canker – the recurrent yearly killing back and healing over of the bark and cambial tissues of woody plants by certain disease organisms.

Perfect stage (sexual stage) – the stage in which the sexual spore stage is produced.

Perithecium – a closed flasklike sexual fruiting body formed by certain *Ascomycetes* in which ascospores are produced.

Pests – species of living organism (insects, mites, microorganisms, nematodes, rodents), capable of causing damage to plants, shrubs, trees, products of plant origin, the damage from which it is economically feasible to avoid.

Phelloderm – the parenchjmiatous type of tissue produced to the inside by the cork cambium.

Phellum – the suberized tissue produced by the cork cambium in the bark.

Phloem – the tissues of the inner bark responsible for the transport of elaborate foodstuffs.

Photolytic – pertaining to the chemical decomposition due to the action of sunlight (radiant energy).

Phycomycete – a group of lower fungi that includes the water molds.

Phytosanitary condition – set of pests, the level of abundance, intensity of development and potential threat.

Phytosanitary diagnostics – principles, methods, signs, technical means by which the species of insects, mites, nematodes, rodents, weeds and plant diseases are determined.

Phytosanitary diagnostics – principles, signs, methods, technical means by which the species of insects, plant diseases, nematodes, rodents and weeds are determined.

Phytosanitary diagnostics and supervision over the development, spread and harmfulness of harmful organisms is carried out by the central executive power, which implements the state policy in the field of plant protection.

Phytotoxic – a chemical that is toxic to plants.

Pitch tube – a tubelike accumulation of pitch around a bark beetle entrance hole on the bark of a tree.

Plant protection – a set of measures aimed at reducing crop losses and preventing the deterioration of agricultural and other plants, perennial and forest plantations, trees, shrubs, indoor vegetation, plant products due to pests.

Plant protection is the practice of managing weather, pests that damage or inhibit the growth of fruit, vegetable and other horticultural crops.

Plant protection products – preparations that contain one or more active substances and are used to protect plants or crop products from harmful organisms and the destruction of unwanted plants or parts of plants.

Plaques – mycelium and sporulation of fungi. Non-infectious plaques occur due to the deposition of dust particles on plant organs, industrial emissions, etc.

Pocket rot – a characteristic pattern of rot caused by certain fungi. The rot occurs in distinct, scattered pockets within the heartwood of a tree rather than in a distinct column.

Predator – an organism that attacks, kills, and feeds on other organisms.

Predicting the mass reproduction of pests and the spread of forest pathogens is to determine the potential threat of damage

or drying of plantations in order to timely implement preventive and extermination measures.

Predisposition – the effect of one or more environmental or biotic factors that makes a plant vulnerable to attack by a pathogen or insect.

Prolegs – fleshy false legs on abdomen of caterpillars.

Protection measures include a set **of measures** – forestry, biological, chemical, physical and mechanical, breeding and genetic, etc.

Pupa (pl. pupae) – inactive stage of an insect which undergo complete metamorphosis, like Lepidoptera, the pupal stage follows the larval stage and precedes the adult stage. A transition stage from larva to adult. The insect does not feed during this time, and is often encased in a cocoon.

Pustules – different size and shape sores and lesions.

Pycnidiospore – an asexual spore or conidium produced within a pycnidium.

Pycnidium – an asexual type of fruiting body, typically flask shaped, in which asexual spores or conidia are produced.

Pycniospore – a specialized spore produced in a pycnium by the rust fungi.

Reconstructive felling – a type of felling to cut an unproductive forest stand in a linear form or randomly.

Reforestation – a set of measures to regenerate a forest stand in a forest area where after felling or impact of other factors the basal area of a forest stand has become smaller than the critical basal area.

Resinosis – the unnatural and profuse flow or accumulation of resin from conifers injured or attacked by insects and disease.

Resistant – able to withstand without serious injury, attack by an organism, or damage by a nonliving agency but not immune from such attacks.

Rhizomorphs – a specialized thread- or cord-like structure made up of parallel hyphae with a protective covering.

Root crown – the uppermost portion of the root system where the major roots join at the base of the stem.

Rot – characterized by softening and destruction of certain parts of plant organs with loss of strength.

Sanitary felling – a type of felling to improve the health condition of a forest by felling trees damaged by forest diseases, pests, animals or otherwise damaged, felled, or broken by wind in a linear form or randomly.

Saprophyte – an organism using dead organic material as food.

Sclerotium – a firm frequently rounded multicellular resting structure produced by fungi.

Selection cut – a type of performance of the final felling. By such felling, the basal area of a forest stand is not reduced within a year from its commencement to the extent that it becomes smaller than the critical basal area.

Septate – having cross walls that divide hyphae or spores into a number of separate cells.

Septum – the cross wall which divides a hypha or spore into two or more distinct cells.

Seta – a bristlelike hair.

Sexual stage (perfect stage) – the stage in the life cycle of a fungus in which spores are produced after sexual fusion.

Site index – a classification unit for the description of the productivity of a forest stand, which is determined on the basis of the height of trees at a certain age.

Skeletonized foliage – leaves or needles in which insects from between the veins, leaving only the veins, have eaten the soft tissues.

Special regime of plant protection – special legal regime of local executive bodies and local governments, enterprises, institutions and organizations, aimed at localization and elimination of especially dangerous pests and diseases within the settlement, district, region, several regions.

Species – a natural group of (fungi, insects, and bacteria) in the same genus made up of similar individuals.

Spore – the reproductive structure of the fungi and other lower plants.

Sporulate – to produce and release spores.

Spots – are characterized by the formation on the organs of plants of spots of different size, shape, color and texture.

Spreader – a chemical additive used in the preparation of fungicide sprays to improve the distribution of the spray on the plant foliage.

Sticker – a chemical additive that is added to fungicide sprays to improve the fungicide's retention on the plant surface.

Stoma (pl. stomata) – a pore in the leaf epidermis, surrounded by two guard cells, leading into an intercellular space within the plant.

Stroma (pl. stromata) – a cushionlike body on or in which fungus fruiting bodies are formed.

Survey and accounting – is carried out in order to identify and establish the number of foci of pests and diseases of plantations and areas of plantations with impaired stability.

Susceptible – unable to withstand attack by an organism or damage by a nonliving agency without serious injury.

Sustainable forest management – management and use of a forest in such a manner and intensity which maintain the biological diversity, productivity, regenerative capacity, viability, and potential of the forest at present and in the future, its ability to fulfil the significant ecological, economic, and social functions on a local and global scale, as well as which do not cause damage to other ecosystems.

Symptoms – the noticeable evidence of disturbances in the normal development and life processes of the host plant.

Symptom – the evidence of disturbance in the normal development and function of a host plant, i.e., chlorosis, necrosis, galls, brooms, stunting, etc.

Systemic – affecting or distributed throughout the whole plant body.

Taproot – the primary descending root of a plant which the secondary or lateral roots branch.

Tar, mucus, gum disease – intense secretion of resin, gum and mucus at the site of injury.

Teliospore – the spore of the rust fungi from which the perfect stage of the basidium and basidiospore arise.

Telium – an aggregation of teliospores of the rust fungi.

Thinning is a type of felling to improve the composition of a forest stand and the growing conditions of trees of the remaining forest stand.

Thorax – the thorax is the middle section of the body (comprised of head, thorax, and abdomen). In adult Lepidoptera and Odonata, the wings and legs are attached to the thorax.

Tracheomycosis (vascular mycosis) – blockage of blood vessels by the mycelium of the fungus and its products.

Translocate – the transfer of elaborated food materials within the plant.

Tubercle – a small rounded projection from the surface of an insect.

Ulcers are the formation of wounds on plant organs, surrounded by influx. Large ulcers are called cancerous ulcers, and small – anthracnose.

Unproductive forest stand – a forest stand that is not efficient to grow due to insufficient increment of wood supplies, composition of tree species, or quality of trees.

Urediospores – one of the many spore stages produced by the rust fungi in their complicated life cycle. These spores are produced in a fruiting body called a uredium.

Uredium – one of the many types of fruiting bodies formed by the rusts in their complicated life cycle. Urediospores are formed in this fruiting body.

Variety – a subdivision of a species having a distinct, though often inconspicuous, difference and breeding true to that difference.

Vector – a carrier of a disease-producing organism.

Weeds – unwanted vegetation in lands, crops, plantings, which competes with them for light, water, nutrients, as well as contributes to the spread of pests and diseases.

Wetwood – a discolored, water-soaked condition of the heartwood of some conifers presumably caused by bacterial fermentation.

White rot – decay caused by fungi that attack all chief constituents of wood and leave a whitish or light colored residue.

Wilt – type of plant disease characterized by the sudden loss in turgor and collapse of the succulent parts of the affected plants.

Witches broom – an abnormally profuse, dense mass of host branches and foliage. This is a common symptom induced by dwarf mistletoes as well as other parasitic and abiotic agents.

Witch's broom – intensive growth of shortened shoots from dormant buds with the formation of a bush.

Withering – water imbalance in the plant with loss of turgor pressure. Withering can be caused by infectious or non-infectious factors. Infectious wilting (childhood seedling disease, blackleg) occurs as a result of various pathogens, most often fungi.

Xylem – the woody conducting tissues of the stem and root.

Young stand – a forest stand of coniferous trees, ashes, and oaks of up to 40 years of age, a forest stand of grey alders of up to 10 years of age, forest stands of other tree species of up to 20 years of age.

Zoospore – a motile free swimming spore produced by the water molds.

REFERENCES

1. Bea Maas et al. Bird and bat predation services in tropical forests and agroforestry landscapes. Cambridge Philosophical Society. 2015. URL : https://karp.ucdavis.edu/wp-content/uploads/sites/310/2016
/01/Maasetal_2015_Bio_Rev_PestControl.pdf

2. Bohumil Stary. Atlas of Insects Beneficial to Forest Trees, Elsevier. Amsterdam : Elsevier, 1988. Vol. 2. 100 p.

3. David G. James. Beneficial insects, spiders, and other mini-creatures in your Garden. Washington State University. 2014. URL : **Ошибка! Недопустимый объект гиперссылки.**

4. FAO Country Profiles: Ukraine. (2018). Available at: http://www.fao.org/countryprofiles/index/en/?iso3=UKR.

5. Forests. Manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests. Hamburg, Germany. 2010. URL : http://www.icp-forests.org/Manual.htm

6. Frank S., Bradley L., and Moore K. Integrated Pest Management, Chapter 8. 2018. URL : http://content.ces.ncsu.edu/8-integrated-pest-management-ipm

7. Glenn W. Peterson, Richard S. Smith Jr. Forest Nursery Diseases in the United States. Forest Service U.S. Department of Agriculture: California Agriculture Handbook. 1975. 131 p. URL : https://naldc.nal.usda.gov/download /CAT88208799/PDF

8. Global Forest Watch. Ukraine Country Profile. 2019. URL : http://www.globalforestwatch.org/country/UKR.

9. Global review of forest pest and diseases. A thematic study prepared in the framework of the Global Forest Resources Assessment. Food and Agriculture organization of the United Nations. Rome, 2009. 235 p.

10. Gregory S. C., Redfern D. B. Diseases and disorders of forest trees. London : The Stationery Office, 1998. 144 p. URL : https://www.planthealthcentre.scot/sites/www.planthealthcentre.scot/files/inline-files/FCFB016.pdf

11. Hanisch B., Kilz E. 1991. Monitoring of forest damage: Spruce and Pine. Eugen Ulmer & Co, Stuttgart, 334 p

12. Klass C., M.P. Attracting beneficial insects. Gardening. Cornell. 2014. URL : http://blogs.cornell.edu/horticulture/about/basicgardening-info/garden-beneficialinsects/

13. Lakatos F., Mirtchev Co-Authors S., Mehmeti A., Shabanaj H. Manual for visual assessment of forest crown condition. Food and agriculture organization of the united nations : Pristina, 2014. 23 p.

14. Marshall Bradley, Fern, Barbara W. Ellis, Deborah L. Martin. The organic gardener's handbook of natural pest and disease control: A complete guide to maintaining a healthy garden and yard the earth-friendly way. New York : Rodale Press. 2009. 300 p.

15. Merrill R. Attracting beneficial insects to the garden with beneficial flowers. Renee's Garden. 2014. URL : http://www.reneesgarden.com/articles/beneficials.html

16. Miller K. V., Miller J. H.. Forestry herbicide influences on biodiversity and wildlife habitat in southern forests. Wildlife Society Bulletin, 2004. Vol.32, No. 4, 1049-–1060.

17. Perry S., Randall C. Forest Pest Management. Michigan State University. Michigan State University. 2000. P. 111.

18. Pest Management Options: Birds and Bats for Pest Suppression. URL : https://intermountainfruit.org/pest-management/birds-bats

19. Sanitary regulations in Ukrainian Forests, Amended by Decree of the Cabinet of Ministers of Ukraine. 2016, № 756.

20. Sow A., Seye D., Faye E., Benoit L., Galan M., Haran J., Brevault T. Birds and bats contribute to natural regulation of the millet head miner in tree-crop agroforestry systems. Crop Protection, 2020. 32 p.

21. Susan K. Hagle, Kenneth E. Gibson, Scott Tunnock. Field guide to diseases and insect pests of Northern and Central Rocky Mountain Conifiers. 2003. P. 251. URL : http://dnrc.mt.gov/divisions/forestry/docs/assistance/pests/fieldguide/complete-field-guide/fg-full-temp.pdf

22. The Forest Code, 1994, № 3852-XII of 8.02.2006.

23. The Law of Ukraine On Plant Quarantine. URL : http://www.vertic.org/media/National%20Legislation/Ukraine/UA_Law_Plant_Quarantine.pdf

24. Vasic V., Konstantinovic B., Orlovic S. Weed Control. (2012). Available at: https://www.researchgate.net /publication/221926184_Weeds_in_Forestry_and_Possibilities_of_ Their_Control.

25. Lakatos F., Mirtchev S. Manual for visual assessment of forest crown condition. 2014. 23 p.

Literature in Ukrainian:

26. Гойчук А. Ф., Решетник Л. Л. Лісова фітопатологія у визначеннях, рисунках, схемах Житомир : Полісся, 2009. 156 с.

27. Завада М. М. Лісова ентомологія. Київ : КВІЦ, 2007. 186 с.

28. Завада Н. М. Надзор за хвоє- й листогрызущими насекомыми и учет их численности. Київ : УСХА, 1986. 46 с.

29. Завада Н. М. Прогноз размножения хвое- и листогрызучих вредных насекомых. Київ : УПК УСХА, 1986. 23 с.

30. Падій М. М. Лісова ентомологія. Київ : Вид. УСХА, 1993. 350 с.

31. Пузріна Н. В., Мєшкова В. Л., Миронюк В. В., Бондар А. О., Токарєва О. В, Бойко Г. О. Моніторинг шкідливих організмів лісових екосистем : навчальний посібник. Київ : НУБіП України, 2021. 274 с.

32. Токарєва О. В., Пузріна Н. В., Сошенський О.М., Грушанський О.А., Брайко В. Б., Виговський А. Ю., Бойко Г. О. Рекреаційне лісівництво : навчальний посібник. Київ : ФОП Ямчинський , 2021. 464 с.

33. Тимченко Г. А., Авраменко И. Д., Завада Н. М. Справочник по защите леса от вредителей й болезней. Київ : Урожай, 1988. 224 с.

34. Цилюрик А. В., Шевченко С. В. Лісова фітопатологія. Київ : КВІЦ, 2008. 464 с.

35. Цилюрик А. В., Шевченко С. В. Лісова фітопатологія: практикум, Київ : КВІЦ, 1999. 203 с.

SUPPLEMENTS

Supplement A

THE FOREST CODE OF UKRAINE

Date of entry into force:
April 13, 1994

The Law of Ukraine “On Amending the Forest Code of Ukraine” No. 3404-IV of 8 February 2006 shall render the Forest Code of Ukraine in a new wording. The new wording of the Forest Code of Ukraine came into force on March 29, 2006.

According to the Code, forest shall be a type of natural system which mainly consists of trees, brushwood vegetation, the relevant soils, herbaceous vegetation, fauna, microorganisms, and other natural components that are interrelated in their development and influence each other and the natural environment.

Relations dealing with forest shall be social relations that are linked to ownership, use and disposal of forests and shall aim at ensuring protection, reproduction and sustainable use of forest resources with due consideration for environmental, economic, social, and other interests of the society.

The forest fund of Ukraine shall include forest plots, including protection plants of linear type, with the area of no less than 0.1 hectare. The forest fund shall not include:

– green plantations within the limits of settlements (parks, gardens, public gardens, boulevards, and so on) that are not included into forests according to the established procedure;

– separate trees and groups of trees, brushwood on agricultural lands, homesteads, country land plots, and garden plots.

Forests located within the border of the Ukrainian territory shall be objects of ownership right of the Ukrainian People. On behalf of the Ukrainian People, rights of owners for forests are exercised by government bodies and bodies of local self-government. Forests can be state, communal and private property. Subjects of ownership right for forests shall be the state, territorial communities, citizens, and legal entities. Subjects of private ownership right for forests shall be citizens and legal entities of Ukraine.

The right to use forests shall be exercised according to the procedure for permanent and temporary use of forests.

Articles 26–33 of the Forest Code shall establish powers of government bodies and bodies of local self-government in the area of relations dealing with forest.

By environmental and socio-economic aspects and depending on the main functions that they fulfill, Ukrainian forests shall be divided into the following categories:

– protection forests;

– recreation and relaxation forests;

– forests for environmental, scientific, historical, and cultural purposes;

– operational forests.

The Forest Code shall envisage keeping of the State Forest Cadastre. On the Ukrainian territory, the State Forest Cadastre shall be kept for the purpose of effectively organizing guarding and protection of forests, rationally using the forest fund of Ukraine, reproducing forests, exercising systematical control over qualitative and quantitative changes in forests.

Monitoring of forests shall be a system for regular supervision, evaluation of and forecast for the dynamic of the qualitative and quantitative condition of forests.

Section 11 of the Forest Code shall envisage the procedure for changing targeted designation of land forest plots and identifying the places for building objects that influence the state and reproduction of forests.

The procedure for managing forests shall be identified by Chapter V.

Forest resources can be used according to the procedure for general and special use of forests.

Citizens shall have the right to freely stay in forests, to collect wild grasses and herbs, flowers, berries, nuts, and mushrooms in forests that are in state and municipal ownership without a special permit and free of charge, as well as upon consent of the owner of forests that are private property.

According to the procedure for special use of forests, the following types of use of forest resources can be carried out:

– logging of timber by felling and chopping forests for the main use;

– logging of secondary timber;

– by-activity in using forests;

– use of useful properties of forests for cultural, recreational, relaxation, sport, tourist, educational, and upbringing purposes, needs of hunting, and the implementation of scientific works.

Special use of forest resources at the allocated forest plot shall be carried out on the basis of a special permit. Such a special permit shall be issued:

– by a body of executive power in the area of forestry of the Autonomous Republic of Crimea;

– by territorial bodies of the central body of executive power in the area of forestry;

– owners of forests;

– regular forest-users.

Section 16 of the Forest Code shall be dedicated to the protection and guarding of forests. Protection and guarding of forests shall envisage a set of measures aimed at protecting forests against fires, illegal felling and chopping, damages, weakening, and other harmful impact, protecting against vermins, pests and diseases. Owners of forests and regular forest-users shall be responsible for developing and implementing a set of fire prevention and other measures aimed at preserving, protecting and guarding forests within an established period of time.

Protection and guarding of forests on the territory of Ukraine shall be carried out:

– by the State Forest Protection Service that operates under the central body of executive power in the area of forestry, the body of executive power in the area of forestry of the Autonomous Republic of Crimea, territorial bodies of the central body of executive power in the area of forestry, as well as enterprises, institutions and organizations that belong to the area of its management;

– by forest protection services of other regular forest-users and owners of forests.

The State Forest Protection Service shall have the status of a law enforcement body. Powers of officials of the State Forest

Protection Service shall be specified by Article 91 of the Forest Code.

According to Article 93 of the Forest Code, the objectives of controlling the protection, guarding, utilization, and reproduction of forests shall be:

– to ensure the implementation of government policy in the area of protecting, guarding, using, and reproducing forests;

– to ensure the adherence to the legislation related to forests by government bodies, bodies of local self-government, enterprises, institutions, organizations, and citizens;

– to ensure the adherence to the legislation related to forests by owners of forests, regular and temporary forest-users;

– to prevent violations of the legislation in the area of protecting, guarding, using, and reproducing forests, to ensure timely detection of such violations and to ensure the relevant measures to eliminate such violations.

State control of the protection, guarding, use, and reproduction of forests shall be carried out:

– by the Cabinet of Ministers of Ukraine;

– by the central body of executive power in the area of protecting the natural environment;

– by the central body of executive power in the area of forestry;

– by bodies of executive power in the area of forestry and in the area of protecting the natural environment of the Autonomous Republic of Crimea;

– by territorial bodies of the central bodies of executive power in the area of protecting the natural environment;

– by territorial bodies of the central bodies of executive power in the area of forestry;

– by other central and local bodies of executive power within the limits of powers established by the law.

Measures aimed at raising the productivity, improving the quality composition of forests, protection, guarding and reproduction of forests shall be financed at the expense of:

– the State Budget and funds of enterprises, institutions and organizations of forestry – with respect to forests that are state property;

– local budgets and funds of enterprises, institutions and organizations of forestry – with respect to forests that are communal property;

– funds of private owners of forests – with respect to forests that are private property.

The country shall provide economic incentives for implementing measures aimed at expanded reproduction of forests specifically by way of:

– compensating expenditures to owners of forests and forest-users that are linked to measures aimed at expanded reproduction of forests implemented thereby;

– applying accelerated depreciation to fixed assets for land protection, forest protection and environmental protection purposes.

Peculiarities of protecting, guarding, using, and reproducing forests on specific categories of lands shall be established by Chapter (Section) 20 of the Forest Code.

Disputes related to the protection, guarding, use, and reproduction of forests shall be resolved:

– by bodies of local self-government (disputes related to the protection, guarding, use, and reproduction of forests that are communal property);

– by bodies of executive power in the area of forestry (disputes related to the protection, guarding, use, and reproduction of forests that are state property);

– by bodies of executive power in the area of protecting the natural environment (disputes related to the protection, guarding, use, and reproduction of forests that are state property);

– by courts (disputes related to ownership, use and disposal of forests that are private property of citizens and legal entities).

If owners of forests and forest-users do not agree to a decision of bodies of executive power in the area of forestry and in the area of protecting the natural environment or a body of local self-government, such a dispute shall be resolved by a court (Article 103 of the Forest Code).

According to Article 105 of the Forest Code, responsibility for violating the legislation related to forests shall be born by individuals and entities that are guilty of:

– illegal felling, chopping and damaging trees and brushwood;

– destroying or damaging forests as a result of setting forests on fire or carelessly treating fire, and violating other requirements to fire safety in forests;

– destroying or damaging forests as a result of contaminating them with chemical and radio-active substances, industrial and residential wastes, waste waters, and other harmful substances, water-logging, dewatering, and other types of harmful impacts;

– littering forests with residential and industrial wastes;

– violating the deadlines for reforestation and other requirement to forestry established by the legislation in the area of protecting, guarding, using, and reproducing forests;

– destroying or damaging forest cultures, seedlings or young plants in forest nurseries and on plantations, as well as natural underbrush and self-sown plants on lands designated for reproduction of forests;

– violating the rules for storing, transporting and applying means for the protection of forest, growth stimulators, mineral fertilizers, and other substances;

– stubbing out forest plots and using them not according their targeted designation, including for constructing residential houses, industrial and other building and structures without the relevant permit;

– laying up hay and pasturing cattle on forest plots without the relevant authorization;

– violating the rules for laying up forest floor, medicinal plants and herbs, wild fruits, nuts, mushrooms, berries, and so on;

– logging forest resources by means that negatively affect the state and reproduction of forests;

– violating the procedure for logging and removing timber, laying up turpentine, and using other forest resources;

– failing to make payments for using forest resources within the established deadlines;

– destroying and damaging land-marks and posts in forests;

– putting into operation new and reconstructed enterprises, facilities and other objects that are not supplied with equipment that prevents negative impact for the state and reproduction of forests;

– violating the deadlines for returning forest plots that are in temporary use or failing to fulfill the obligations to bring them into condition that is suitable and fit to ensure their designated use;

– damaging hayfields, pastures and tillage on agricultural lands;

– destroying or damaging forest drainage furrows, drainage systems and roads on forest plots;

– failing to implement instructions of the State Forest Protection Service and bodies of executive power that exercise control over the adherence to the legislation in the area of protecting, guarding, using, and reproducing forests.

According to Article 106 of the Forest Code, land plots for forestry purposes and other land forest plots occupied without permission shall be returned to their owners without compensation of expenditures sustained during the period of unauthorized use of such plots.

On the basis of Article 108 of the Forest Code, illegally acquired timber and other forest resources shall be subject to withdrawal. If it is impossible to withdraw illegally acquired timber and other forest resources, their cost shall be collected from the relevant individuals and entities.

Supplement B

LAW ON PLANT PROTECTION

The Law consists of 5 Sections composed of 29 articles.

Section 1 (arts. 1-2) lays down general provisions.

Section 2 (arts. 3-20) regards state regulation in the sphere of plant protection.

Section 3 (arts. 21-23) establishes liability and regulates dispute settlement.

Section 4 (arts. 24-29) regards scientific and financial coverage of the plant protection arrangements.

Section 5 lays down final provisions. The present Law regulates legal relations connected with protection of agricultural, perennial, forest plants, shrubbery, plantations, phytogenous products against pests, diseases and weeds, determines the rights and the duties of enterprises, institutions, organizations of all forms of property and citizens, establishes the plenary powers of the executive bodies and officials. The main principles of the state policy in the sphere of plant protection shall be:

1) state policy building in the sphere of plant protection;

2) state supervision over plant protection;

3) priority of the application of integrated pest management and other ecologically safe plant protection arrangements (art. 3).

The main plant protection requirements shall be:

1) observance of plant growing technologies;

2) ecological and economic substantiation of the utility of plant protection against pests;

3) obligation to carry out plant protection arrangements by all land tenants, water users and farmers;

4) strict observance of the regulations on transport and rage of pesticides;

5) conservation of beneficial flora and fauna; 6) prevention of annihilation and damage to plants (art. 4).

Special plant protection procedure (quarantine) shall be introduced on the territory of a determined area in case of mass

propagation of especially dangerous pests for the purpose of the localization and liquidation thereof (art. 14).

Liability shall be established for the following offences:

1) propagation of pests caused by the breakdown of the process of plant growing;

2) application of plant protection arrangements without environmental substantiation;

3) infringement of the legislation on plant protection;

4) failure to report or incorrect reports on hazard to crops and plantations by the propagation of pests;

5) import and trade of pesticides that have non been tested and haven’t passed state registration;

6) failure to execute legal requirements of the authorized officials in the sphere of plant protection (art. 21).

Supplement C

THE LAW OF UKRAINE ON PLANT QUARANTINE

This Law determines the general legal, organizational, financial and economic basis of plant quarantine, activities of the state bodies, enterprises, institutions, organizations, officials and citizens aimed at preventing the entry and spreading of dangerous pests, plant diseases and weeds, which are not present in the territory of Ukraine.

CHAPTER I GENERAL PROVISIONS

Article 1. Definition of Terms

The terms set out below in this Law are used in the following meaning:

– plant quarantine – a legal regime which provides for the system of government measures aimed at the protection of plants, products of their processing, raw materials, individual shipments, etc. from the quarantine objects;

– special quarantine regime – a special legal regime of activities of the state bodies, bodies of local and regional selfgovernment, enterprises, institutions and organizations aimed at the localization and liquidation of the seats of quarantine objects which allows the temporary introduction of restrictions provided for by this Law on the citizens' rights and rights of legal entities, and assigns additional obligations upon them;

– quarantine object – pests, agents of a plant disease or a weed that is not present or is present in limited quantities on the territory of Ukraine, but which may pose a significant threat to the plants or vegetable products.

The Ministry of Agriculture and Food of Ukraine shall determine a list of quarantine objects.

Materials and objects subject to quarantine – any materials and objects that may cause or facilitate the spread of quarantine objects.

A list of materials and objects subject to quarantine shall be determined by the Statute of Plant Quarantine in Ukraine to be approved by the Cabinet of Ministers of Ukraine.

Quarantine zone – a territory where the special quarantine regime is established due to the revealed quarantine objects.

Article 2. Basic Goals of Plant Quarantine

The basic goals of plant quarantine are:

– protection of the country's territory from bringing in or independent entry of quarantine objects from abroad or from the quarantine zone;

– timely disclosure, localization and liquidation of quarantine objects, as well as the prevention of their spread to those regions of the country that are free from them;

– implementation of the state control over observance of the special quarantine regime and implementation of the plant quarantine measures during the process of cultivating, procurement, exporting, importing, transporting, storing, processing and utilizing the materials and objects subject to quarantine.

Article 3. Legislation on Plant Quarantine

The legislation on plant quarantine shall be based on the Constitution of Ukraine and shall embody the present Law and other legislative acts adopted in accordance with this Law.

CHAPTER II
STATE REGULATION OF PLANT QUARANTINE

Article 4. Bodies Exercising State Regulation of Plant Quarantine

State regulation of plant quarantine shall be carried out by the Verkhovna Rada of Ukraine, the Cabinet of Ministers of Ukraine,

the Verkhovna Rada and the Council of Ministers of the Republic of Crimea, and by the specially authorized state bodies on plant quarantine, other state bodies and bodies of local and regional self-government in the order established by the legislation.

Article 5. Specially Authorized Bodies on Plant Quarantine

The central specially authorized state body on plant quarantine is the Chief State Inspection on Plant Quarantine of Ukraine with the Central Research and Development Quarantine Laboratory and the Central Fumigation Detachment of the Ministry of Agriculture and Food of Ukraine.

Other special bodies of plant quarantine that are subordinate to the Chief State Inspection on Plant Quarantine of Ukraine is the state inspection on plant quarantine of the Republic of Crimea, border oblasts inspection, or oblast and city inspections on plant quarantine, plant quarantine stations in the sea and river ports (in docks), on the railway stations and in airports (at airfields), at post offices, on highways (at bus stations, bus terminals), at border posts on the state border of Ukraine, laboratories and regional fumigation detachments.

The plant quarantine stations may be established, where necessary, at other objects, the activities of which are related to the procurement, exporting, importing, transportation and utilization of materials and objects subject to quarantine.

The organizational structure and the number of employees of the state service on plant quarantine shall be approved by the Ministry of Agriculture and Food of Ukraine upon presentation of the Chief State Inspection on Plant Quarantine of Ukraine.

Article 6. Competence of the Chief State Inspection on Plant Quarantine of Ukraine

The competence of the Chief State Inspection on Plant Quarantine shall be as follows:

1) directing the activity of the Central Research and Development Quarantine Laboratory and the Central Fumigation Detachment, the border state inspection on plant quarantine of the

Republic of Crimea, the border oblast, oblast and city state inspections on plant quarantine;

2) establishing the procedure for bringing in and utilization of seed, plants and products of plant origin from abroad, their transportation within the territory of Ukraine and beyond its borders in coordination with the quarantine services of the countries with which Ukraine has concluded the treaties, on the basis of a convention or an agreement on cooperation between the states;

3) researching the varieties, biology and ecology of the quarantine object and other dangerous pests, the diseases of plants and weeds that are not present in the country's territory, developing forecasts of their spreading in order to prevent their entry to those regions where they may cause damage;

4) issuing relevant instructions, regulations, rules, orders and other normative documents on plant quarantine;

5) keeping records and informing on the spread of the quarantine objects;

6) conducting an expertise of the materials and objects subject to quarantine;

7) issuing quarantine documents for the import of seed, plants and products of plant origin;

8) submitting proposals to the Cabinet of Ministers of Ukraine regarding the introduction of the special quarantine regime;

9) coordinating together with the Ministry of Agriculture and Food of Ukraine and the Ukrainian Academy of Agrarian Sciences, the research and development activities on plant quarantine;

10) exercising control over compliance with the legislation on plant quarantine, including the process of signing agreements (contracts) on delivery of products of plant origin from abroad;

11) publicizing knowledge on plant quarantine;

12) state control over the implementation of quarantine measures by enterprises, institutions, organizations and citizens.

The State Service on Plant Quarantine shall carry out its activities together with the Security Service of Ukraine, the Ministry of Interior of Ukraine, the State Committee on Guarding the National Border of Ukraine, the State Customs Committee of Ukraine, the local bodies of the state executive power, other state bodies, bodies of local and regional selfgovernment.

Enterprises, institutions, organizations and citizens should assist the state inspectors on plant quarantine in their performance of the duties assigned to them.

The rules of phytosanitary control, issued by the Chief State Inspection on Plant Quarantine of Ukraine within its competence, shall be binding on all state bodies, as well as enterprises, institutions and organizations, officials and citizens.

Article 7. Competence of the Border State Inspection on Plant Quarantine of the Republic of Crimea, Border Oblast Inspections and the Oblast and City Inspections on Plant Quarantine

The border state inspection on plant quarantine of the Republic of Crimea, border oblast inspections and the oblast and city Inspections on plant quarantine shall, within their competence:

1) issue certificates for seed, plants and products of plant origin that are exported or withdrawn from the zones with the special quarantine regime;

2) conduct the quarantine checks and laboratory expertise of materials and objects subject to quarantine delivered from abroad (including those delivered in baggage, postal correspondence and passenger hand luggage);

3) organize the treatment and disinfections of materials, objects and vehicles subject to quarantine that are delivered from abroad;

4) the state control over the implementation of quarantine measures by enterprises, institutions, organizations and citizens;

5) organize the systematic and control examinations of agricultural lands and forests, places of storage and processing of the seed, plants and products of plant origin, of delivery points to which materials and objects subject to quarantine are delivered, as well as of the adjacent territory;

6) control over the activities of the introductory quarantine nurseries, the state-owed strain-testing stations, hothouses and greenhouses, where quarantine testing of seed, plants and cultivated materials delivered from abroad is provided;

7) exercise the state control on production, procurement, transportation, storage, processing, utilization and sales of seed, plants and products of plant origin that are exported or imported; 8) take, according to the legislation, urgent measures in order to localize and liquidate the quarantine objects, and prevent their spreading;

9) control over the implementation of quarantine measures according to the international agreements and conventions;

10) publicizing knowledge on plant quarantine;

11) submit to relevant bodies proposals regarding the introduction (lifting) of the special quarantine regime;

12) attract to their activities the public representatives on plant quarantine from the employees of procurement, transportation, processing, and other enterprises, institutions and organizations.

Article 8. Procedure on Introduction of the Special Quarantine Regime

In case of revealing the quarantine objects the Chief State Inspector of plant quarantine of Ukraine and other state inspectors on plant quarantine shall submit within 24 hours a draft proposal on the introduction of the special quarantine regime, to the relevant body of local or regional self-government, body of the state executive power or to the Cabinet of Ministers of Ukraine.

The territory of the special quarantine regime shall be established by the relevant body of local or regional selfgovernment, the local body of the state executive power within the boundaries of the populated area, district, several districts or oblast, and if it falls within the boundaries of several oblasts, it should be established by the Cabinet of Ministers of Ukraine.

The body that has made a decision on introducing or lifting the special quarantine regime must immediately inform the enterprises, institutions and organizations located on that territory and citizens living on that territory.

A decision, by which a special quarantine regime is established, shall indicate:

– circumstances that caused the introduction of the special quarantine regime;

– boundaries of the territory subject to the special quarantine regime;

– time on which the special quarantine regime is introduced;

– list of quarantine restrictions, measures on localization and liquidation of the quarantine objects.

Article 9. Measures that are Implemented in the Territory with the Special Quarantine Regime

The following measures may be implemented on the territory with the special quarantine regime:

– restrictions on the exit of the vehicles and their inspection;

– utilization of the resources of enterprises, institutions and organizations for localization and liquidation of the quarantine objects with the further compensation for damages;

– prohibition of the removal of relevant materials subject to quarantine;

– disinfections of the materials and objects subject to quarantine;

– technical processing or disposal of the materials subject to quarantine.

Compensation for damages caused as a result of unlawful actions taken by the state bodies and officials that are ensuring the implementation of the quarantine measures, shall be made in accordance with the legislation.

Article 10. The Authority of the Oblast, District Radas of People's Deputies, the City Radas of People's Deputies and Their Executive Committees, Local Bodies of the Executive Power in the Field of Plant Quarantine

The oblast, district Radas of People's Deputies, the city Radas of People's Deputies and their executive committees, local bodies of the executive power shall organize and provide control over implementation of the quarantine measures and, together with the owners or the authorized bodies of the sea and river ports (docks), railway stations, airports (airfields), post offices, bus stations (bus terminals), the officials of the customs-houses and the state border

posts, shall create appropriate conditions for the state inspectors on plant quarantine for due performance of their official duties.

Upon submission of the chief state inspectors on plant quarantine or the state inspectors on plant quarantine, these bodies may introduce a special quarantine regime, which can be lifted upon submission of a proposal by the chief state inspectors.

Article 11. Phytosanitary Control

All materials and objects subject to quarantine that cross the state border of Ukraine and the borders of the special quarantine zones shall be subject to phytosanitary control.

Import of materials subject to quarantine into Ukraine shall be allowed if the following documents are available:

– a phytosanitary certificate issued by the state bodies on quarantine and protection of plants of the exporting country;

– quarantine import permit issued by the Chief State Inspection on Plant Quarantine of Ukraine. Customs clearance of cargoes shall be conducted only after the phytosanitary control.

A sample of the phytosanitary certificate and the procedure of its issuance shall be determined by the Chief State Inspection on Plant Quarantine of Ukraine in compliance with the existing international conventions.

The sample of the quarantine import permit and the procedure for its issuance shall be determined by the Chief State Inspection on Plant Quarantine of Ukraine.

Materials subject to quarantine may be exited from the special quarantine zone provided they have a quarantine certificate.

The sample of the quarantine certificate and the procedure of its issuance shall be determined by the Chief State Inspection on Plant Quarantine of Ukraine.

The phytosanitary rules on delivery from abroad, transportation within the country, export and the order of processing of the materials subject to quarantine shall be determined by the Chief State Inspection on Plant Quarantine of Ukraine.

Article 12. Officials Implementing the State Control on Plant

Quarantine Organization and implementation of the state control over plant quarantine of plants is laid upon the chief state inspectors on plant quarantine, their deputies and the state inspectors on plant quarantine.

The Chief State Inspector on Plant Quarantine of Ukraine is the head of the Chief State Inspection on Plant Quarantine of Ukraine, appointed to or dismissed from the position by the Ministry of Agriculture and Food of Ukraine.

The chief state inspector on plant quarantine of the Republic of the Crimea, oblast and the city of Kyiv is the head of the relevant body on plant quarantine appointed to and dismissed from by the Chief State Inspector on plant quarantine of Ukraine.

The chief, leading specialists and the specialists of all categories of border oblast, oblast, city inspections on plant quarantine, the heads of the border posts on plant quarantine in the sea, river ports (in docks), on the respective railway stations, in airports, at the central post-offices or highways are, by their offices, at the same time the state inspectors on plant quarantine of the relevant territory or a post.

Article 13. Obligations and Rights of the Chief State Inspector on Plant Quarantine of Ukraine, the Republic of Crimea, Oblast and the City of Kyiv

1. The Chief State Inspector on plant quarantine of Ukraine, the Republic of Crimea, oblast and the city of Kyiv shall administer the plant quarantine service, exercise the state control and are responsible for the implementation of quarantine measures on the territory of Ukraine, the Republic of Crimea, oblast and the city of Kyiv, respectively.

When exercising the quarantine control the Chief State Inspector on plant quarantine of Ukraine, the Republic of Crimea, oblast and the city of Kyiv, the state inspectors shall have the right to:

– detain the materials and objects subject to quarantine that were removed from the territories where the special quarantine

regime is introduced without the quarantine certificates, or those imported from abroad without a quarantine permission, for the period of phytosanitary expertise;

– freely visit the respective objects within the service zone, request information necessary for exercising their authorities;

– provide the sampling of seed, plants, products of plant origin and other materials to carry out a laboratory expertise in compliance with the legislation;

– impose administrative sanctions on the persons guilty of violating the legislation on plant quarantine;

– be supplied with tickets for any type of public municipal and local transport purchased by budget institutions in accordance with the procedure established by the Cabinet of Ministers of Ukraine;

– wear an established type of the uniform.

The samples of uniforms outfit, their lifetime and the supply procedure shall be determined by the Cabinet of Ministers of Ukraine.

2. The Chief State Inspector on Plant Quarantine of Ukraine, the Republic of Crimea, oblast, city/town and state inspector on plant quarantine in case of revealing the quarantine objects on the territory of Ukraine shall submit, within 24 hours, a proposal on the introduction of the special quarantine regime and shall have the right:

– to issue binding instructions on implementations of quarantine measures;

– to detain the transportation vehicles that can facilitate the spread of the quarantine objects;

– to disinfect the materials and objects subject to quarantine;

– to confiscate, liquidate or send the materials subject to quarantine for technical processing;

– to issue relevant conclusions for the insurance bodies.

Article 14. The Guarantees of the Activities of Persons Exercising the State Control on Plant Quarantine

The Chief State Inspector on Plant Quarantine of Ukraine, the Republic of Crimea, oblast and the city, the state inspectors on plant quarantine are independent in performing their activities and

shall be guided by this Law, the Statute of Quarantine Service and by other acts of legislation on plant quarantine.

The decisions of the state inspector that are adopted within their terms of reference regarding the prohibition of cultivating, exporting, importing, storing or utilizing the material subject to quarantine shall be binding.

Upon approval of the Chief State Inspector on Plant Quarantine of Ukraine, the Republic of Crimea, oblast and city/town the authorities of the state inspectors on plant quarantine may be partially delegated to the staff employees of procurement, transport, processing and other enterprises, institutions and organizations, and the citizens being public representatives authorized to activities in plant quarantine in compliance with the Provision on Public Representatives.

Article 15. Obligations of Enterprises, Institutions, Organizations, Officials and Citizens on Ensuring the Plant Quarantine

Enterprises, institutions, organizations, officials and citizens the activity of which is related to the production, processing, storing, transportation and trade in materials subject to quarantine should:

– comply with the phytosanitary rules;

– assist, within their competence, the state service on plant quarantine, execute the directives of the state service on plant quarantine with regard to the implementation of the relevant quarantine measures;

– submit upon the request of the state service specialists on plant quarantine the information on the presence of materials and objects subject to quarantine;

– provide, in order to reveal the quarantine objects, a systematic monitoring of crops, storage facilities where materials subject to quarantine are stored and also submit for inspection and expertise the available materials subject to quarantine;

– in case of revealing the quarantine objects immediately inform the state service on plant quarantine, facilitate implementation of the quarantine measures in the special quarantine and adjacent zones;

– when purchasing abroad the large consignments of seed, plants and products of plant origin, delegate, on their own account, the state inspectors on plant quarantine to exercise phytosanitary control in the places where materials subject to quarantine are shipped in Ukraine.

The relevant state bodies, enterprises, institutions, organizations, officials and citizens the activity of which is related to the production, processing, storage, transportation and trade in materials subject to quarantine should provide free of charge the office buildings, necessary equipment, means of communication, and reimburse the expenses on their maintenance and rental fee to the bodies and institutions of the state service on plant quarantine (including those on motor, railway, water and air transport, border posts on plant quarantine, customs offices and the state border posts, plant quarantine points on the markets, post offices, etc.).

Article 16. Liability for Violation of Quarantine Requirements

Citizens and officials guilty of violating the legislation on plant quarantine shall be called to account in accordance with the legislation of Ukraine.

Entrepreneurs guilty of violating the quarantine requirements as to the exit from the quarantine zones or entry from abroad of the materials subject to quarantine shall be fined in accordance with the court procedure upon petition of the chief state inspectors on plant quarantine.

CHAPTER III
FINAL PROVISIONS

Article 17. Professional Requirements to the Specialists in the Field of Plant Quarantine

The citizens of Ukraine who have higher or secondary special education may carry out professional activity in the field of plant quarantine.

The specialists in the field of plant quarantine shall work under a labor agreement (contract).

Professional training of the specialists in the field of plant quarantine with further attestation shall be funded from the state budget once per five years.

The procedure of the specialists' in plant quarantine attestation shall be determined by the Chief State Inspector on Plant Quarantine of Ukraine. The specialists in the field of plant quarantine who have violated their official duties shall be liable in accordance with the legislation of Ukraine.

Article 18. Scientific Support for the State Service on Plant Quarantine

Scientific support for the state service on plant quarantine shall be provided by the Ministry of Agriculture and Food of Ukraine and the Ukrainian Academy of Agrarian Sciences through the network of profile research and development institutes and stations.

Article 19. Phytosanitary Expertise

For the purposes of revealing the quarantine objects in materials and objects subject to quarantine the quarantine laboratories shall conduct the phytosanitary expertise.

Phytosanitary expertise can be carried out repeatedly according to the requirement of concerned person and for the account of this person.

Article 20. Financing of Quarantine Measures

The measures on preventing the spread, localization and liquidation of the quarantine objects, and the control observations of agricultural lands shall be financed from the state budget.

Article 21. Financing and Logistics of the Bodies of State Service on Plant Quarantine

Financing and logistics of the bodies of state service on plant quarantine shall be provided from the state budget and non-budgetary funds.

Scientific support for plant quarantine shall be financed by the Ukrainian Academy of Agrarian Sciences and the Ministry of Agriculture and Food of Ukraine.

Article 22. International Agreements

If the international agreements to which Ukraine is a party establishes the rules other than those provided for by this Law, the rules of that international agreement shall be applied.

Supplement D

PLANT TAXONOMY

NOMENCLATURE	EXAMPLES
DOMAIN	Eukarya
KINDOM	Plantae
PHYLUM	Anthophyta
CLASS	Magnoliopsida
ORDER	Caryophyllales
FAMILY	Droseraceae
GENUS	Dionaea
SPECIES	Dionaea muscipula

Supplement E

FUNGI TAXONOMY

NOMENCLATURE	EXAMPLES	
DOMAIN	Eukarya	Eukarya
KINDOM	Fungi	Fungi
PHYLUM/ DIVISION	Ascomycota	Basidiomycota
CLASS	Leotiomycetes	Agaricomycetes
ORDER	Erysiphales	Boletales
FAMILY	Erysiphaceae	Boletaceae
GENUS	Erysiphe	Boletus
SPECIES	Erysiphe alphitoides	Boletus edulis

Supplement F

INSECTS TAXONOMY

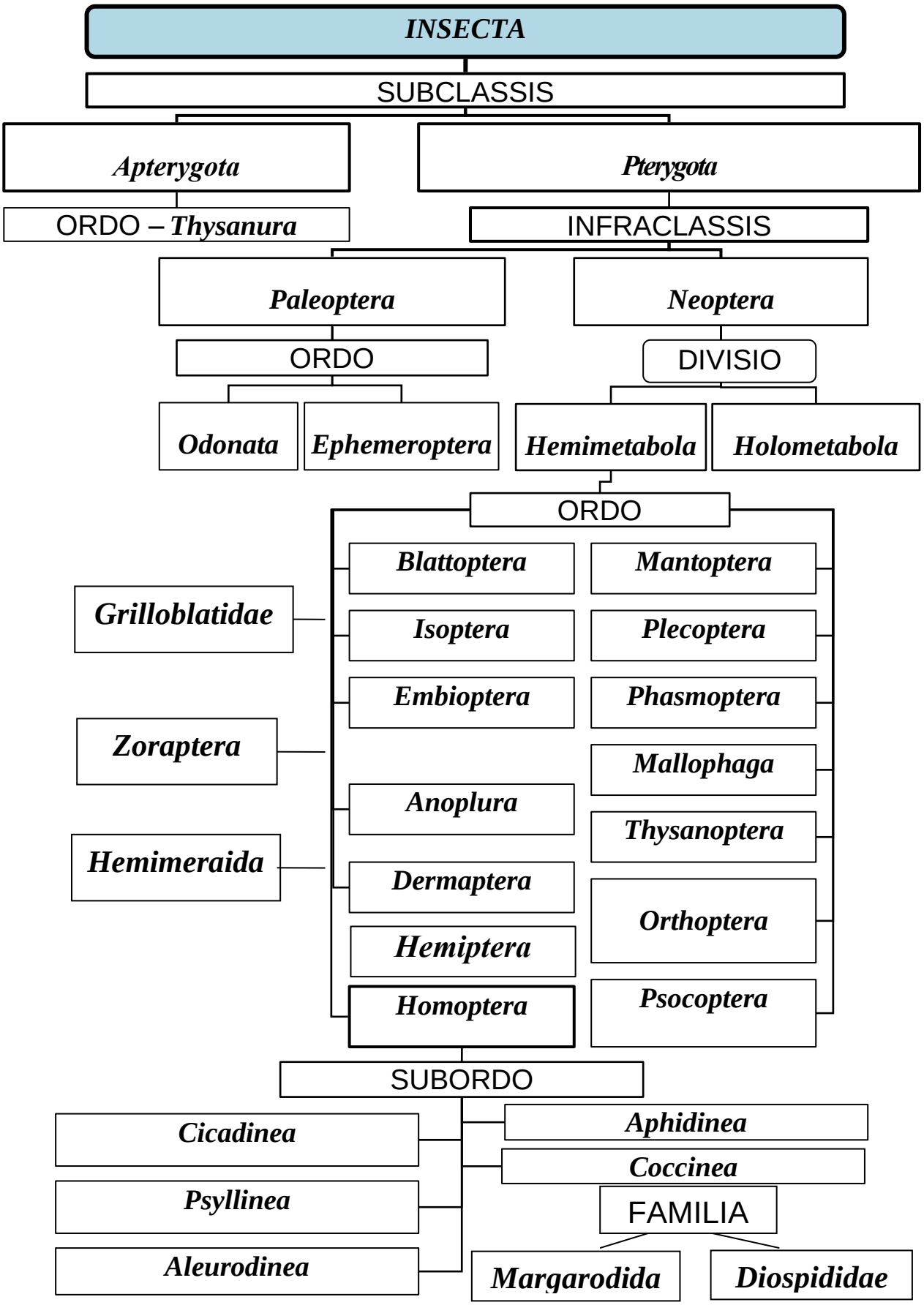
NOMEN-CLATURE	EXAMPLES			
KINGDOM	Animalia			
PHYLUM	Arthropods			34 other phyla
CLASS	Arachnids (spiders, scorpions)	Insects		
ORDER		Hymenoptera	Hemiptera	34 other orders
FAMILY		Apidae	Lygaeidae	
GENUS		Apis	Oncopeltus	
SPECIES		Apis mellifera	Oncopeltus fasciatus	

Supplement G

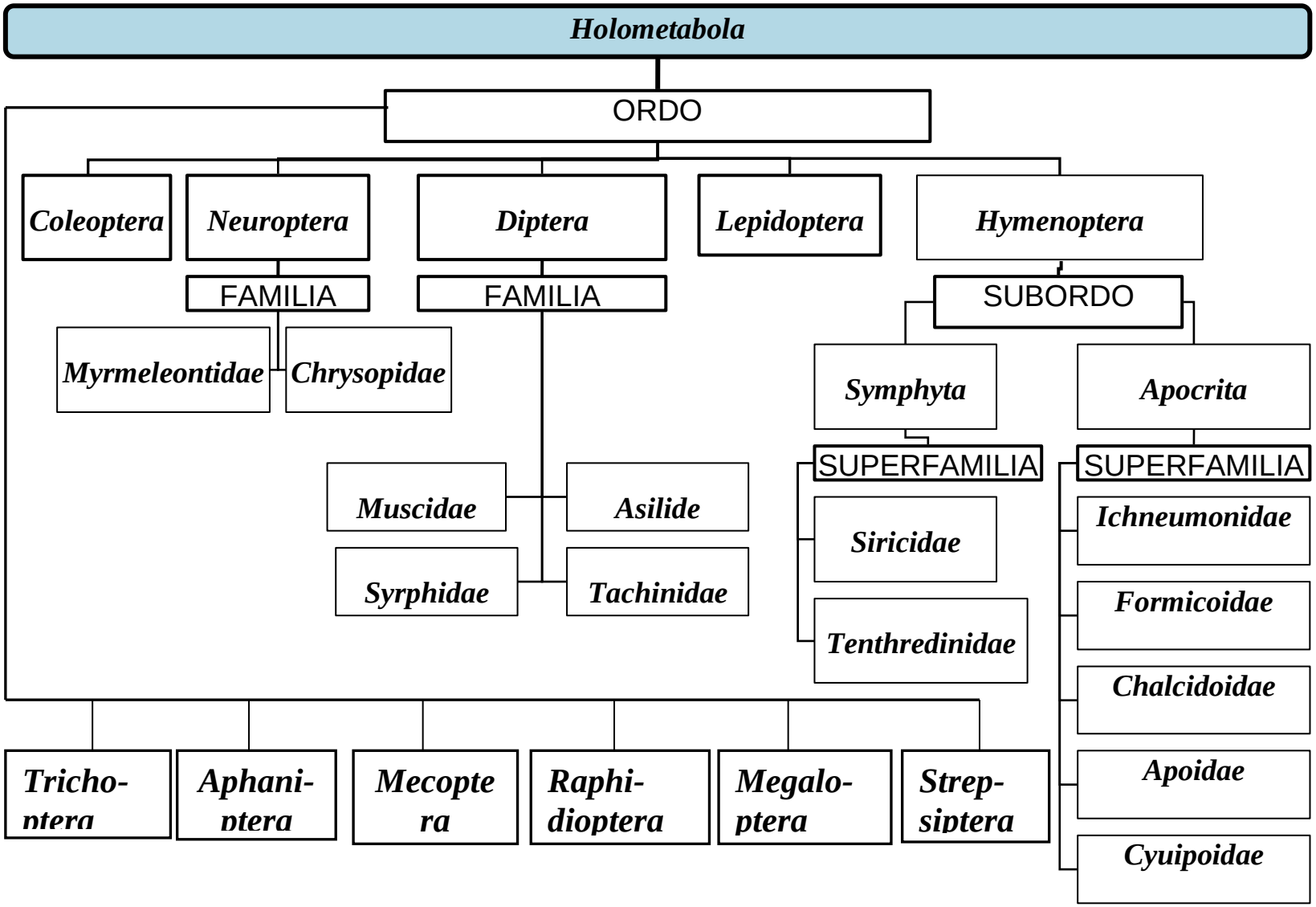
BACTERIA TAXONOMY

NOMENCLATURE	EXAMPLES
DOMAIN	Bacteria
PHYLUM	Firmicutes
CLASS	Bacilli
ORDER	Lactobacillales
FAMILY	Lacpobacillaceae
GENUS	Lactobacillus
SPECIES	Lactobacillus acidophilus

Supplement H



Supplement H



Supplement I

STAGES OF DEVELOPMENT OF HARMFUL INSECTS, TERMS OF MONITORING AND ACCOUNTING FOR THEIR NUMBER

Conventional designations of development stages in the tables: + – imago; • – eggs; – larvae (caterpillars); (-) – their wintering period; ◊ – pupa; E – eonymph; P – pronymph.

- terms of supervision,

- terms of accounting of the number.

Dendrolimus pini

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first									+	+ •	+ •	+ •	•								
										-	-	-	-	-	-	-	-	-	(-)	(-)	(-)
second	(-)	(-)	-	-	-	-	-	-	-												
								◊	◊	◊											
									+	+	+	+									

The wintering place is under the forest floor

Lymantria (Ocneria) monacha

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first											+	+	+	+							
											•	•	•	•	•	(-)	(-)	(-)	(-)	(-)	(-)
second	(-)	(-)	-	-	-	-	-	-													
									◊	◊	◊										
											+	+	+	+							

The wintering place is on the bark

Panolis flammea

Year	Stages of development by month																					
	IV			V			VI			VII			VIII			IX			X-III		
first		+	+	+	+																	
		•	•	•	•																	
			-	-	-	-	-	-	-	-	-											
									◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	(◊)	(◊)	(◊)	
second	◊	◊	◊																			
		+	+	+	+																	

The wintering place is under the forest floor

Bupalus piniarius

Year	Stages of development by month																					
	IV			V			VI			VII			VIII			IX			X-III		
first						+	+	+	+													
							•	•	•	•												
								-	-	-	-	-	-	-	-	-						
																◊	◊	◊	(◊)	(◊)	(◊)	
second	◊	◊	◊	◊	◊	◊																
						+	+	+	+													

The wintering place is under the forest floor

Diprion pini

Year	Stages of development by month																					
	IV			V			VI			VII			VIII			IX			X-III		
first		+	+	+	+																	
		•	•	•	•																	
					-	-	-	-	-													
										◊	◊											
											+	+	+									
											•	•	•									
													-	-	-	-	-	-				
																		E	(E)	(E)	(E)	
																			(P)	(P)	(P)	
second	E P	E P	E P	diapause																		
		◊	◊																			
		+	+	+	+																	

The wintering place is under the forest floor

Neodiprion sertiffer

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first														+	+	+	+				
														.	.	.	.	.	(.)	(.)	(.)
second	.	.	.	.																	
				-	-	-	-	-	-	-											
										◊	◊	◊	◊	◊	◊						
														+	+	+	+				

The wintering place is a needles

Acantholyda erythrocephala

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first			+	+	+																
			.	.	.																
				-	-	-	-	-													
								E	E	E	E	E	E	E	E	E	E	E	(E)	(E)	(E)
																	P	P	(P)	(P)	(P)
	E	E	E																		
second	P	P	P																		
		◊	◊	◊																	
			+	+	+																

The wintering place is soil

Acantholyda posticalis

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first					+	+	+	+	+												
					.	.	.	.	.												
						-	-	-	-	-											
									E	E	E	E	E	E	E	E	E	E	(E)	(E)	(E)
																	P	P	(P)	(P)	(P)
second	E	E	E	E	diapause																
	P	P	P	P																	
			◊	◊	◊																
					+	+	+	+	+												

The wintering place is soil

Zeiraphera diniana

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first											+	+	+	+	+					
											.	.	.	.	.	.	.	(.)	(.)	(.)
second	.	.	.	.	.															
					-	-	-	-	-	-										
										◊	◊	◊	◊							
												+	+	+	+	+				

The wintering place is shoots

Tortrix viridana

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first								+	+	+											
								.	.	.	.	.	.	.	.	.	.	.	(.)	(.)	(.)
second	.	.	.																		
			-	-	-	-	-														
							◊	◊	◊												
								+	+	+											

The wintering place is shoots

Lymantria (Ocneria) dispar

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first										+	+	+	+								
										.	.	.	.	.	.	(-)	(-)	(-)	(-)	(-)	(-)
second	(-)	(-)	(-)																		
			-	-	-	-	-	-	-												
									◊	◊	◊										
										+	+	+	+								

The wintering place is the trunk

Operophtera brumata

Year	Stages of development by month																					
	IV			V			VI			VII			VIII			IX			X -III			
first																		+	+	+		
																			(•)	(•)	(•)	
second	•	•	•	•																		
			-	-	-	-	-	-														
						◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	+	+	+		

Wintering place - branches

Biston hispidaria, Lycia hirtaria, Erannis defoliaria

Year	Stages of development by month																					
	IV			V			VI			VII			VIII			IX			X-III			
first		+	+																			
		•	•																			
		-	-	-	-	-	-	-														
second	◊	◊ +	◊ +					◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	(◊)	(◊)	(◊)

The wintering place is under the forest floor

Acrocercops brongniardella

Year	Stages of development by month																					
	IV			V			VI			VII			VIII			IX			X-III			
first	(+)	(+)	(+)	+	+	+																
				•	•	•																
					-	-	-	-	-	-												
									◊	◊	◊	◊										
											+	+	+	+	+	+	+	+	(+)	(+)	(+)	
second	(+)	(+)	(+)																			

The wintering place is a non-residential premises, under the bark of an old tree

Euproctis chrysorroea

Year	Stages of development by month																					
	IV			V			VI			VII			VIII			IX			X-III			
first									+	+	+	+										
									•	•	•	•										
											-	-	-	-	-	-	(-)	(-)	(-)	(-)	(-)	
second	(-)	(-)	-	-	-	-	-	-	-													
								◊	◊													
									+	+	+	+										

The wintering place is nests in the crown

Hyphantria cunea

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first				+	+	+	+														
					.	.	.	.	.												
							-	-	-	-	-	-	-								
											◊	◊	◊								
												+	+	+	+						
												.	.	.	.						
													-	-	-	-	-	-			
																		◊	(◊)	(◊)	(◊)
second	◊	◊	◊	◊ +	+	+	+														

The wintering place is bark cracks

Leucoma salicis

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first									+	+	+	+									
									.	.	.	.									
										-	-	-	-	-	-	-	-	-	(-)	(-)	(-)
second	-	-	-	-	-	-															
						◊	◊	◊	◊												
									+	+	+	+									

The wintering place is the trunk

Cnetocampa prokcessionea

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first											+	+	+	+	+						
												.	.	.	.	.	.	.	(.)	(.)	(.)
second	.	.	.																		
			-	-	-	-	-	-	-	-	-										
									◊	◊	◊	◊									
											+	+	+	+	+						

Wintering place - branches

Calliteara pudibunda

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first						+	+	+													
						.	.	.													
								-	-	-	-	-	-	-	-	-	-				
																◊	◊	◊	(◊)	(◊)	(◊)
second	◊	◊	◊	◊	◊	◊															
						+	+	+													

The wintering place is under the forest floor

Malacosoma neustria

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first									+	+	+	+									
									.	.	.	.	.	.	.	.	.	.	(.)	(.)	(.)
second	.	.	.																		
			-	-	-	-	-	-	-												
								◊	◊												
									+	+	+	+									

The wintering place is shoots

Phalera bucephala

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first							+	+	+	+	+	+									
							.	.	.	.	.	.									
								-	-	-	-	-	-	-	-	-	-				
														◊	◊	◊	◊	◊	(◊)	(◊)	(◊)
second	◊	◊	◊	◊	◊	◊															
							+	+	+	+	+	+									

The wintering place is soil

Peridea anceps

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first					+	+	+	+													
					.	.	.	.													
						-	-	-	-	-	-	-									
									◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	(◊)	(◊)	(◊)
second	◊	◊	◊	◊																	
					+	+	+	+													

The wintering place is soil

Exaereta ulmi

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first			+	+	+	+															
				•	•	•															
					-	-	-	-	-												
									◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	(◊)	(◊)	(◊)
second	◊	◊	◊ +	+	+	+															

The wintering place is soil

Alsophila (Anisopteryx) aescularia

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first								+	+	+	+										
									•	•	•	•									
										-	-	-	-	-	-						
																◊	◊	◊	(◊)	(◊)	(◊)
second	◊	◊	◊	◊	◊	◊	◊														
								+	+	+	+										

The wintering place is soil, under the forest floor

Macrophya punctumalbum

Year	Stages of development by month																				
	IV			V			VI			VII			VIII			IX			X-III		
first					+	+	+	+													
					•	•	•	•													
						-	-	-	-	-	-										
									E	E	E	E	E	E	E	E	E	E	(E)	(E)	(E)
second	E	E	E	E	E	diapause															
			P	P	P																
			◊	◊	◊	◊															
					+	+	+	+													

The wintering place is soil

PESTS OF UNDERGROUND PARTS OF PLANTS
Chafer beetles

Year	Stages of development by month																			
	IV			V			VI			VII			VIII			IX			X-III	
	Melolontha melolontha																			
first				+	+	+														
					•	•	•													
							-	-	-	-	-	-	-	-	-	-	-	-	-	-
second	-	-	-	-	-	-	=	=	=	=	=	=	=	=	=	=	=	=	=	=
third	=	=	=	=	=	=	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡
fourth	≡	≡	≡	≡	≡	≡	≡	≡	≡											
									◊	◊	◊	◊	◊	◊	◊					
															+	+	+	+	+	+	+
fifth	+	+	+	+	+	+														
	Polyphylla fullo																			
first									+	+	+	+								
										•	•	•	•							
											-	-	-	-	-	-	-	-	-	-
second	-	-	-	-	-	-	=	=	=	=	=	=	=	=	=	=	=	=	=	=
third	=	=	=	=	=	=	=	=	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡
fourth	≡	≡	≡	≡	≡	≡	≡	≡	≡											
									◊	◊	◊	◊								
									+	+	+	+								
	Anoxia pilosa																			
first							+	+	+	+										
								•	•	•	•									
									-	-	-	-	-	-	-	-	-	-	-	-
second	-	-	-	-	-	-	=	=	=	=	=	=	=	=	=	=	=	=	=	=
third	=	=	=	=	=	=	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡	≡
fourth	≡	≡	≡	≡	≡	≡	≡	≡	≡											
						◊	◊	◊	◊											
							+	+	+	+										
	Amphimallon solstitiale																			
first						+	+	+	+	+	+	+								
							•	•	•	•	•	•	•							
							-	-	-	-	-	-	-	-	-	-	-	-	-	-
second	-	-	-	-	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
third	=	=	=	=	◊	◊	◊	◊	◊											
						+	+	+	+	+	+	+	+							
	Anomala dubia																			
first							+	+	+	+	+	+								
							•	•	•	•	•	•								
								-	-	-	=	=	=	=	=	=	=	=	=	=
second	=	=	=	=	=	=														
						◊	◊	◊	◊	◊	◊									
							+	+	+	+	+	+								

The wintering place is soil

Legend: + (imago); • (eggs); - (first instar larvae); = (second instar larvae); ≡ (third instar larvae); ◊ (pupa)

GRYLLOTALPA GRYLLOTALPA, *LETHRUS APTERUS*, *AGRIOTES LINEATUS*, *AGROTIS SEGETUM*

Year	Stages of development by month																			
	IV			V		VI			VII			VIII			IX			X-III		
	Gryllotalpa gryllotalpa																			
first					+	+	+	+												
						•	•	•	•											
							-	-	-	-	-	-	-	-	-	-	-	-	-	-
second	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
third	-	-	-	-	-															
					+	+	+	+												
	Lethrus apterus																			
first			+	+	+	+														
				•	•	•	•													
					-	-	-	-	-	-	-	-								
											◊	◊	◊							
												+	+	+	+	+	+	+	+	+
second	+	+	+	+	+	+														
	Agriotes lineatus																			
first					+	+	+	+												
						•	•	•	•											
							-	-	-	-	-	-	-	-	-	-	-	-	-	-
second	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
third	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fourth	-	-	-	-	-	-	-	-	-	-	-	-								
												◊	◊	◊	◊	◊	◊	◊	◊	◊
fifth	◊	◊	◊	◊																
					+	+	+	+												
	Agrotis segetum																			
first						+	+	+												
						•	•	•												
							-	-	-	-	-									
									◊	◊	◊									
										+	+	+								
											•	•	•							
												-	-	-	-	-	-	-	-	-
second	-	-	-	-	-															
			◊	◊	◊	◊														
						+	+	+												

The wintering place is soil

EVETRIA

Year	Stages of development by month																			
	IV			V			VI			VII			VIII			IX			X-III	
	Evetria buoliana																			
first							+	+	+	+										
							.	.	.	.										
								-	-	-	-	-	-	-	-	-	-	-	-	-
second	-	-	-	-																
					◊	◊	◊													
							+	+	+	+										
The wintering place is buds																				
	Evetria duplana																			
first		+	+	+	+															
			.	.	.	.														
				-	-	-	-	-	-	-										
										◊	◊	◊	◊	◊	◊	◊	◊	◊	◊	◊
second	◊	◊	◊																	
		+	+	+	+															
The wintering place is bark cracks																				
	Evetrla lurionana																			
first				+	+	+	+													
				.	.	.	.													
					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
second	-	-	◊	◊	◊															
				+	+	+	+													
The wintering place is buds																				
	Evetria resinella																			
first					+	+	+													
					.	.	.													
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
second	-	-	-	◊	◊															
					+	+	+													
The wintering place is shoots																				

Supplement J

CHECKLIST OF WOODY PLANT INSECTS

Species	Damage
Acanthochermes quercus	
Acanthocinus aedilis	
Acanthocinus carinulatus	
Acanthocinus griseus	
Acantholyda erythrocephala	
Acantholyda stellata	
Acholcus dalmanni	
Achrysocharella ruforum	
Acyrthosiphon caraganae	
Aegeria apiformis	
Aeolesthes sarta	
Agelastica alni	
Ageniaspis fuscicollis	
Agria affinis	
Agrilus angustulus	
Agrilus betuleti	
Agrilus biguttatus	
Agrilus hastulifer	
Agrilus obscuricolli	
Agrilus olivicolor	
Agrilus sulcicollis	
Agrilus viridis	
Agriotes gurgistanus	
Agriotes lineatus	
Agriotes obscurus	
Agriotes sputator	
Agrotis segetum	
Agrotis vestigialis	
Agrypon flaveolatum	
Amphimallon solstitialis	
Anastatus disparis	
Andricus foecundatrix	
Andricus inflator	

Continuation of the supplement J

Species	Damage
Anobium domesticum	
Anobium pertinax	
Anomala dubia aenea	
Anomala errans	
Anoxia pilosa	
Anthaxia conradti	
Anthaxia quadripunctata	
Apanteles liparidis	
Apanteles melanoscelus	
Apanteles ordinarius	
Apanteles sericeus	
Apanteles spurius	
Aphis evonymi	
Aphis fabae	
Aphytis mytilaspidis	
Apis mellifera	
Apocheima hispidaria	
Aradus cinnamomeus	
Arge rosae	
Asemum striatum	
Asterolecanium pustulan	
Asterodiaspis quercicola	
Athous niger	
Barichneumon bilunulatus	
Beauveria bassiana	
Beauveria densa	
Beauveria teriella	
Biorrhiza pallida	
Biston strataria	
Blastophagus minor	
Beauveria pilifer	
Beauveria piniperda	
Beauveria puellus	
Blastothrix sericea	
Boarmia bistortata	

Continuation of the supplement J

Species	Damage
Bostrychus capucinus	
Brachyderes incanus	
Braconidae	
Bradybatus clentzeri	
Bupalus piniarius	
Cacoecia crataegana	
Cacoecia reticulana	
Cacoecia rosana	
Cacoecia xylosteana	
Calasoma inquisitor	
Cacoecia sycophanta	
Caliroa cinxia	
Callidum violaceum	
Callipogon relictus	
Carpoborus minimus	
Carpocapsa amplana	
Carpocapsa grossana	
Carpocapsa splendana	
Cerambix cerdo	
Cerambix dux	
Cerambix scopolii	
Chionaspis salicis	
Chrysobothris affinis	
Chrysobothris chrysostigma	
Chrysonotomyia ruforum	
Cicindela silvatica	
Cimbex femoratus	
Cnorrhinus globatus	
Codiosoma spadix	
Compsilura concinnata	
Cossus cossus	
Cossus terebra	
Cratichneumon nigritarius	
Crosus septentrionalis	
Criocephalus rusticus	

Continuation of the supplement J

Species	Damage
Cryphalus piceae	
Cryphalus piceus	
Cryptognatha nodiceps	
Curculio glandium	
Curculio nucum	
Cynips quercus calicis	
Cyzenis albicans	
Dahlbominus fuscipennis	
Dasychira albodentata	
Dasychira pudibunda	
Dasyneura laricis	
Dendroctonus micans	
Dendrolimus pini	
Dendrolimus sibiricum	
Dendrolimus superans	
Dioryctria abietella	
Diplolepis quercus-folii	
Diplostichus janithrix	
Diprion hercyniae	
Diprion pini	
Drino inconspicua	
Dryocoetes autographus	
Dryocoetes baicalicus	
Elateroides dermestoides	
Elateroides glabellicornis	
Endomyces hylocoeti	
Ephealtes manifestator	
Erannis defoliaria	
Eremotes porcatus	
Eriosoma ulmi	
Ernestia rudis	
Eucallipterus tiliae	
Euproctis crysorrhoea	
Eupteromalus nidulans	
Evetria buoliana	

Continuation of the supplement J

Species	Damage
Evetria duplana	
Evetria resinella	
Evetria turionana	
Exapate congelatella	
Formica aquilonia	
Formica cinerea imitans	
Formica exsecta	
Formica lugubris	
Formica polyctena	
Formica pratensis	
Formica truncorum	
Galerucella luteola	
Galerucella viburni	
Gilpina pallida	
Glypta rcsinanae	
Graphium ulmi	
Graphium pachymcrus	
Gryllotalpa africana	
Gryllotalpa grullotalpa	
Gryllotalpa unispina	
Haloxylonomyia gigas	
Haltica saliceti	
Hayhurstia tataricae	
Helicomya saliciperda	
Holcocerus arenicola	
Hylesinus crenatus	
Hylesinus eos	
Hylesinus fraxini	
Hylesinus laticollis	
Hylesinus oleiperda	
Hylobius abietis	
Hylobius albosparsus	
Hylobius haroldi	
Hylobius pinastri	
Hylotrupes bajalus	

Continuation of the supplement J

Species	Damage
Hylorgops palliates	
Icerya purchasi	
Ips acuminatus	
Ips duplicatus	
Ips sexdentatus	
Ips subelongatus	
Ips typographus	
Lacon murinus	
Lasiomma baicalense	
Lasiomma infrequens	
Lasiomma iaricicola	
Lasiomma melania	
Laspeyresia strobilella	
Lepidosaphes ulmi	
Lethrus apterus	
Leucoma salicis	
Lignyodes enucleator	
Lucanus cervus	
Lycaena bellargus	
Lycia hirtaria	
Lyctus brunneus	
Lyctus linearis	
Lyctus pubescens	
Lymexylon novale	
Macrophya punctumalbum	
Magdalis frontalis	
Magdalis violacea	
Malacosoma neustia	
Megastigmus strobilobius	
Melanophila acuminate	
Melanophila picta	
Melasoma populi	
Melasoma saliceti	
Melasoma tremulae	
Melolontha hippocastani	

Continuation of the supplement J

Species	Damage
Melolontha melolontha	
Mesites pallidipennis	
Mesoleius tenthredinis	
Mesosa myops	
Metarrhizium anisopliae	
Meteorus versicolor	
Monochamus galloprovincialis	
Monochamus impluviatus	
Monochamus saltuarius	
Monochamus sutor	
Monochamus urussovi	
Neodiprion sertifer	
Neuroterus numismalis	
Neuroterus quercusbaccarum	
Notodonta anceps	
Ocneria dispar	
Ocneria monacha	
Oecophilla smaragdina	
Olesicampe benefactor	
Opatrum sabulosum	
Oparinia autumnata	
Operophthera brumata	
Orgyia antiqua	
Orthotomicus suturalis	
Oryctes nasicornis	
Ostoma ferrogineum	
Otiorrhynchus niger	
Otiorrhynchus ovatus	
Panolis flammea	
Parand racaspica	
Paranthrene tabaniformis	
Parasarcophaga harpax	
Parnassius Mnemosyne	
Parthenolecanium corni	
Pegohylemia anthraciria	

Continuation of the supplement J

Species	Damage
Pemphigus lactucarius	
Pentodon idiota	
Phaenops cyanea	
Phaenops guttulata	
Phaeogenes invisor	
Phalera bucephala	
Phigalia pedaria	
Phorocera silvestris	
Phyllopertha horticola	
Phyrrhidium sanguneum	
Pimpla instigator	
Pityogenes chalcographus	
Pityogenes irkutensis	
Pityogenes quadridens	
Pityokteines curvidens	
Pitiophtorus micrographus	
Pissodes harcyniae	
Pissodes insianitus	
Pissodes notatus	
Pissodes piceae	
Pissodes pini	
Pissodes piniphilus	
Pissodes validirostris	
Plagionotus arcuatus	
Plagionotus detritus	
Pleolophus basizonus	
Poecilonota variolosa	
Poecilopsis pomonaria	
Polygraphus polygraphus	
Polygraphus proximus	
Polyphylla adspersa	
Polyphylla alba	
Polyphylla fullo	
Pristiphora abietinus	
Pristiphora erichsoni	

Continuation of the supplement J

Species	Damage
Pseudophycus malinus	
Pseudosarcophaga mamiilata	
Pteleobius kraatzi	
Pteleobius vittatus	
Purpuricenus kaehleri	
Quadraspidiotus perniciosus	
Rhabdophaga rosaria	
Rhabdophaga salicis	
Rhagium inquisitor	
Rhagium mordax	
Rhagium sycophanta	
Rhaphidia ophiopsis	
Rhisophagus grandis	
Rhizotrogus aequinoctialis	
Rhizotrogus aestivus	
Rhyncolus culinaris	
Rhysokermes piceae	
Rhyssa persuasoria	
Rodolia cordinalis	
Ropalicus tutela	
Roptocerus xylophagorum	
Sacchiphantes abietis	
Sacchiphantes viridis	
Saperda carcharias	
Saperda populnea	
Saperda scalaris	
Scolytus amurensis	
Scolytus intrieatus	
Scolytus kirsch	
Scolytus morawitzi	
Scolytus multistriatus	
Scolytus pygmaeus	
Scolytus ratzeburgi	
Scolytus rugulosus	
Scolytus multistriatus	

Continuation of the supplement J

Species	Damage
Scolytus sulcifrons	
Scolytus zaitzevi	
Selatosomus aeneus	
Selatosomus latus	
Siphonaphis padi	
Sirex ermak	
Sirex juvencus	
Sirex noctilio	
Spondylis buprestoides	
Stromatium unicolor	
Strophosomus capitatus	
Strophosomus rufipes	
Sturmia scutellata	
Symydobius oblongus	
Telenomus gracilis	
Telenomus laeviuscus	
Telenomus verticillatus	
Tetraneura ulmi	
Tetropium castaneum	
Tetraneura gabrieli	
Tetraneura gracilicorne	
Tetraneura fuscum	
Tetraneura staudingeri	
Thecodiplosis brachyntera	
Tomiacobia seitneri	
Tortrix viridana	
Tremex fuscicornis	
Trichagramma embryophagum	
Trichagramma evanescens	
Trichagramma pallida	
Trypodendron lineatum	
Trypodendron signatum	
Urocerus gigas	
Vanessa antiopa	
Vespa erabro	

Continuation of the supplement J

Species	Damage
Xeris spectrum Xiphydria camelus Xiphydria longicollis Xyleborus dispar Xyleborus saxeseni Xylechinus pilosus Xylogenes dilatatus Xylonites retusus Xylotrechus antelope Xylotrechus altaicus Xylotrechus rusticus Zeiraphera diniana Zeuzera pyrina	

Supplement K

CHECKLIST OF WOODY PLANT DISEASES

Species	Damage
Abortiporus borealis	
Agrobacterium tumefaciens	
Albugo candida	
Alternaria humicola	
Amyloporia xantha	
Apiosporium piniphilum	
Apiosporium salicinum	
Antrodia serialis	
Antrodia sinuosa	
Antrodia vaillantii	
Antrodia xantha	
Arceuthobium oxycedri	
Armillaria mellea	
Armillaria ostoyae	
Armillaria borealis	
Ascocalyx abietina	
Aspergillus glaucus	
Aspergillus niger	
Biatorella difformis	
Biatoridina pinastri	
Bjerkandera adusta	
Botrytis cinerea	
Brunchorstia pinea	
Bursaphelenchus xylophilus	
Cenangium abietis	
Cercospora acerina	
Cercospora microsora	
Ceratocystis fagacearum	
Ceratocystis roboris	
Ceratocystis ulmi	
Ceratocystis valachicum	
Chaetomium globosum	
Chrysomyxa abietis	
Chrysomyxa ledi	

Continuation of the supplement K

Species	Damage
Chrysomyxa pirolae	
Cladosporium herbarum	
Climacocystis borealis	
Clithris quercina	
Coccomyces hiemalis	
Coleosporium campanulae	
Coleosporium senecionis	
Coleosporium sonchi-arvensis	
Coleosporium tussilaginus	
Coniophora puteana	
Coleosporium cerebella	
Coriolellus serialis	
Coriolopsis trogii	
Coriolus vaporarius	
Coriolus versicolor	
Coriolus zonatus	
Corticium leave	
Cronartium flaccidum	
Cronartium ribicola	
Cryptodiaporthe populea	
Cuscuta europaea	
Cuscuta monogyna	
Cytophoma pulchella	
Cylindrosporium hiemale	
Cytospora chrysosperma	
Cytospora foetida	
Cytospora intermedia	
Cytospora leucostoma	
Cytospora quercella	
Daedalea quercina	
Dasyscyphus willkommii	
Diaporthe perniciosa	
Diatrype stigma	
Discoccum asperum	
Discula bruneo-tingens	

Continuation of the supplement K

Species	Damage
Dothichiza ferruginosa	
Dothichiza populea	
Dothidella betulina	
Dothidella ulmi	
Endomyces magnusii	
Endomycopsis vernales	
Endothia parasitica	
Endoxylina astroidea	
Erwinia nimipressuralis	
Erwinia salicis	
Fibuloporia vaillantii	
Fistulina hepatica	
Flammulina velutipes	
Fomes fomentarius	
Fomitopsis annosa	
Fomitopsis officinalis	
Fomitopsis pinicola	
Fomitopsis rosea	
Fumago vagans	
Funalia trogii	
Fusarium bulgigenum	
Fusarium oxysporum	
Fusarium roseum	
Fusarium sporotrichoides	
Fusicladium betulinum	
Fusicladium saliciperdum	
Ganoderma applanatum	
Ganoderma lipsiene	
Gloeophyllum sepiarium	
Gloeophyllum odoratum	
Gloeosporium betulinum	
Gloeosporium quercinum	
Gloeosporium tremulae	
Gnomonia quercina	
Graphium ulmi	

Continuation of the supplement K

Species	Damage
Gremmeniella abietina	
Grumenula abietina	
Guignardia aesculi	
Gymnosporangium juniperum	
Hendersonia acicula	
Herpotrichia nigra	
Herpotrichia juniperi	
Heterobasidion annosum	
Heterobasidion parviporum	
Heterobasidion abietinum	
Hirschioporus abietinus	
Hirschioporus fusco-violaceus	
Hormiscium pinophilum	
Hypodermella sulcigena	
Hypoxylon pruinatum	
Hysterographium fraxini	
Inonotus dryadeus	
Inonotus dryophilus	
Inonotus hispidus	
Inonotus obliquus	
Ischnoderma benzoinum	
Kuehneromyces mutabilis	
Lachnellula willkommii	
Laetiporus sulphureus	
Lentinus lepideus	
Lenzites betulina	
Libertella fraxini	
Lophodermium abietis	
Lophodermium conigenum	
Lophodermium macrosporum	
Lophodermium pinastri	
Lophodermium seditiosum	
Lophodermium juniperinum	
Loranthus europaeus	
Marssonina betulae	

Continuation of the supplement K

Species	Damage
Marssonina populi	
Massaria inguinans	
Melampsora alli-populina	
Melampsora evonymi-caprearum	
Melampsora larici-caprearum	
Melampsora larici-populina	
Melampsora larici-tremulae	
Melampsora larici-salicina	
Melampsora pinitorqua	
Melampsora ribesii-vinimalis	
Melampsorella cerastii	
Melampsoridium betulinum	
Melanconium botulinum	
Meria laricis	
Microsphaera alphitoides	
Microsphaera betulae	
Microsphaera berberides	
Microsphaera grossulariae	
Microsphaera lonicera	
Microsphaera penicillata	
Microsphaera syringae	
Microsphaera vanbruntiana	
Microsphaera viburni	
Mucor mucedo	
Mucor racemosus	
Monilia sitophila	
Mycosphaerella ribis	
Naemospora croceola	
Nectria cinnabarina	
Nectria coccinea	
Nectria ditisima	
Nectria galligena	
Nummularia buillardii	
Onnia triqueter	
Osmoporus odoratus	

Continuation of the supplement K

Species	Damage
Oxyporus populinus	
Paxillus panuoides	
Penicillium commune	
Peniophora gigantean	
Peridermium pini	
Pestalotia hartigii	
Phacidium infestans	
Phaeolus schweinitzii	
Phialophora fastigata	
Phellinus chrysoloma	
Phellinus igniarius	
Phellinus hartigii	
Phellinus pini	
Phellinus robustus	
Phellinus tremulae	
Phlebiopsis gigantea	
Pholiota adiposa	
Pholiota squarrosa	
Phomopsis quercella	
Phragmidium disciforum	
Phyllactinia suffulta	
Phyllosticta fraxini	
Phyllosticta sphaeropsoidae	
Phytophthora cactorum	
Phytophthora infestans	
Piptoporus betulinus	
Plasmopara viticola	
Pleurotus ostreatus	
Podosphaera oxyacanthae	
Pollacia elegans	
Pollacia radiosa	
Polyporus squamosus	
Polystictus circinatus	
Pseudomonas fluorescens	
Pseudomonas fraxini	

Continuation of the supplement K

Species	Damage
Pseudomonas quercus	
Pseudomonas quercina	
Pseudomonas pini	
Pseudomonas piri	
Pseudomonas remifaciens	
Pseudomonas syringae	
Pullularia pullulans	
Puccinia graminis	
Pythium debaryanum	
Rhizoctonia solani	
Rhizopus nigricans	
Rhizosphaera kalkhoffii	
Rhytisma acerinum	
Rhytisma pseudoplatanus	
Rhytisma punctatum	
Rhytisma salicinum	
Rosselinia quercina	
Sclerophoma pithyophila	
Sclerotinia alni	
Sclerotinia aucupariae	
Sclerotinia betulae	
Sclerotinia graminearum	
Scleroderris lagerbergii	
Schizophyllum commune	
Septoria quercina	
Septoria ribis	
Serpula lacrymans	
Sphaeropsis malorum	
Sphaerotheca pannosa	
Stereum abietinum	
Stereum frustulosum	
Stereum hirsutum	
Stereum sanguinolentum	
Stigmina compacta	
Stromatinia pseudotuberosa	

Continuation of the supplement K

Species	Damage
Sydowia polyspora	
Synchytrium endobioticum	
Taphrina acerina	
Taphrina alni-incanae	
Taphrina aurea	
Taphrina betulae	
Taphrina carnea	
Taphrina cerasi	
Taphrina epiphylla	
Taphrina johansonii	
Taphrina pruni	
Taphrina rhisophorus	
Taphrina turgida	
Taphrina tosguinetii	
Tilletia caries	
Thamnidium elegans	
Thecopsora areolate	
Thecopsora padi	
Thelephora terrestris	
Thyrostroma compactum	
Trichaptum abietinum	
Trichaptum fusco-violaceum	
Trichocladia caraganae	
Trichaptum enonymi	
Trichoderma lignorum	
Trichothecium roseum	
Tubercularia vulgaris	
Typhula graminearum	
Uncinula aceris	
Uncinula salicis	
Uncinula fraxini	
Uncinula clandestine	
Ustilago nuda	
Ustilago tritici	
Valsa sordida	

Continuation of the supplement K

Species	Damage
Venturia chlorospora Venturia ditricha Venturia populina Venturia tremulae Verticillium albo-atrum Verticillium dahliae Verticillium glaucum Verticillium latericium Viscum album Vuilleminia comedens	

VOCABULARY

NOUNS

Abundance – чисельність, рясність, поширеність, багатство

Accuracy – точність

Acorn – жолудь

Aphid – попелиця, тля

Arachnids – павукоподібні

Assessment – оцінка

Bacterium (bacteria) – бактерія

Bait – наживка

Bark – кора

Bast – луб

Beetle – жук

Benefit – користь

Billbug – клоп

Blossom – цвіт, квітка, суцвіття

Borer – точильник

Branch – гілка

Breed, brood – виплодок, виводок

Brushwood – хмиз

Bud – бутон, брунька

Bulb – цибулина

Burl, wart – кап

Burn – опік

Canopy – намет

Cause – чинник, причина

Cell – клітина

Chafer, cockchafer – хрущ

Chemicals – хімічні речовини

Cockroach – тарган

Cocoon – кокон

Cohort – покоління, генерація

Compaction – ущільнення

Cone – шишка

Consequence – наслідок

Core – ядро

Cricket – цвіркун

Curliness – кучерявість
Curvature – кривизна, викривлення
Damage – пошкодження
Deforestation – вирубка лісів
Deformation – деформація, викрилення
Degree – ступінь
Depletion – виснаження
Desert – пустеля
Destruction, disturbance – порушення
Deterioration – погіршення стану
Development – розвиток
Dioecious – дводомні рослини
Disease – хвороба
Disorder – захворювання
Dispersal – розсіювання
Disturbance – порушення
Diversity – різноманіття
Division – поділ
Drought – засуха
Emergence – поява
Enemy – ворог
Enterprise – підприємство
Entomologist – ентомолог
Environment – навколишнє середовище
Enzymes – ферменти
Establishment – поновлення
Estimation, evaluation – оцінка
Examination – обстеження
Excavation – розкопки
Fade – цвіль
Feature особливості
Female – самиця
Firewood – дрова
Flea – блоха
Foci – осередок, вогнище
Forecast – прогноз
Fung(i) – гриб, гриби
Galls – гали

Generation – покоління, генерація
Germination – схожість
Grove – гай
Gum – смола, камедь
Gummosis – камедетеча
Habitat – середовище існування
Harmfulness – шкідливість
Heartwood – серцевина
Herbage – трав'яний покрив
Hole – отвори
Hollow – дупло
Host – господар
Hothouse, greenhous – теплиця
Humidity – вологість
Impact – вплив
Incidence – захворюваність
Increment – приріст
Indices – індикатор
Influence – вплив
Insect – комаха
Intensity – інтенсивність
Interaction – взаємодія
Invertebrate – безхребетні
Knot – сучок
Landowner – землевласники
Larch – модрина
Larva – личинка
Leafhopper – листовійка
Lesion – ураження
Limb – сучок
Limbing – обрізка сучків
Log – колода
Logging – лісозаготівля
Losses – втрата, збитки
Louse (pl. lice) – воші
Lumber – пиломатеріали
Lure – приманка
Male – самець

Mammal – ссавці
Means – засоби
Measure – заходи
Mensuration – таксація
Mildew – пліснява, цвіль
Mistletoe – омела
Mite – кліщ
Mold – пліснява
Mollusk – молюск
Molt – лінька
Monoecious – однодомні рослини
Moss – мох
Moth – метелик, міль
Mucus – слиз
Mulch – мульча
Mummification – муміфікація
Needle – хвоя
Nematode – нематода
Nest – гніздо
Noctuid – совка
Nucleus – ядро
Nutrients – поживні речовини
Nymph – німфа
Observation – спостереження
Offspring – потомство
Order – ряд
Origin – походження, першопричина
Outbreak – спалах
Outgrowth – наріст
Parasite – паразит
Path – стежка
Pathogen – патоген
Pest - шкідники
Petal – пелюстка
Phenomena – явище
Pheromone – феромон
Plaque – наліт
Poison – яд

Pole – жердина
Pollinator – запилювач
Poplar – тополя
Predator – хижак
Prediction – прогноз
Preventing – запобігання
Prey – здобич
Pruning – обрізка
Psyllid – листоблошка
Pupa – лялечка
Pustule – пустула
Quotient – коефіцієнт
Radicle – корінець
Rate – показник
Reforestation – лісовідновлення
Regeneration – генерація, покоління, відновлення
Reserve – заповідник
Resistance – стійкість
Ride, path – просіка
Rodent – гризун
Root – корінь
Rot – гнилі
Rrepresentative – представник
Rust – іржа
Sample – зразок, вибірка
Sapling – саджанець
Sapwood – заболонь
Sawfly – пильщик
Sawlog – пиловочник
Seedling – сіянець
Set – комплекс
Shape – форма, вид, вигляд
Shoot – пагін
Shrub, bush – кущ
Sign – ознака, симптом
Silvics – лісознавство
Silviculture – лісівництво
Slim – слиз

Slop – схил
Slug – слимак
Snail – равлик
Spore – спора
Sprig – гілочка, пагін
Sprout – пагін, паросток
Stem – стебло
Sting – жало
Storey – ярус
Strain – штам
Stump, stub – пеньок
Surveys – інспектування
Suvel – сувель
Tapping – підсочка
Tar – смола
Tending – догляд
Thinning – рубка (догляду, санітарна)
Thorn – шип, колючка
Threat – загроза, небезпека
Tier – ярус
Tissue – тканина
Toolbox – набір інструментів, інструментарій
Trail – слід, стежка
Trap – пастка
Trip – тріпс
Trunk – стовбур
Tumor – пухлина
Twig – гілочка, прут
Ulcer – виразка
Underbrush, underwood, undergrowth – підлісок
Unearthing – розкопки
Vegetation – рослинність
Vermin – паразити
Vertebrate – хребетні
Viability – життєздатність
Violation – порушення
Virgin – праліси
Wasp – оса

Weakening – ослаблення
Weed – бур'ян
Weevil – довгоносик
Whorl – мутовка
Wireworm – дротяник
Withering – в'янення
Wound – рана
Yeast – дріжджі

VERBS

Assess – оцінювати
Avoid – уникати
Benefit – допомагати, приносити користь
Blossom – цвісти
Bring abut – призводить, викликає
Carry out – здійснювати
Cause – чинити, викликати
Chew – жувати
Compete – конкурувати
Conduct – сприяти
Contribute – сприяти
Control – контролювати, регулювати
Crawl – повзати
Damage – шкодити, пошкоджувати
Defend – захищати
Destroy – знищувати
Destruct – руйнувати
Deteriorate – погіршувати
Determine – визначати
Dieback – відмирати
Disperse – розсівати
Disrupt – порушувати
Draw – окреслити
Dry up – сохнути
Eliminate – усунення, ліквідація
Embrace – охоплювати
Estimate – оцінювати

Fade – в’янути
Forecast – прогнозувати
Germinate – проростати
Harm – шкодити
Hatch – вилуплюватися
Highlight – висвітлювати, виділять
Identify – розпізнавати, визначати
Impair –погіршувати
Increase –збільшити
Infect – заражати
Inhabit – населяти, мешкати
Interact – взаємодіяти
Justify – обґрунтовувати
Lead – призводити
Mate – спарюватись
Measure – міряти
Monitor – контролювати
Observe – спостерігати
Obtain – отримати, добувати
Overwinter – перезимувати
Penetrate – проникати
Pollinate – запилювати
Predict – прогнозувати
Prevent – запобігати
Promote – сприяти
Prove – доводити
Provide – забезпечити
Prune – обрізати, скорочувати
Pursue – переслідувати
Quantify – кількісно оцінювати
Rate – оцінювати
Reduce – зменшити
Resist – протидіяти, чинити опір
Rot – гнити
Route surveys – маршрутні обстеження
Spoil – псувати
Sporulate – спороносити
Spread – поширюватись

Sting – жалити
Suck – смоктати
Suffer – потерпати, страждати
Survey – інспектувати, оглядати
Tend – доглядати
Trap – ловити в пастку
Undertake – здійснити
Unearth – розкопувати
Windblow, windthrow – вітровал
Wipe out – знищувати
Wither – в'янути

ADJECTIVES

Adverse – несприятливий, шкідливий
Available – доступний, придатний, досяжний
Beneficial – корисний
Burnt – сгорівший, обгорівший
Damp – вологий
Desirable – бажаний
Developed – розвинений
Diverse – різноманітний
Dry – сухий
Efficient – ефективний
Essential – суттєвий
Examination – обстеження
Gnarled – сучкуватий
Harmful – шкідливий
Harmless – нешкідливий
Herbaceous – трав'янистий
Homogeneous – однорідний
Legal – законний, правовий
Light-demanding – світлолюбний
Meadow – луговий
Nocturnal – нічний спосіб життя
Perennial – багаторічний
Profound – глибокий
Relevant – актуальний

Resistant – стійкий
Ripe – стиглий, зрілий
Rotten – гнилий, трухлявий
Sexual – статевий
Shade-requiring – тіньолюбний
Spinate, thorny – колючий
Stagnant – в'ялий, застійний
Sticky – липкий
Undemanding – невибагливий
Underdeveloped – недорозвинений
Understocked – низькоповнотний
Undesirable – небажаний
Unfavorable – несприятливий
Uniform – однорідний
Unwanted – небажаний
Uppressed – пригнічений, подавлений
Withered – сухий

COLLOCATIONS

Active substance – діюча речовина
Advisable to apply – доцільно застосувати
Affected surface – уражена поверхня
Affected trees – уражені дерева
Annual temperature – річна температура
Artificial plantation – штучне насадження
Artificial regeneration – штучне лісовідновленя
Ascigerous stage – зимова стадія
Assimilation apparatus – асиміляційний апарат
Average daily temperature – середньодобова температура
Average height and diameter – середня висота і діаметр
Bark beetle – короїд
Bark beetle tunnel – хід короїд
Basal area – сума площ поперечних перерізів
Based upon the obtained results – на основі отриманих результатів
Biometric indicators – лісівничо-таксаційні показники
Bird of prey – хижий птах

Blister rust – пухирчаста іржа
Bracket fungi – трутовик
Broad-leaved forest – широколистяні ліси
Clear cutting – суцільна рубка
Conduct the research – проводити дослідження
Conifer tree – хвойне дерево
Coppice restoration – вегетативне поновлення
Crown coverage percentage – зімкнутість крони
Crown fire – верхова пожежа
Curling leaves – кучерявість листя
Current state – сучасний стан
Dead trees – відпад
Dead wood – сухостій
Decayed wood – гнила деревина
Deciduous tree – лиственное дерево
Division stage – стадія ділення
DNA (deoxyribonucleic acid) – ДНК
Dormant bud – спляча брунька
Dormant stage – стадія спокою
Due to abovementioned facts – внаслідок вище-викладених фактів
Eaten fruits – виїдені плоди
Edge of forest – узлісся
Eggg stage, egg laying – період яйцекладки
Even aged – одновікові (одноярусні)
Experience gained – набутий досвід
Experimental data – дослідні дані
Felling area, cutting unit –лісосіка, вирубка
Fertile soils – родючі ґрунти
Forecast to assess – прогноз для оцінки
Forest belt – лісосмуга
Forest cover – лісистість
Forest crops (forest farming) – лісові культури
Forest floor – лісова підстилка
Forest fuels – лісові горючі матеріали
Forest mensuration – вимірювання лісу
Forest nursery – лісовий розсадник

Forest pathology examinations – лісопатологічні обстеження

Forest residues (logging residues) – порубкові рештки

Forest stand, timber stand – деревостан

Forest type – тип лісу

Forest use – лісокористування

Fresh forest types – свіжі умови лісу

Frost crack – морозобійна тріщина

Further computations – подальші розрахунки

Gall wasp, gallfly – горіхотвірки

General conclusions and proposals – головні висновки та пропозиції

General population – генеральна сукупність

Ground vegetation – надгрунтовий покрив

Groundwater level – рівень грунтових вод

Growing condition – лісорослинні умови

Growing season – вегетаційний період

Growing stock – запас

Hardwood trees – листяні дерева

High accuracy – висока точність

High forest – насадження насінневого походження

Incipient stage – початкова стадія

Index class scale after Prof. M. M. Orlov – бонітетні шкали проф. Орлова

Knotty wood – сучкувата деревина

Land temperature – температура ґрунту

Larval tunnel – хід личинки

Lay eggs – відкладати яйця

Leaf roller – листовійка

Leaf spot – плямистість

Leaf unfolding – розпускання листя

Litterfall (plant litter, leaf litter, tree litter, soil litter) – опад

Live biomass – фітомаса

Living ground cover – живий надґрунтовий покрив

Local executive bodies – місцеві органи влади

Local governments – органи місцевого самоврядування

Low forest (coppice) – насадження вегетативного походження

Mathematical computations – математичні обчислення (розрахунки)

Mature stage – стадія зрілості

Mean age – середній вік

Mensurational indices – таксаційні показники

Mensurational tables – лісотаксаційні таблиці

Mixed stand – мішані деревостани

Modern science – сучасна наука

Mole cricket – вовчок звичайний, капустянка

Natural regeneration – природне поновлення, підріст

Nature reserve – заповідник

Need-eating species – хвоєлистогризи

Need-leav-eating species – хвоєгризи

Nuptial chamber – шлюбна камера

Nutritive substance – поживна речовина

Open wood – рідколісся

Overmaturity stand – перестійний деревостан

Owing to this – завдяки цьому

Pathoentomological surveillance – патоентомологічне спостереження.

Phytosanitary condition – фітосанітарний стан

Poisonous substances – отруйні речовини

Potential threat – потенційна загроза

Powdery mildew – борошниста роса

Primeval forest – первісний ліс.

Protective measures – захисні заходи

Pure stand – чисті деревостани

Pursuance of verification – проведення перевірки

Put in sample plots – закладати пробні площі

Quantitative assessment – кількісна оцінка

Recreational pressure – рекреаційне навантаження

Regeneration harvest – лісозаготівля, рубки головного користування

Regeneration tending – лісівничий догляд

Relative stocking – повнота

Relevance of study – актуальність досліджень

Reproductive stage – репродуктивна стадія

Research data – дослідні дані

Resin duct – смоляні ходи
Rest stage – стадія спокою
Ripe wood – стигла деревина
RNA (ribonucleic acid) – РНК
Root cause (prime cause) – першопричина
Root collar – коренева шийка
Root sponge – коренева губка
Sampling unit – пробна площа
Silvicultural and mensurational characteristics – лісівничо-таксаційні характеристики
Single celled – одноклітинний
Site index – бонітет
Site index class – клас бонітету
Softwood trees – хвойні дерева
Spring frosts – весняні заморозки
Statistical description – статистичний опис
Suggestions for forest practice – пропозиції виробництву
Surface fire – низова пожежа
Sustainable forestry – стійке лісове господарство
Temperature threshold – температурний поріг
Temporary sample plots – тимчасові пробні площі
Timely planning – своєчасне планування
Transitory stage – перехідна стадія
Tree cover – зімкнутість
Trunk burrows – ходи
Two-aged stand – двоярусні деревостани
Underground fire – підземна пожежа
Uneven aged – різновікові
Urban forests – міські ліси
Urgent issues – нагальні питання
Urgent problems of contemporaniety – нагальні проблеми сучасності
Vascular mycosis – судинний мікоз
Vectors of disease – переносники захворювань
Wild stand – корінний деревостан
Winter survival – зимостійкість
Witch's broom – відьмина мітла
Wood waste – відходи деревини

Yield of commercial wood – вихід ділової деревини
Yield tables – таблиці ходу росту
Young stage – ювенільна фаза