

PLANT PROTECTION OF THE APPLE



Morphological description

Taxonomical classification

Phylum of Angiosperms (Angiospermae)
Class of Dicotyledon
Order of Rosales
Family of Rosaceae
Subfamily of Maloideae
Species: *Malus domestica*

The body of the apple

The body of the apple being a fruit-yielding plant consists of two main parts

- The root system that can be found in the soil (main and adventitious roots), the turion and the offset
- The sprout system, that is, the stem, the treetop-and system of branches and the productive parts

I. The root system of the apple tree:

In the case of apple trees propagated from seed the main axis of their root system is a strong „stake root”. The primary side roots of different strength branch out of the stake root then secondary side roots branch out of the primary ones and so on. The last ramifications of the root system are the capillary roots. The main root nature of the root system ceases during the years because of the increasingly strong development of the side roots.

The root structure of fruit bearing plants propagated in vegetative way is different from the root formation of fruit bearing plants propagated in generative way because within the root system a strong central the axis does not develop and the side roots are of approximately same strength. Branching of the roots is richer, rooting is more superficial and the areal network is less. The optimal temperature of root development is 17-20 °C. Above 35°C growing stops. Concerning the root growth of apple trees an intensive spring period and the less intensive autumn period can be distinguished. In spring the growing of the root starts 1-2 weeks earlier than that of the plant parts above the ground.

The roots shape and location in the soil is primarily defined by hereditary determined characteristics. Several outer factors modify the genetically determined root formation.

For example:

- differences between soil types
- the grafted choice species
- the heterogeneity of the soil
- depth of the applied soil cultivation
- the salt endurance capability of the roots
- the nutrient content of the soil
- the temperature of the soil
- the level of ground water

As a result of these root locations with different depth and areal network appear. During that process we have to strive to create a desirable balance between the root system and the sprout system.

II. The sprout system of apple trees

1. The stem of the apple tree

The part of the apple tree between the root collar (or the ground) and the lowest crown branching is called stem. The stem connects the root system and the branch system. Water and nutrient transport, storage of some assimilates and holding the branch system are the task of the stem. The thickness and endurance of the stem make it possible to hold the branch system. From this aspect the ligneous tree part play an important role. Besides, the living the body, the phloem and the bark also help strenghten the stem. Nutrient transport in the stem has two directions. The height of the stem is formed with grafting in tree nurseries or by branchless sapling plantation in fruit orchards. The height of the stem is determined by biological requirements and the applied method of cultivation. Trees with short stems have physiological and economic importance in apple production.

2. The crown and branch system of the apple tree

The crown of the apple tree is the ramified branch system above the stem. The tasks of the crown consist of assimilation. It also makes the vegetative and generative activity of the plant possible. Its typical basic characteristic is natural formation. The majority of apple trees with natural crown do not bear fruit of suitable economic value and high quality so it is appropriate to form an artificial crown. The typical branch system and developmental characteristics of the species have to be taken into account if a crown form is to be created that is proper from biological and economic point of view.

The main parts of the crown are the following:

- branches
- twigs
- sprouts
- productive parts

The branching productive twigs altogether form the productive branch system that is located on the frame branches. In the case of apple trees the direction change of twigs, rods and branches compared to horizontal is an extremely important characteristic. It is the peculiar mark mainly until the time when trees start fruit producing. We make differences between the following branch types in the case of apple trees:

- straight
- bending downwards at the base
- curving upwards at the top
- bending down in an arch-like way

The change of sprout position, the species and subject effect play a vital role in sprout growth, productive bud embedding and fruit production control in the case of intensive crown forms.

The development of branching determines the disposition of the trees and wedersity of the crown. The apple trees with artificial crown forms usually bear fruits earlier and they produce fruits of better quality whereas fruit formation is regular.

The most typical forms of the apple tree:

- lash branch groups
- combined crown
- reel forms (natural, free, slender)
- hedges

3. The productive parts of the apple tree

Buds: the bud is a vegetative or generative sprout outset that is covered with bud scale. In the case of apple trees a differentiation is made between flower buds and temporary buds on quality basis. On the basis of life period buds living for one year and others living for more years can be separated. It is typical in the case of apple trees that bud outskirts which live for more years but do not sprout can be found on them. These are called slumbering buds.

The productive buds form different productive part types on the basis of the place they take in the sprout system. On the apple trees we can distinguish:

- productive twigs (short, of middle-length, long)
- spears
- productive spits
- productive knots

Flowers: the propagating organs of the apple tree are the flowers that form inflorescence. Its parts are: flower axis, cover leaves and genital leaves. The inflorescence is a sprout system on which there are not foliage leaves and flowers develop from each bud.

The flowers of the apple form a so-called umbel. The core is developed from five productive leaves with 2 seed outskirts at the bottom of every productive leaf. On specific apple species even 4-6 seed outskirts may develop, which results in many seeds with fertilisation. The flowers of the apple tree have two sexes. Pseudo fruits are formed at the end of the long flower stalk. In the formation of these the pistil and the receptacle (the upper, widening part of the flower axis) also take part.

Lifecycles

The apple plant's stages of life:

1. Growth stage:

It means the thriving and growth of vegetative parts after planting. It lasts until the plant becomes yielding.

In this cycle the treetop can be formed, sprouting can be modified and the growth of roots can be stimulated.

2. Productive stage

- On this stage beside vegetative growth the generative productive character dominates. Then the harmony between growth and fruit formation may be labelled as proportional.
- Balance in production can be maintained steadily by the modification of disturbing factors such as nutriment, water and bud burden.

3. Stage of decreasing production

- Growth to a lesser extent
- Weakening generative productivity
- Gradual etiolation of productive parts
- Senescence
- Etiolation

Annual biological cycles

1. Dormancy stage:

From autumn to spring.

It is called relative dormancy the stages of which are the following: initial dormancy, innate dormancy and enforced dormancy.

2. Vegetativ stage:

from bud burst to leaf fall

- prefoliation
- sprouting
- blossoming
- foliation
- fruit development
- bud differentiation
- ripening of fruit
- defoliation

Its important phenological phases:

Bud burst: after the dormancy period it is the first active life activity, the visible start of developmental processes that happens in a way and pace characteristic of species and depends on enviromental effects.

Blossoming: the last phase in the whole development of generative organs (sexual maturity), the period of which is species characteristically and genetically encoded but varies considerably because of enviromental effects.

Foliation: it is the phase when the assimilating parts (leaves, sprouts) appear. During foliation these parts incessantly grow as an intensive life-activity affected by the common effect of inner and outer factors.

Fruit development: it is the period when, after binding the fruits grow in weight; volume and diameter. It organites in cell clivision and extension.

Bud differentiation: it is a histological process that takes place from the end of June until the middle of July. In the propagating come of the buds cell division activity increases that means the gradual transformation of the vegetative parts into flower outsets.

Fruit ripening: its base in a sequence of biochemical changes. As a result, species-characteristic, visible and measurable features evolve, for instance colouring, hardness of fruit flesh, sugar-acid rate, dry matter content, flavour-scent-taste materials.

Defoliation: it means the gradual decrease of life processes and biological rhytm of apple trees. It is due to outer enviromental changes and hereditary features. It is also a preparation for the dormancy period.

Pathology - viruses, bacteria, fungi

Viruses - mycoplasmas

I. Name of the disease: Apple mosaic virus

Causal organism: Apple mosaic virus

Host range: peach, almond and plum

Occurrence and importance:

It is the most wide-spread virus of the apple. It infects all kinds of apple in commerce. It appears sporadically but frequently. The virus spreads by vegetative propagation. We are not familiar with its vector. The damage it causes should not be underestimated from economic point of view. The presence of the virus may considerably influence the amount of the crop. In serious case it can cause a 25% decrease in crop. The virus is present in the whole country.

Symptoms and process of the disease:



The typical symptom of the infection is the change in the colour of the leaf. It is chlorotic. It occurs in the form of irregular circle-shaped spots that are yellow or almost white and can be easily defined. In serious cases the infection may cause broad stripes along the veins as well as big chlorotic spots that later turn into necrotic ones. Leaves like that fall prematurely off the tree.



Pale cream-coloured spots may appear on the fruits. The spots are particularly prominent on apples with red cover colour. The infected crop may become little, even deformed.

Disease cycle:

Strain of the virus appear, that is the 'serious mosaic', the 'mild vein stripes mosaic' and the 'mild mosaic'. It is localised and does not spread by either insects or pollen.

Control:

As the virus spreads by propulage - we are not familiar with its vector - we can protect our trees by using virus immune propulage. The production of virus immune propulage and the verification of the virological condition of it towards the consumer are the duty of the tree nurseries. The M9 stock may get infected from roots systematically because of its susceptibility.

II. Name of the disease: Apple witches broom - mycoplasma

Causal organism: Apple proliferation mycoplasma

Host range: only apple

Occurrence and importance:

The pathogenic is known all around Europe although its damage has been detected only sporadically during the last years, which can be carried out by the destruction of cicada species that promote its quick spreading. Its mass presence may cause considerable economic damage because it decreases the life energy of the tree and influences the quantity and the quality of the crop. Apple witches broom may occur on productive trees as well as in the stock of tree nurseries. The symptoms can vary in different generations. The infected tree may not show any symptoms in certain years. The most sensitive species: Golden Delicious, Cox Orange Renet, Jonathan.

Symptoms and process of the disease:

The pathogenic induces several symptoms. The axillary buds under layering get broom-like and develop in bunches or strings. The leaves are usually smaller whereas it is a characteristic symptom for the auricles to grow considerably. Flowering may be delayed. The infected drying flowers fall with difficulty. The pedicel of the flower and the fruit is considerably longer, the crop becomes small, its size may reduce to the one-third of the healthy fruit's size. The infected fruit is ill-coloured in many cases. The skin remains thicker and rougher.

Control:

Protection can be carried out by the usage of healthy propulage. As the infection spreads via virus vectors, that is, cicadas, protection against them may also be effective. During propulage production, before distribution the substance is selected on the basis of the typical symptoms on plant health inspections.

III. Name of the disease: Apple flat limb virus

Causal organism: Apple flat limb virus

Host range: apple and quince

Occurrence and importance:

The pathogenic spreads only by propagule since it has not got virus vector. It is mainly present on young trees. The framework of the diseased trees gets gradually weaker, their fracture stability is considerably diminished. The crop is strongly fastened but its endurance is poor. The frost sensitivity of the infected trees increases.

Symptoms and process of the disease:

The pathogenic causes deformity in the structure of the ligneous parts. Initially hollows and longitudinal cavities appear on the branches and the stem. Later bark splitting, deformity and twisting occur. The symptoms may be present on certain parts of the tree or every branch of it. As the result of bark splitting the body of the tree is exposed to the possible damage caused by different tree spoiling fungi.

Control:

As it is not possible to carry out chemical control only the usage of virus immune propagule can be a solution.

Bacteria

I. Name of the disease: Crown gall - *Agrobacterium tumefaciens*

Causal organism: *Agrobacterium tumefaciens* (E.F. Smith et Town) Conn

Host range: apple, pear, stone-fruits, nut and ornamental trees

Occurrence and importance:

The damage of the pathogenic primarily appears in tree nurseries and on young trees where its economic damage may be significant. It often attacks stone fruits, shell fruits, bacciferous trees, vines, ornamental trees as well as dicotyledonous herbs, eg. sunflower, geranium, dahlia. The plants with galls on their root or root collar must be annihilated. The sale of the plants with galls is forbidden! The pathogenic is only able to infect via wounds from the soil. Its development is likely during the vegetation period. In dormancy the development of the galls is interrupted because it is promoted by vegetation and nutrient increase. The bacterium gets from the collapsed gall to the soil and remains capable of infecting for years. The galls caused by the bacterium trigger water and nutrient transport hindrance in the root transport tissue and serious deformities emerge because of this.

Symptoms and process of the disease:

The bacterium triggers galls that develop on the root and the root collar. The stick-shaped, 1-3 µ long bacteria form colonies. At first small, pea-sized and white galls appear, then they develop strongly and turn into increasing, lignifying and mouldering collapsed galls that gradually get dark brown. Trees like that wither and languish. They are backward in both vegetative and generative development. The pathogenic prefers wet soil rich in nutrients.

Disease cycle:

The pathogenic sticks develop one by one or in short chains. The bacterium does not produce spores. The cell is surrounded by mucilage. The virulence of the isolated phylums is considerably varied and can be effectively traced only in young galls.

Control:

Crown gall protection is not an easy task. As the pathogenic is a typical wound parasite every procedure that decreases the wounds on the root and the root collar may promote the effective control. A partial solution may be soil and propulage sterilisation before cropping. The trees with galls can not be cured that is why prevention is essential. Plants from infected areas must not be used for cropping. The trade of the plants with galls is forbidden. The diseased plants must be filtered in the tree nurseries.

II. Name of the disease: Agrobacterium rhisogenes

Causal organism: Agrobacterium rhisogenes (Riker et al.) Conn

Host range: only apple trees

Occurrence and importance:

The pathogenic is a species specific bacterium as it only damages apple trees. Its presence is rather rare nowadays. It may appear along with crown galls because it is similar to it biologically. As the infected trees possess a larger root system they may be preferred in cropping by mistake.

Symptoms and process of the disease:

In the case of young grafts a typical symptom is the extremely intensive root development that results in the so-called root hairiness. The constant and strong root development disrupts the physiological balance of the tree, which leads to stunted development of the parts above the ground.

Disease cycle:

The developmental process of the pathogenic is similar to that of the Agrobacterium Tumefaciens. Because of the considerably varied virulency the exact identification of the pathogenic is very difficult. The physiological balance breaks down, which initiates an irreversible process.

Control:

In protection the same viewpoints must be taken into consideration as in the case of the crown gall.

III. Name of the disease: Necrosis and bacterial cancer of apple trees - Erwinia amylovora

Causal organism: Erwinia amylovora (burill) Winslow et al.

Host range: apple, pear, quince, slawthorn

Occurrence and importance:

The commonly used name of the disease is fire blight. The name clearly points out the seriousness of the infection and the rapidity of its spreading. The pathogenic may destroy a fully developed and healthy apple tree during a very short time - it may even happen in a month. What is more, the infection can spread like wildfire on more hectares of land. During the process of its spreading the pathogenic attacks a number of cultivated and wild plants belonging to the Rosaceae family, for instance Malus, Pyrus, cydonia, Cotoneaster, crategus, Pyracanta, Sorbus.

The disease is particularly dangerous since

- the pathogenic spreads extremely quickly in the host plant
- the climate and weather conditions of the country are favourable for the pathogenic
- the disease increases production costs and destroys crop and land

- the tools of effective control are restricted.

The bacterium survives the winter mainly in the ulcerous wounds of the trees, sometimes in the buds. It gets activated during the flowering period. The pathogen spreads by propulage, fruit, insects - even bees - birds of passage, wind, rain, pollen and human activity, such as cultivation tools and irrigation. The infection's spreading significantly accelerates if during the flowering period high humidity (75%), high temperature (18-25°C) and water coverage are present at the same time. The pathogenic bacteria settle on the stigma and multiply. They enter the tissue through the natural and wound gaps. The bacterium advances through the stalk to the twigs and branches and induces secondary and further infections in the new shoots, leaves, second flowerings and preliminary fruits.

Symptoms and process of the disease:

During vegetation at first the symptoms of flower infection can be detected. On the sepals and the flower stalks bacterium mucilage occurs, the flowers fade and the preliminary fruits get black but



they remain on the tree. The infected and necrosed young fruits are mummified on the tree. The infection of the growing and not yet lignified shoots takes place on the apex part that fades and curves like a shepherd's crook. The brown or black leaves do not fall off the infected shoots and twigs. In the case of advanced infection in the branches and stem of the susceptible species abundant bacterium mucilage (exudatum) is secreted. The infection on the stem or root collar causes bark splitting, ulcerous wounds and reddish-brown miscolouration of the ligneous part.

The cortical tissue of the infected tree becomes oedematous and turns dark and hollow and later withers. The infected fruits shrivel and get mummified, turn black and remain on the tree for long. The bacterium mucilage occurs in small milk-like drops that later become brownish in the air and form big drops. The bacterium definitely prefers softer tissues, higher humidity and wetter conditions.

Disease cycle:

The bacterium mucilage containing bacteria appears at blossoming. The bacterium that develops inside the flower enters the tissues. The produced enzyme dissolves the cell wall and the pectin material of the cells. In the tissues bacterial hollows are formed full of bacterium cells of 1-2 length that often form 3-5 mms sized separated colonies. The bacterium only attacks actively developing plants but can get activated in the necrotic tissues even in two years' time.

Control:

The first and most important step of the protection - apart from prevention - is the early recognition of the disease. In the case of *Erwinia amylovora* disease it is particularly true that only a complex application of protection methods can bring on some results (agrotechnical elements, plant health rules, production of resistant and tolerant species, chemical and biological control).

The infected plant parts must be removed and burnt immediately. The pruning scissors must be disinfected after every pruning in 10% Hypo solution. One method of protection can be the restriction of the exaggerated nutrient (chiefly nitrogen) dosage.

The range of the chemicals used in protection is narrow worldwide. Chemicals containing copper, certain antibiotics (mainly streptomycin, secondly oxytetracyclin), occasionally chemicals containing flumenique and aluminium-fosetil can be used. The application of pesticides is strictly regulated in several countries. The precisely timed protection that is based on prediction are more effective because they use less antibiotics so they are more economical. In the absence of prediction data protection programme should be carried out 2-4 times during the flowering phenophase.

The following plant protection chemicals can be used in chemical control:

Erwinia amylovora					
Active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Usage class for IPM Integrated classic
Copper	Contact	Champion 50WP	2,0 – 4,0 kg/ha	10	green
Copper	Contact	Bordóilé FW	10 l/ha	10	green
Copper	Contact	Rézoziklorid 50WP	5,0 – 7,0 kg/ha	10	green
Copper	Contact	Scarmagnan rézgálic	10 kg/ha	10	green
Copper	Contact	Cuproxát FW	5,0 l/ha	10	green
Fosetil-aluminium	Systemic	Aliette 80WP	4,0 kg/ha	30	yellow
Kasugamicin	Local-systemic	Kasumin 2L	4,0 l/ha	2	yellow
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

IPM: Integrated Pest Management

1. Table

Applying chemicals with copper content fitotoxicity influenced by varietal susceptibility and weather conditions must be carried out carefully. In commercial orchards during flowering in infection emergency the local plant health authority in charge orders compulsory protection along with the description of control technology. At the same time the authority provides the antibiotics to be used.

Fungi

I. Name of the disease: Apple scab -*Venturia inequalis* (Cke.) Wint

***Fusicladium dendriticum* (Wallr.) Fuckel**

Causal organism: *Venturia inequalis* (Cooke) Wint.

Host range: only apple

Occurrence and importance:

It is one of the most serious fungal diseases of the apple trees. In wet years it can spread epidemically and cause extremely big damage in small and industrial orchards as well. The danger of the infection is considerably enlarged by the complete development of the perithecia that survive the winter as saprophytes in the infected leaves having fallen in autumn. The ascus developing in the perithecia and the scattering ascospores start germinating immediately and infect the leaf and the preliminary flower. They break through the cuticle or via the stomata they start their parasitic life. This process is the phase of the primary infection. The starting point for the secondary infection is the occurrence of the summer propagating organs, the conidia. The big mass of the conidia is swept away by the rain or by the wind. They get to the green surface of the tree, to the leaf, shoot or fruit and trigger additional spots by new infection. Certain apple species are very susceptible to the infection, among these the following ones are outstanding: Red Delicious, Golden Delicious, Jonathan, Cox Orange Renet, Gala, Elstar, Jonagold, Fuji.

The fungus causes regular and serious damage on areas where the amount of the annual rainfall is over 650 mm or the plantation is located in closed, foggy and wet valleys, on soil covered by weed and the foliage is thick. Unilateral nitrogen fertilising also increases susceptibility.

Symptoms and process of the disease:

Velvety, dull and round spots 2-8 mm in diameter appear on the infected leaves, fruits and rarely on the shoots. In the case of strong infection the leaves get curved, deformed and partially or completely wither and fall. The fruitlet is deformed. It becomes flat, degenerated and small. Its skin and flesh get cracked then the fruit falls preliminary. On the fruits the traces of the spring infections are the most salient and spectacular. The subsequent infections often develop during storage and determine the period and cost-effectiveness of storage.





The condition of the infection: the presence of the contagious pathogenic, a susceptible plant (or susceptible species), wet surface of the plant and temperature between 2°C-25°C.

The definition of the infection period is still based on the Mills chart. The chart created by Shows the period of leaf surface wetness needed for infection and incubation time in relation with temperature. The chart can be efficiently applied nowadays. More sorts of instruments can be used for the measurement of leaf surface wetness, for instance metos, Luft, Bi-os.

In spring and summer the 8-10 hour dew coverage in deeper locations may cause surprise as it may create the conditions of the konidium infection.

Table of Mills

Temperature °C	Infection grades			Latency period in days
	Slight	Medium	Strong	
	Period needed for infection in hours			
5°	More than 2 days	More than 2 days	More than 2 days	22
6°	26	34	51	20
7°	21,5	27	40	19
8°	18	23	34	18
9°	15	20	30	17
10°	14	19	28	16
11°	12,5	17,5	26	15
12°	11,5	16	24	14
13°	10,5	15	22,5	13
14°	10	14	21	12
15°	9,5	13	20	11
16°	9	12,5	19	10
17°	9	12	18	9
18°	9	12	18	8
19°	9	12	18	8
20°	8	12	18	8
21°	9	12	18	8
22°	9	12	18	-
23°	9	12	18	-
24°	9,5	12,5	19	-

25°	10,5	14	21	-
-----	------	----	----	---

Because of the intensive spring growing of the trees, in case of frequent infection period protection takes place in every 5-6 days while on 1 summer days devoid of infection the maintaining protection happens in every 12-14 days.

To avoid the resistance to chemicals it is advise able to apply substances with different effect mechanisms, absorbing and contact chemical combinations and the rotation of these.

Disease cycle:

Venturia inaequalis overwinters on fallen leaves on the ground. In the early spring, the fungus produces spores in fruiting structures know as pseudothecia. The spores are discharged during rain and blow to the leaves and the developing fruit. Ascospore discharge usually starts about the time bud swell occurs and continues through petal fall. Leaf infections can occur in as few as 8 hours under favorable temperature and wetting conditions. Recently expanded leaves are more susceptible than older ones. Spores produced on these primary lesions are washed onto fruit and leaves, causing secondary infections, which can continue into the early summer if the weather is cool and wet. Fruit become more resistant to infection as they mature.

Control:

Against *Venturia inaequalis* there are two ways of efficient control on the basis of the pathogenic's way of life. One opportunity is the reduction of the development and further infection of the perithecia that survive the winter in the fallen, infected leaves. A very easy way of it is the collection, annihilation or tedding of the leaves. On top of this it is essential that a chemical treatment should be applied to prevent the pathogenic's survive. The other opportunity is to hinder the germination of the ascospores and konidiums on the surface of the plant and creeping of those into the tissues.

Resistant varieties: Freedom, Liberty, Prima...

The following chemicals can be used in chemical control:

Apple scab (<i>Venturia inequalis</i>)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Propineb	Contact	Antracol 50WP	2,0 kg/ha	30	yellow
Klórtalonil Chlortalonil	Contact	Bravo 500	2,5-3,0 l/ha	21	green
Kaptan Captan	Contact	Buvidic K	1,5 – 4,0 kg/ha	10	green
Ciprodinil	Systemic	Chorus 75 WG	0,2 – 0,3 kg/ha	21	green
Kesoxin-metil	Systemic	Discus DF	0,2 kg/ha	35	green
Mankoceb Mankoceb	Contact	Dithane M-45 (DG)	2,0 kg/ha	30	yellow
Rézhidroxid Copper	Contact	Kocide 101 (DF)	2, -3,0 kg/ha	10	green
Metiram	Contact	Polyram DF	2,0 – 2,5 kg/ha	30	yellow
Difenikonazol	Systemic	Score 250 EC	0,2 – 0,25 l/ha	14	yellow
Penkonazol	Systemic	Topas 100	0,5 l/ha	14	yellow
Copper + oil	Contact	Vegecol R	2,0 – 3,0 l/ha	-	green
Bromukonazol	Systemic	Vectra	0,3 l/ha	14	yellow
Trifloxistrobin	Systemic	Zato 50 WG	0,1 – 0,15 kg/ha	14	green
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

2. Table

II. Name of the disease: Powdery mildew of apple trees - *Phodoshpera leucotricha* (Ell. et Ev.)

Causal organism: *Phodoshpera leucotricha* (Ell. et Ev.) Salm.

Host range: apple, pear, quince and medlar

Occurrence and importance:

It is a really frequent, almost permanent disease of the apple trees. In the case of certain species (eg. Idared, Jonathan) it germinates in abundance. Powdery mildew constantly endangers the young green plant parts during the whole vegetation period. On the young shoots, leaves and the productive bases epiphyte fungi threads and productive parts compose a white flour-like coat on the surface, develop and infect (secondary infection). The mycelium of the pathogenic survives the winter in the buds. In milder winters myceliums can occasionally be found on the surface of the twigs. The development of the konidiums starts in spring before blossoming so along with the bursting buds the fungi also develop (primary infection). Powdery mildew is the most frequent in warm, dry places and years and on sandy, dry soil.

Symptoms and process of the disease:



After bud bursting the joints of the shoots sprouting from the infected buds are short, the leaves are narrow and a bit thickened. They turn white from the quickly developing mass of mycelium. A typical symptom of apple tree powdery mildew is the white-greyish, leafless so-called "candle shoot". The infected flower buds become deformed and blossom later, possibly perish. If the stalk of the preliminary fruits also gets infected the infection spreads on to the fruit as well, which is followed by cellular browning. Then the fruit' corkiness develops into a network that may crack and deform.

Some species are rather sensitive: JONATHAN and clones, IDARED etc.

Disease cycle:

The fungus overwinters as mycelium in dormant apple buds. The mycelium grows from the infected buds, and by the tight cluster of pink stage it produces spores on the leaf surface. These spores are blown to new leaves and fruit and initiate primary infections. Mildew infections are favored by warm, humid weather. Unlike scab and most other apple diseases, powdery mildew does not require free water (rain or dew) for infection. Secondary infections can continue through the summer until the terminal bud sets.

Control:

In protection the special resistance, the growing force, the production area, the unilateral nutrition and proper winter pruning of the species can be determining factors in the process of the infection. The chemical treatment of the primarily infected shoots is practically impossible. By chemical treatment only the protection of the shoots and preliminary fruits developing from healthy buds can

be successfully carried out. The most effective method is removing the infected twigs and the fringed` terminal buds by pruning. In spring until the end of the intensive shoot growing the frequency of the application of the organic chemicals against powdery mildew must be based on the phenological and weather conditions, the pathogenic`s way of life and the extent of the infection.

The following substances can be used in chemical control:

Powdery mildew of apple trees (<i>Phodoshpera leucotricha</i>)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Ciprodinil	Systemic	Chorus 75 WG	0,2 – 0,3 kg/ha	21	green
Sulphur	Contact	Cosavet DF	3,0 – 7,5 kg/ha	-	yellow
Kresoxin-metil	Systemic	Discus DF	0,2 – 0,3 kg/ha	35	green
Dinokap	Contact Local-systemic	Karathane LC	0,6 – 1,2 l/ha	30	red
Sulphur	Contact	Kén 800 FW	4,0 – 7,0 l/ha	-	yellow
Bupirimat	Systemic	Nimrod 25 EC	0,8 – 1,2 l/ha	2	green
Fuzilazol	Systemic	Punch 40 EC	0,05 – 0,1 l/ha	21	yellow
Fenarimol	Systemic	Rubigan 12 EC	0,4 – 0,6 l/ha	21	yellow
Difenokonazol	Systemic	Score 250 EC	0,2 – 0,25 l/ha	14	yellow
Miklobutanil	Systemic	Systhane 12 E	0,6 l/ha	14	yellow
Penkonazol	Systemic	Topas 100 EC	0,5 l/ha	14	yellow
Trifloxistrobin	Systemic	Zato 50 WG	0,1 – 0,15 kg/ha	14	green
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

3. Table

In certain technologies Dinokap and substances with copper content are still used but they are more and more frequently omitted from integrated control because of their side-effect against predatory mites.

III. Name of the disease: **Canker collar rot of apples - Sclerotinia fructigena**

Causal organism: Sclerotinia fructigena Pers.

Host range: apple, pear, quince and stone-fruits

Occurrence and importance:

It is a very frequent disease of the fruit trees. The wound-parasite triggers fruit rotting on apples and pears. The fungus infects the fully developed and almost ripe fruits on the trees. It occurs simultaneously with mechanical injuries, hailstorms, insect mastication, apple and leaf skeletonisers. The flower and branch withering is rather rare.

Symptoms and process of the disease:



Brown, rotting spots appear on the infected fruits. The spots constantly get larger, then eventually they spread over the whole surface of the fruit. Around the place of the infection circle-shaped mould pads occur on the fallen fruits or those remaining on the tree. The mycelium of the fungus entirely interweaves the infected fruit that becomes stiff, mummified, maybe black. The fungus spreads on the stored fruits - mainly if they in close contact - through the cortical pores or lenticels.



Disease cycle:

As in spring the fungus develops very slowly so it later infects fruits instead of flowers. In the case of drupes the monilia infection of the flowers is caused by *Monilia laxa*, not by *Monilia fructigena*. On the rotten fruits mould colonies form where the konidiums of the fungus develop in mass. They spread by the wind and insects and may trigger an epidemic infection.

Control:

The efficiency of the protection depends on the successful intervention against the insect pests (leaf skeletonisers and fruit moths) and the removing of the fruit mummies that remain on the trees. During the summer the protection against scabbing and the chemicals used for this purpose provide suitable control chiefly if they are completed with a final spraying before harvest that can be an adequate protection against storage diseases.

The following substances can be used in chemical control:

Canker collar rot of apples (<i>Sclerotinia fructigena</i>)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Kaptan	Contact	Buvicid K	1,5 – 4,5 kg/ha	10	green
Copper	Contact	Champion 50 WP	2,0 – 3,0 kg/ha	10	green
Mankoceb	Contact	Dithane M45 (DG)	2,0 kg/ha	30	yellow
Copper	Contact	Pluto 50 WP	3,0 – 4,0 kg/ha	10	green
Iprodion	Contact	Rovral 50 WP	1,0 kg/ha	10	green
Tiofanat-metil	Systemic	Topsin M-70 WP	0,8 – 1,6 kg/ha	14	red
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

4. Table**IV. Name of the disease: Bark necrosis**

Causal organism: *Phacidiella discolor* of apple trees (Mont et Sacc.) Poteb

Host range: apple, pear and quince

Occurrence and importance:

The most frequent cancer diseases of the apple are the following:

- *Nectrina galligena* (Bres)
- *Sphaeropsis malorum* (Berk.)
- *Phomosis mali* (Schulc et Sacc.) Rob.
- *Nectria cinnabarina* (Tode et Fr)

Mycosis causes branch and bark necrosis on older trees and entire destruction in more serious cases. The starting point of the infection is the untreated wounds that occur during pruning or other mechanical bark and body injuries. The apotecium of the pathogenic is embedded in the ligneous tissue.

Symptoms and process of the disease:

The pathogenic is a wound parasite that attacks the healthy tissues through wounds and destroys the cortical tissue and the cambium.



A serious infection destroys main branches and stems accompanied by tissue rank growth.



Tissue rank growth usually forms on the border of the healthy and the infected parts. At first a necrotic spot appears that is some centimetres in diameter. Later it grows and the necrotic part of the bark cracks and separates.

Disease cycle:Nectria cinnabarina (Tode et Fr):

The ascospores spread in autumn. Because of winter and summer rains the 1,5-3 μ big conydiae separates and infects very quickly through wounds. That is the reason why cancerous wounds do not occur. The pathogene spreads in the inner bark. The infected branches wither before leafing.

Nectria galligena Bres.:

The process of the disease is slow. The annually developing cambium perishes. The bark and the inner bark get thicker in the form of continuously enlarging branch canker. Kadmiums incessantly develop where 0,5 mm big stromes carrying peritelyums winter.

Physalospora obtusa (Schw.) Cke: asexual.Sphaeropsis malorum Berk.:

The occurrence of sexes is rare. The bark withering on the stem and branches may cause the partial or total cankering of the tree. The infection triggers reddish-brown spots on leaves while the

emerging black spots make the fruits rotten. The pycnidiums developing here winter embedded in the tissue. The pycnosporangia are $15 \times 10 \mu$ in size. They are one or two-cell propagating organs.

Control:

Careful wound treatment and proper removing of the infected parts may prove to be an effective method of protection.

The importance of wound treatment against the pathogenic and spraying with chemicals containing copper after harvest has declined lately in apple plantations but they can be considered useful again in the control of fire blight as a compulsory technological phase in the protection from cancer diseases. Further chemical control is carried out with absorbing fungicides.

Pests

I. Name of the pest: Apple codling moth - *Cydia pomonella* Linnaeus

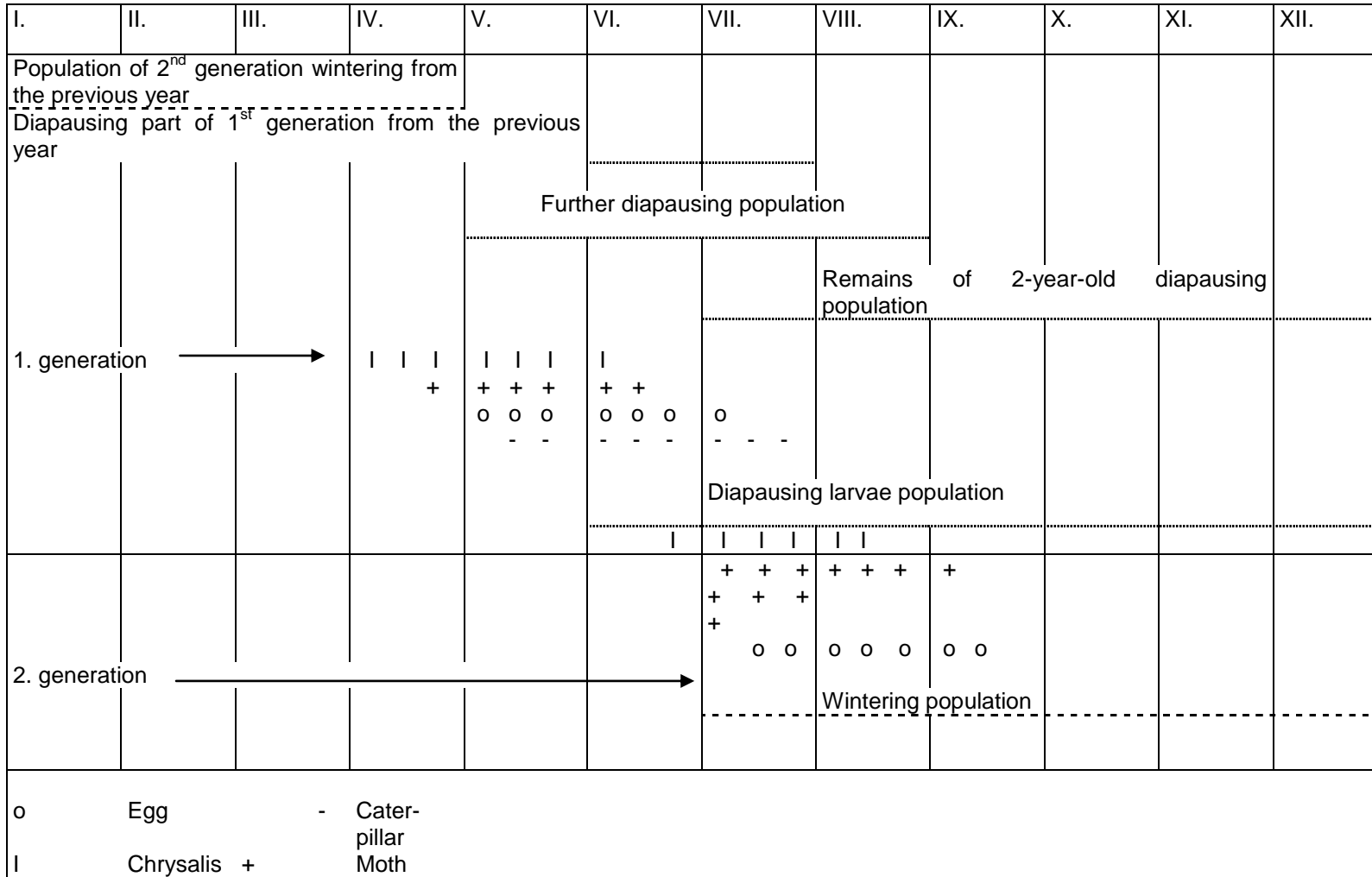
Causal organism: *Laspeyresia (=Cydia) pomonella* Linnaeus

Host range: apple, pear, plum and nut

Occurrence and importance:

It often causes surprisingly big damage in gardens and fruit farms. It survives the winter in the form of a developed caterpillar in the bark splits of the stem or in other shelters. In spring, at the end of the long chrysalis progress the first moths turn up towards the end of April, but it varies according to the area and the year. The moth normally has two generations annually. Its mass swarming lasts from the middle of May until the end of June. The two generations frequently melt. The explanation for this is that swarmings take a long time and weather can further influence the intensity of the swarming. In many cases the images of the apple moth swarm from the second half of April even until the end of September without a swarming peak. The image of the apple moth is 9-12 mm long. The span of its wings is 20 mm. Its front wings are brownish on blue-greyish base. On their top a salient bronze coloured `mirror-spot` is located. The hind wings are pale brownish-grey. The fully developed larva is a 15-18 mm long caterpillar the back of which is reddish while its abdominal part is yellowish-white. The moths stay on a hiding place during the day. They start flying around twilight. After mating the females lay approximately 150-250 eggs on the leaves and the fruits that are as small as nuts. The caterpillars hatch in 1-2 weeks and spend short time on the surface of the plant. They find a suitable place on the surface of the small green for intruding. The first shedding takes place near the skin whereas the second happens towards the core. When it gets to the core it destroys the pips and after a new shedding it chews an outleading channel. It removes its excreta through this hole and then it also leaves there to find a new fruit or a proper place to become a chrysalis.

THE DEVELOPMENTAL PROCESS OF THE APPLE MOTH



1.

Figure

Symptoms:



The damage of the infection is widely known. On the fruit as small as a nut a tiny wound can be found where the caterpillar intruded the fruit. Around the hole the excreta of the caterpillar can be detected. In many cases the excreta can be found between fruits adjacent to each other. The early infected fruits may deform, fall or remain small. The wound may be a starting point for a new infection caused by the rotting activity of a parasite fungus (eg. monilia). In the case of late infection the larva of the apple moth can get to the consumer's table with the harvested and stored fruit. The pest regularly

damages pears, plums and nuts as well.



Life cycle:



Eggs are laid in clusters of 3-150 on leaves or fruit. Adults produced by the overwintering larval generation emerge during October and November. These give rise to the first summer generation, in which final instar larvae mature between January and mid February. Second generation larvae reach maturity during March and April, and the adults from this generation provide third generation eggs. Normally, the rate of larval development is slowed considerably during the winter; thus the majority of larvae over-winter in the prolonged early juvenile phases of the second, third, and fourth instars. During this period they normally feed on herbaceous plants. Re-invasion of apple trees takes place during October-December, when moths of the third generation start laying eggs again on the apple leaves.

Control:

Apple moth control is the essential part of the plant protection program. Along with the agrotechnical protection that involves the partial destroying of the larvae that survive the winter in the cracks of the bark it is also very important to use absorbing, quick and effective piretroids that hinder chitin synthesis in chemical control. Protection may be aimed at the swarming moths, the eggs or the hatching larvae. For the exact observation of the male swarming it is advisable to use sexual attractant (pheromon). In each trap 5-8 males in a week may be warning concerning the swarming.

Within a week after the observation of the critical number of entities it is expedient to start chemical control against moths and eggs while in the case of larvae the period is 10-14 days. The range of the chemicals at disposal are wide. The usage of the substances with different effect mechanism and duration must be adjusted to the developmental phases of the pest. The swarming moths are killed by piretroids (Alfamrin) and gaseous chemicals (Diklorfosz). The eggs and the young larvae are mainly destroyed by insecticides that hinder chitin synthesis (Fenoxikarb). In protection the abovementioned piretroids are effective against larvae as well as the organic phosphorus acid aesters. The Benzutap, the Etonfenpox and the Bacillus Thuringiensis can be involved in the rotation of the chemicals. Two wasps as the natural enemies of the apple moth must be mentioned here, the egg parasite Trichogamma Cacoeciae and the larva parasite Dibrachys Cavus. As the part of the integrated plant protection technology the Juvenilhormon productions, the Bacillus Thuringiensis and chemicals hindering chitin synthesis play a more and more important part.

The following plant protection substances can be used in chemical control:

Apple moth (Cydia pomonella Linnaeus)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Triflumuron	Contact	Alsystin	0,4 – 0,5 kg/ha	35	green
Bacilus Thuringiensis	Contact	Bactucid P.	0,5 – 1,0 kg/ha	1	green
Diazinon	Systemic	Basudin 600 EW	1,5 l/ha	10	yellow
Dimetoát	Systemic	BI 58 EC	0,8 – 1,0 l/ha	7	red
Tiaklopid	Systemic	Calypso 480 SC	0,24 – 0,45 l/ha	14	-
Permetrin + Tetra Metrin + PBO	Contact	Chinetrin 25 EC	0,3 – 0,5 l/ha	4	red
Alfametrin	Contact	Fendona 10 EC	0,12 l/ha	7	red
Béta-Ciflutrin	Contact	Bulldock 25 EC	0,3 – 0,5 l/ha	7	red
Béta-Cipermetrin	Contact	Chinmix 5 SC (ME)	0,25 l/ha	7	red
Cipermetrin	Contact	Ripcord 20 EC	0,2 – 0,3 l/ha	10	red
Lambda-Cihalotrin +	Contact	Judo	1,0 – 1,2 kg/ha	10	red
Diklórfosz	Gas	Unifosz 50 EC	1,0 l/ha	5	red
Endosulfán	Contact	Thiodan 35 EC	1,2 – 2,0 l/ha	30	yellow
Foszalon	Local-systemic	Zolone 35 EC	1,75 l/ha	21	yellow

Metidation	Local-systemic	Ultracid 40 WP 40 EC	0,05 – 0,1 %	14	red
Fenoxikarb	Contact	Insegar	0,3 – 0,6 kg/ha	21	green
Diflubenzuron	Contact	Dimilin 25 WP	0,05 – 1,0 %	14	green
Flufenoxuron	Contact	Cascade 5 EC	1,0 – 1,5 l/ha	30	green
Teflubenzuron	Contact	Nomolt 15 SC	0,5 – 0,75 l/ha	14	green
Bacillus Thuringiensis	Contact	Dipel	1,5 – 2,0 kg/ha	-	green
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

5. Table

II. Name of the pest: Woolly aphid - *Eriosoma lanigerum* Hausmann

Causal organism: *Eriosoma lanigerum* Hausmann

Host range: apple, pear, quince and slawthorn

Occurrence and importance:



It is a parasite pest living exclusively on apple trees. In the case of high entity density the pest forms colonies on the ligneous parts, mainly around the bark wounds and colonies can also be found on the green shoots along the leaf joints. The reddish-brown aphids are 1.7-2.2 mm long with thick, white and cotton-like vax thread on their abdomen. The females are viviparous. By parthenogenesis 8-10 generations develop annually. They resist the winter cold. They put their offspring on the collar root or the root part of the tree. They start their life activity in early summer, their reproduction is quick, the colonies causing tissue rank growth form rapidly.

Symptoms:

The suction of the pest is followed by tissue rank growth on the shoots and branches that triggers nutrition supply disorders. In serious cases a part of the tree or the whole tree withers. The pest may damage the root as well where it induces abnormal tissue rank growth.

**Life cycle:**

The woolly apple aphid, like many other of its aphid cousins, is capable of rapid development in summer and can complete a series of overlapping generations. This means that, after the early spring period, all stages of the insect are likely to be present at one time. The population is composed entirely of females which reproduce asexually (parthenogenetically), giving birth to live female young. The only exception to this occurs rarely. A proportion of the females are winged and they produce male and female wingless young. These sexuales develop to adult,

mate and lay eggs which overwinter on the trees.

Control:

The abnormal increase of the pest can be hindered by proper pruning, regular tree care, removing stock sprouts and wound treatment. The spraying at the end of winter considerably thins the entities that survive the winter on the trees. The chemicals used against other pests (aphids) in the vegetation can efficiently control the woolly aphid. The activity of the woolly aphid wasp (*Aphelinus mali*), the natural enemy of the woolly aphid is very important because it is present in every infected fruit and its reproduction must be promoted. The right choice of insecticides makes it

possible. The usage of piretroids should be avoided as these substances are toxic to the *Aphelinus mali*.

Woolly aphid (<i>Eriosoma lanigerum</i> Hausmann)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Metidation	Local-systemic	Ultracid 40 EC	0,075 – 0,15 %	14	red
Foszalon	Local-systemic	Zolone 35 EC	1,75 l/ha	21	yellow
Triakloprid	Systemic	Calypso 480 SC	0,3 – 0,45 l/ha	14	-
Triazamat	Systemic	Aztec 140 EW	0,5 – 0,7 l/ha	7	green
Poliszulfidkén+ vazelinolaj	Contact	Vektafid S	25 – 50 l/ha	-	green
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

6. Table

III. Name of the pest: **Weevil (Blossom or bud weevil) –**

***Anthonomus pomorum* Linnaeus**

***Anthonomus pyri* Kollar**

Causal organism: *Anthonomus pomorum* Linnaeus
Anthonomus pyri Kollar

Host range: apple and quince

Occurrence and importance:

Its main host plant is the apple tree but it rarely occurs on pear trees as well. Warm and dry weather promotes its mass reproduction. The developed bud weevils survive the winter under the bark of the trees but they often use the trees of the surrounding forest and the level of the fallen, dry leaves as a hiding place. The image is 3-5 mm long, its colour is greyish-brown. On the wing top there is a characteristic V-shaped diagonal light-coloured stripe. Their mass swarming starts early in spring, almost immediately after snow melting.

Symptoms:



The mass reproduction of the pest is promoted by dry and warm weather. Mainly the larvae cause damage. The perforated flower buds do not blossom, they turn rusty-brown and wither. The damaged preliminary flowers are not able to develop and fasten so the fruit production do not occur. In mass it can trigger serious economic harm. The woolly aphid is a one-generation pest. The gradation can be predicted by sexual attractant.

Life cycle:

The pest produces one generation per year.

The wintering insects carry out maturing nutrition for 8-10 days. The females lay their 30-80 eggs to the green buds. The larvae hatch out in 5-7 days and eat inside the buds. After 2-3 shedding they transform into chrysalis on the place of damage 4 weeks later the fully developed insects peeling leaves start their relaxing period.

The adult emerges from the pupa between mid-May and mid-June. For about a fortnight, it feeds by taking small bites from the leaves of trees. It then conceals itself beneath the bark of apple or forest trees, or beneath stones, dead leaves, etc., and remains in diapause until the following spring (aestivo-hibernation). It leaves its hiding-place between mid-February and the beginning of April when the mean daily temperature has been at least 9°C for a number of days. The time of emergence can thus vary from one orchard to the next, according to differences in microclimate. The diurnal beetle feeds by piercing buds. 10 to 15 days after emergence, it has reached sexual maturity and mates. 3 days later, the female deposits eggs singly, each inside a flower bud. The larva feeds on the reproductive parts (ovaries and stamens) and inner surface of the petals.

Control:

Spraying before bud bursting and the chemicals applied around `mouse ear` condition hinder the mass egg-laying of the females and through this the larva population remains rare.

The following substances can be used in chemical control:

Weevil (Blossom or bud weevil)-<i>Anthonomus pomorum</i> Linnaeus					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Cipermetrin + Klórpifosz	Local-systemic	Nurelle D 50/500 EC	0,7 – 1,0 l/ha	14	red
Endosulfán	Contact	Thiodan 35 EC	1.2 – 2,0 l/ha	30	yellow
Eszfenvalerát + Fenitroton	Contact	Alpha-Combi	0,6 – 0,8 l/ha	14	red

Foszfalon	Local-systemic	Zolone 35 EC	1,75 l/ha	21	yellow
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

7. Table

IV. Name of the pest: San Jose scale - Diaspidiotus perniciosus Comstock

Causal organism: Quadraspidiotus (=Diaspidiotus) perniciosus Comstock

Host range: apple, pear, apricot, plum, almond and grapes

Occurrence and importance:



On regularly and properly treated plantations the San Jose scale almost never turns up and cause damage. It primarily settles on ligneous parts but its trace can be detected on the fruits as well. It has typically many host plants and two generations. The developed females give birth to their tiny yellow offspring in a viviparous way under a greyish-black shell 1.5-2mm in diameter. The freely moving larvae later settle down and excrete an increasingly wider and thicker black shell from their wax glands. In many cases the border

between the two generations melts.

Symptoms:



On the branches and twigs of the trees attacked by the San Jose scale suction traces can be found. The occurrence of more crowded colonies may trigger a more serious infection that may lead to the partial or complete withering of the branches. This damage can significantly decrease the amount of the productive soil and the crop. On the infected fruit a red-coloured ring, the so-called `fever spot` can be sharply defined that considerably ruins the market value of the goods.

Life cycle:

Most of the life cycle of this insect is spent under a secreted waxy covering that protects the soft, sessile insect from predators and to some extent even insecticides. Young scales have smaller, very light-colored coverings that darken to a sooty black or ashy appearance as they grow larger and mature. Similar species of scale found on fruit, such as lecanium scale, oystershell scale and scurfy scale, all have non-circular coverings distinctive to their species. The lemon-yellow, newly born nymphs (called "crawlers") are barely visible to the eye, and resemble mites except they have only

three pairs of legs and possess a pair of antennae. The full grown female scale covering is about 1/16 inch (1.5 mm) in diameter. Under this covering, the female scale is pale yellow in color and rather baglike in form, with no discernible head or legs. Male scale coverings are about half the size of female coverings. Adult male scales are strikingly different, with well-developed legs, antennae, and a single pair of wings. They are a dark yellow to cinnamon brown color and have a thin dark brown band extending across the thorax between the wing bases. Males are rarely seen except in pheromone traps.

Control:

One of the best opportunities of the protection is spraying with radical substances at the end of the winter. By the application of these the wintering entities can be destroyed so thoroughly that the scales practically do not survive the effects of the substances used for thinning in the vegetation period. During the vegetation period protection must be aimed at the flying males. Prediction and observation can be carried out by the so-called `white sheet` trapping method. Proper timing and careful, cautious application technique determine the success of the protection to a great extent.

The following plant protection substances can be used in chemical control:

San Jose scale (<i>Diaspidiotus perniciosus</i> Comstock)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Metidation	Local-systemic	Ultracid 40	0,075 – 0,1 %	14	Red
Vegetable oil	Contact	Vegeol	3 %	-	Green
Poliszulfidkén + vazelinolaj	Contact	Nevikén	25 – 50 kg/ha	-	Green
Permetrin + Tetrametrin + PBO	Contact	Chinetrin 25 EC	0,3 – 0,6 l/ha	4	Red
Dimetoát	Systemic	BI 58 EC	1,0 – 3 l/ha	7	Red
Metilazinfosz	Systemic	Metil-Cotnion 25 W	1,0 l/ha	10	Red
Karbaril	Systemic	Ravion 85 WP	2 kg/ha	10	Red
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

8. Table

On plantations with closed foliage cultivated in a traditional way a bigger amount of plant protection liquid must be used in spraying.

V. Name of the pest: Green apple aphid - Aphis pomi Deg.

Causal organism: Aphis pomi Deg.

Host range: apple- rumex, anthriscus, berried, forestry plants,

Occurence and importance:

It is a widespread pest with many generations. Its foremost host plant is the apple but can also be found on pears, quinces and other species of the Rosaceae family. It develops mainly on the young shoots and leaves of young trees but can multiply in older plantations, too. It causes more serious damage in tree nurseries by shrinking the leaves and deforming the shoots. The green apple aphids are light green or grass-green, 1-2 mm long insects with soft body. They are either winged or not. In the beginning of March the viviparous primary mothers hatch from the eggs that have survived the winter. They form new generations of mothers that found further colonies. In September the developed generation with own sex lay wintering eggs to the root of the buds and the shoot apex.

Symptoms:



The green coloured aphids suck along the axis of the shoot and on the adaxial surface of the leaf, mainly along the main vein. As the result of this, the leaves get curled in longitudinal direction and the growing of the shoots stops. The shoots may even perish.





Life cycle:

Green apple aphid overwinters in the egg stage. The eggs are shiny-black and look identical to those of rosy apple aphid and apple grain aphid. Overwintering eggs of green apple aphid are found at the base of buds and leaf scars on terminal shoots and water sprouts. Most eggs can be found 15-20 cm (6 to 8 inches) from the tips of twigs; they are seldom found on scaffold limbs or tree trunks.

In the spring, eggs begin to hatch as buds are unfolding. Newly hatched nymphs are all females. After feeding for about two weeks and molting several times, the nymphs mature into wingless adults that are able to reproduce without being fertilized by males. They give birth to live young, thus skipping the egg stage and allowing for the rapid build-up of large populations. Each female produces 50 to 100 offspring that reach maturity in about seven to ten days.

Depending upon weather conditions, one generation is completed in two to three weeks. There are many generations per year. Adult aphids in a colony are generally wingless until crowded conditions induce the formation of winged individuals that can disperse to new hosts. Green apple aphid usually stays on apple throughout the summer. In late-summer, it goes through the sexual phase of its life cycle; males are produced as well as females, which mate and produce offspring that then lay overwintering eggs.

Control:

In the case of the green apple aphid the wintering eggs can be removed from the shoot apex in agrotechnical way, by pruning. The eggs that have survived the winter is considerably thinned by the spraying at the end of the winter. In the vegetation period the tendentious usage of special aphidocids are effective and successful. (Pirimikar B, Trizamat). As the colonies of the green apple aphid are really fragile substances not precisely aimed at aphids can bring good results. (Dimetoát, Metidation, Cipermetrin, Endosulfán). In protection the natural enemies of the aphids can help a lot (ladybirds, buzzing flies, lacewings). It is possible only if environment friendly technology is applied.

VI. Name of the pest: Leaf reddening aphid - *Dysaphis devecta* Walker

Causal organism: *Dysaphis devecta* Walker

Host range: apple, pear, quince and species rosaceae

Occurrence and importance:

The leaf reddening aphid is the pest of home orchards and the cultivation of stone fruits. It brings on many typical symptoms. It survives the winter in egg form. In April the larvae - that were born in a viviparous way - cause damage to the bursting leaves. The body of the pest is grey, round and covered by wax. In summer it moves to host plants (*Rumex crispus*, *Anthriscus silvestris*) from where it returns to the apple tree to lay eggs.

Symptoms:

Following the traces of suction the lamina gets bulging in a longitudinal direction on the abaxial surface. It gets thicker, deformed and it turns to yellowish-red, reddish colour. Later (in June) the infected leaves necrotise and fall. The suction traces can be located on the fruit itself in the form of red spots. An infection recurring more times may weaken the tree or even destroy it.

1. Picture

Life cycle:

The ancestress hatches out at the beginning of spring and soon lays alive larvae that suck under the shield of the leaves. And the end of July the sexually mature generation develops. The fertilised female lays the wintering eggs into the cracks of the bark. After the development of several generations return to the wintering place on the apple tree with dwelling on other host plants.

Control:

The following plant protection substances can be used in chemical control

Leaf reddening aphid (<i>Dysaphis devecta</i> Walker)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Triazamat	Systemic	Aztec 140 EW	0,5 l/ha	7	green
Diazinon	Systemic	Basudin 600FW	1,5 l/ha	10	yellow
Vegetable oil	Contact	Biola	30 – 50 l/ha	-	green
Permetrin + Tetrametrin + PBO	Contact	Chinetrin 25 EC	0,3 – 0,5 l/ha	4	red
Lambda Cihalotrine	Contact	Karate 2,5	0,3 – 0,5 kg/ha	3	red
Dimetoát	Systemic	BI 58 EC	0,8 – 1,0 l/ha	7	red
Metidation	Local-systemic	Ultracid 40 WP EC	0,05 – 0,1 %	14	red
Pirimicarb	Systemic	Pirimor 25 WG	0,35 – 0,5 kg/ha	10	green
Bifentrin	Contact	Talstar 10 EC	0,15 – 0,3 l/ha	8	red
Endosulfán	Contact	Thiodan 35 EC	1,2 – 2,0 l/ha	30	yellow
Green:	can be generally used in integrated plant protection without the danger of				

Yellow:	resistence
Red:	can be used in integrated plant protection with restrictions
	can only be used along with the plant and soil protection service in integrated plant protection

9. Table**VII. Name of the pest: Spider mites - Panonychus ulmi Koch**

Causal organism: Panonychus ulmi Koch
Bryobia rubrioculus Sche.
Tetranychus urticae Koch
Tetranychus viennensis Zacher

Host range: apple, plum, cherry, sour cherry, apricot, peach and grapes

Occurrence and importance:

The tiny, almost indiscernible red or orange spider-like pests can be detected on both the abaxial and adaxial surfaces of the leaf. The pace and mass of their occurrence are significantly influenced by climatic (microclimatic) factors. They survive the winter in egg form in the cracks of the tree's bark, near the buds and between the twigs and the bark's creases. In the case of serious infection the mass of the slightly flattened, 0.15 mm long eggs is salient. The eggs are adjacent tightly to each other and form red spots. Larva hatching usually starts before the beginning of apple blossoming (in April). Its duration is generally 10-15 days. 5-6 generations develop annually but they melt into each other because of the constant egg laying and lasting hatching. The females lay the winter eggs in August and September, which may be incessant until the coming of foggy days.

DEVELOPMENTAL CYCLES OF RED FRUIT MITE												
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
§ § §	§ § §	§ § §	§ § -	- - - -: -: -:	-:		§ §	§ § §	§ § §	§ § §	§ § §	Wintering
				+ + + o o -	+ o o - - - -: -: -:							1. generation
				+ o	+ + + o o - - - -: -: -:							2. generation
					+ + + o o o - - - -: -: -:	+ o - -:						3. generation
					+ + o o - - -: -:	+ o - -:						4. generation
					+	+ + + o o o - - -: -:	o o o - - - -: -: -:	o o o	§ § §	§ § §	§ § §	5. generation
						+	+ + + o o o § §	+ o o o § § §	§ § §	§ § §	§ § §	Wintering
o Egg, - larvae, -: Nympha, + adult (sexually mature) § Wintering egg												

2. Figure

Symptoms:

The early damage of the fruit tree red spider mite starts with scattered traces of suction on the leaves. In the case of more serious infection the suction traces melt into each other and the leaves become fading, withering, maybe bronze. The damaged leaves turn spoon-shaped. They are backward in development and fall in a number of cases. Their early spring damage may be dangerous for fruit fastening. The mass multiplication in summer may badly influence the amount of the crop in the following year.

**Life cycle:**

Overwintering egg hatch in the spring is closely correlated with apple bud development and first occurs when 'Delicious' buds are in the prepink stage; hatch continues throughout the bloom period. Larvae immediately move to the young foliage and begin to feed. Before the mites transform to each succeeding stage, they go through a short quiescent period. Adult mites usually appear by petal fall. Female mites live up to an average of 18 days and each female is capable of laying approximately 35 eggs during her life span. The rate of development is temperature dependent. Under ideal hot conditions (average 80° F; 26.7° C), a life cycle may be completed in 10 to 12 days, however, a generation normally takes 20 to 25 days to complete. Eight to ten generations can occur during a normal growing season. Females begin laying overwintering eggs in early to mid-August.

Control:

If we want to avoid the early spring damage the destruction of the wintering eggs is vital. It can be only partially carried out by pruning and tree care. Consequently, chemical treatment before larva hatching is inevitable mainly if the number of the eggs verifies this. It is suitable to use spraying (mineral oil, paraffin oil, vaseline oil, polysulphid sulphur and vaseline oil). During the spring and summer protection it is proper to use chemicals with different effect mechanism in an alternating way. In the rotation of chemicals we can choose from a lot of substances (Amitráz, Propargit, Tetradifon, Fenpropatrin etc.). If the number of the mites exceeds 5-8 on each leaves it must be considered a critical entity number and intervention must not be delayed any more. The predatory mite belonging to the Phytoseiidae family is the natural enemy of the red spider mite and can considerably decrease the number of the entities in a short time.

Name of the pest: Tetranychus urticae Koch
Tetranychus viennensis Zacher

Host range: apple, plum, sour cherry, tomato, green pepper, carnation, strawberry

Life cycle: The sexually mature, fertilised females winter under the bark of the trees maybe under dry, dead leaves. They occur from the end of March until the end of April on bursting buds and young leaves. Spring and autumn generations develop slower (in 20-40 days) while summer generations develop much faster (in 10-25 days). Dry, warm and long days especially promote multiplication. Consequently, these two species are typically active in summer.

Control: in old spider mite control we have to achieve perfect spraying technology, mainly during the usage of contact chemicals. We have to be consistant in chemical rotation (Abamektin, Fenpropatrin, Propargit, Flufenzin, piridaben, Fenpiroximat,Hexitiazox).

If among the pests T. urticae or T. viennensis are present it is suitable to spray with the highest dose and biggest liquid amount of the proposed chemicals, because the pests hide in a web on the adaxial surface of the leaf.

DEVELOPMENTAL CYCLES												
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	
⊕ ⊕ ⊕	⊕ ⊕ ⊕	⊕ ⊕							⊕ ⊕ ⊕	⊕ ⊕ ⊕	⊕ ⊕ ⊕	
		+	+ + o o o - - -:	- -:								1. generation
			+	+ + o o o - - - -: -: -:								2. generation
				+ + o o - - -: -:	-:							3. generation
				+ o - - -:	+ o - - -: -:							4. generation
					+ + + o o - - -: -:	o - -:						5. generation
					+	+ + o o o - - -: -:	- -:					6. generation
						+	+ + + o o o - -	+ + + o o o - - -				7. generation
							-:	-: -: -:	⊕ ⊕ ⊕	⊕ ⊕ ⊕	⊕ ⊕ ⊕	Wintering
o	Egg,	-	larvae,	-:	Nympha,	+	Adult (sexually mature)		⊕	Wintering nympha		

3. Figure

The following plant protection substances can be used in chemical control

Fruit tree red spider mite (<i>Panonychus ulmi</i> Koch)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Vazelinoil	Contact	Agrol plusz	30 – 60 l/ha	-	green
Alifás fatty acid	Contact	Bio-sect	10 – 20 l/ha	-	green
Flucikloxuron	Contact	Andalin DC-25	0,6 – 0,9 l/ha	30	green
Fenazaquin	Systemic	Magus 200 SC	0,5 – 0,7 l/ha	14	yellow
Fenpiroximát	Systemic	Ortus 5 SC	0,7 – 1,0 l/ha	4	yellow
Piridaben	Contact	Sanmite 20 WP	0,5 – 0,75 kg/ha	7	yellow
Sunflower-seed oil+ lecitin	Contact	Vegesol	3 %	-	green
Vaselineoil	Contact	Vektatid A (R)	0,5 – 2 %	-	green
Abamektin	Contact	Vertimek 1,8 EC	0,75 l/ha	14	red
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

10. Table

Some insecticides and fungicides have strong mite destructive side effect as well. (Eg. Bifentrin, Dimetoát, Fluazinam, Dinokap).

VIII. Name of the pest: Apple leaf curl mite – Apple rust - *Aculus schlechtendali* Nalepa

Causal organism: *Aculus schlechtendali* Nalepa (=Phyllocoptes schlechtendali Nalepa)

Host range: apple, pear and quince

Occurrence and importance:

It is a frequent pest of the young and intensively cultivated plantations. It can mainly cause serious losses in tree nurseries. Their damage is salient at the beginning or in the middle of June. In case of critical entity number (40-60 per leaf) protection is essential only after flowering. In recent years the damage of the apple leaf curl mite has increased considerably along with its importance.

Symptoms:

The adaxial surface of the leaf turns brown, gets spoon-like and shrivel. In more serious cases the leaf falls and shoot growing slows down, then stops. The surface of the fruit becomes misted and the skin tissue gets rough. In dry, drouthy years the leaves get shineless while the fruits show signs of broiling nature.

Life cycle:

The developed, spindle-shaped (cylindrical) mites are pale yellowish-white and four-legged. They survive the winter in the cracks of the bark or in the buds. The number of the wintering entities is small so they do not multiply in mass early. The leaf curl mite may as well have 10-12 generations annually.

Control:

On apple plantations the natural enemies of the apple leaf curl mite regularly and frequently appear (*Zetzilia mali*, *Euseius finlandicus* Oudemans, *Typhlodromus pebibilis* Wainstein et Arutunjan, *Amblyseius andersonii* Chant) but, in addition, the application of special acaricides is suitable.

The following plant protection substances can be used in chemical control

Apple leaf curl mite (<i>Aculus schlechtendai</i> Nalepa)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Fenazaquin	Systemic	Magus 200 SC	0,5 – 0,7 l/ha	14	yellow
Propargit	Gas	Omite 30 W	5,0 – 6,0 kg/ha	10	green
Piridaben	Contact	Sanmite 20 WP	0,5 – 0,75 kg/ha	7	yellow
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

11. Table**IX. Name of the pest: Leaf miner moths – *Leucoptera scitella***

Causal organism: Pear leaf blister moth (*Leucoptera scitella* zel.)
(*Leucoptera malifoliella* O.G.Costa)

Host range: apple, pear, stone-fruits

Pear leaf blister moth (*Leucoptera scitella* zel.)
(*Leucoptera malifoliella* O.G.Costa)

Nepticula malella Stt. (= *Stigmella malella* Stt.)
Lyonetia clerkella L.
Lithocolletis blancardella Fabr. (= *pomifoliella* Z.)
Lithocolletis corylifoliella Haw.
Parornix petiolella Frey
Coleophora hemerobiella Sc.

Occurrence and importance:

In each year and on each productive area different leaf miner moth species appear and damage on the fruit yielding territories of Europe. Their ways of life and damages are really similar to each other but in the majority of the cases the size and shape of the mines are species-specific. The following ones belong to the big family of the leaf miner moths that damage on apple plantations:

The pear leaf blister moth has called our attention with its intense multiplication more times. Among its host plants the apple, the pear, the stone fruits, the crataegus and sorbus species can be found.

Symptoms:

Its damage is a mine spot and mine channel 1-2 cm in diameter. The symptom occurs as a very tiny point then it widens as the caterpillar develops. The spot grows in widening circles into a spot mine. The caterpillar deposits its excreta in the inner part of the channel. The mine, where the larva stays, constantly grows. It is greenish-brown but after the larva leaves it becomes dark brown with light grey edge.



The destruction of the leaf's mesophyll results in preliminary mass leaf falling that considerably diminishes the assimilation surface, weakens the vegetative ability of the tree and may trigger has effect to the bad different action and the next year's yield the forced ripening of the fruit.

Life cycle:

Two or three generations of the pest develop. The moth spends the winter in the ligneous parts or among the dry, fallen leaves in chrysalis form, in white cocon. The swarming of the moths often coincides with the flowering of the apple. This makes the protection techniques more difficult. The female lays the eggs one by one on the adaxial surface of the leaf from where the larva directly drills into the leaf. The complete development takes place under the epidermis, in the round channel the diameter of which incessantly grows. The caterpillar leaves through the upper epidermis slot and descends along a thread. It looks for a suitable place to become a chrysalis on the ligneous part. In the case of strong, mass infection the place for becoming a chrysalis may be the leaf, the fruit stalk or the calix.

Control:

Agrotechnical control can be carried out during pruning and tree care by the annihilation of the infected cut parts and the fallen leaves. Spraying at the end of the winter thins the mass of the pests

to a limited extent so this kind of control protection does not offer a complete solution. The application of chemicals with deep effect and hindering chitin synthesis is reasonable in this case. The swarming of the moths can be observed with the help of pheromon traps. If entity number reaches a critical level (more than 50 moths in each trap in a week) it is proper to apply control methods before the egg laying phase. With this technique a single spraying may bring satisfactory results in every generation, mainly in the case of the summer generation. Against the swarming moths piretroids and the combinations of them can be used effectively and successfully (Alfamezin, Lambda-cihalotrin, Deltamezin, Fenpropatrin, Permetrin + Tetramezin + PBO, Cipermetrin + Klorpirifosz).

The larvae having intruded into the leaf are difficult to catch so chemicals with Dimetoát, Endosulfán, Foszfamidon or Metomil content can be used efficiently against the first phase. In the case of environment and bee-friendly techniques the *Bacillus thuringiensis* is also effective when simultaneously applied with chemicals hindering chitin synthesis (Triflumuron, Teflubenzuron). The leaf miner moths, but especially the pear leaf blister moth can be destroyed by its natural enemies (parasitoids) if their activity is promoted. If about 30% of the examined leaf infection is parasited by the mixed occurrence of calchid wasps it is reasonable to postpone the chemical treatment and continue the observation. In case the leaf infection is in almost 1:1 proportion with the extent of `parasitedness` and the dominant wasp is the *Holcorthorax testaceipes* Ratzeburg its beneficial role must be promoted.

The following plant protection substances can be used in chemical control

Leaf miner moths (<i>Leucoptera scitella</i>)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Diflubenzuron	Contact	Dimilin 25 WP	0,3 – 0,5 kg/ha	14	green
Flufenoxuron	Contact	Cascade 5 EC	1,0 – 1,5 l/ha	30	green
Lufenuron	Contact	Match 50 EC	0,8 – 1,0 l/ha	28	green
Teflubenzuron	Contact	Nomolt 15 EC	0,5 – 0,75 l/ha	14	green
Triflumuron	Contact	Alsystin 25 WP	0,4 – 0,5 kg/ha	35	green
Acetamiprid	Systemic	Mospilan 20 SP	0,25 – 0,4 kg/ha	14	yellow
Dimetoát	Systemic	BI 58 EC	0,8 – 1,0 l/ha	7	red
Tiakloprid	Systemic	Calypso 480 EC	0,24 – 0,45 l/ha	14	-
Permetrin + Tetrametrin + PBO	Contact	Chinetrin 25 EC	0,3 – 0,5 l/ha	4	red
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

12. Table

X. Name of the pest: Tortrix moth - Tortricidae

Summer fruit tortrix moth (or leaf roller)
(*Adoxophyes reticulana* Hbn)

Causal organism: Summer fruit tortrix moth (or leaf roller)

Adoxophyes reticulana Hbn

Species causing damage during bud bursting:

Pandemis cerasana Hübner

Pandemis heparana Denis et Schiff.

Archips podana Scopoli

Host range: apple, peach and apricot

Occurrence and importance:

Its frequency and importance varies in Europe. Its occurrence and mass multiplication is independent from year and producing area, a bigger population can emerge whenever and wherever. The tortrix moth prefers the apple species that ripe early but damages apricots and peaches, too. It cause salient harm by the chewing of the fruits but also damages sprouts, shoot apex leaves, buds and flowers. The *Pandemis ribeana* Hübner, the *Argirotaemia pulchellana* Haw and the *Pandemis heparana* Denis et Schiffermüller belong to the big family of the tortrix moths that cause damages in fruit plantations. The more important species usually have two generations every year whereas the summer fruit tortrix moth frequently has three. The swarming of the last generation may coincide with the harvest time.

Symptoms :

The damage may already be present in spring during bud bursting when the caterpillars chew the sprouts and tangle the young leaves into a web knot. The buds and flowers become the victims of the early damage. In the case of slower development even the young fruit can be damaged. The young attacked parts deform, get miscoloured (brown) and necrotise. The caterpillars of the summer generation peel the surface of the fruit under the shield of the leaf woven to the fruit. The chewing is usually shallow, irregular and a few square centimetres in extension. The caterpillars occasionally peel the leaf or chew into the pedicel of the bud.

Life cycle:

The imago is 5-10 mm long. The base colour of the wings changes from light yellow to dark yellowish-brown, with blurred diagonal stripes. The males are smaller. The lighter ones have clearer pattern. The eggs are flattened. They form groups (50-150 entities) and partly cover each other. The developed larva is 12-22 mm long. Its colour is apple green with big greyish warts on its back. The chrysalis is a light brown so-called pupa. The young (L1-L3) caterpillars survive the winter. The moths fly in May or July and August. The possible third group occurs in September. The summer fruit tortrix moth sometimes multiplies in mass and its damage along with the other tortrix moth species can cause an infection as serious as that of the apple moth.

Control:

The wintering larvae can be thinned by pruning. The first and maybe most effective date of the chemical control is the green bud phenophase of the apple. Then we should use chemicals with good contact effect and the success of which is not obstructed by low temperature.

Protection is very difficult to carry out efficiently without local observations. The swarming of the moths on intensively cultivated plantations can be well observed with the help of pheromon traps and Metos or KMS-P gadget. The 10-15 male in one trap in one week situation urges intervention. Protection must be aimed at the occurrence of young larvae (Piretroids, Organic phosphorus aesters, Endosulfan).

The natural enemies can play an essential role in the regulation of the tortrix moths population dynamics. The presence and forbearance of the chalcid wasp and predatory capsids may be a very important part in the protection of the industrial-sized fruit plantations. The following beneficial creatures appear on apple plantations: *Macrocentrus linearis*, *Habrodytus chryso walker*, *Toplectis maculator* (Fabricius) and *Himacerus apterus*.

The application of Insegar containing fenoxycarb can be delayed as its active ingredient is the most effective against the older (L5-L6) larvae. We can use sufficiently this substance, the *Bacillus thuringiensis* and the chemicals with Indoxacarb and Tiakloprid content in environment-friendly, integrated plant protection. A part of this technology may be the usage of substances hindering chitin synthesis (Lufenuron, Hexaflumuron).

The following plant protection substances can be used in chemical control:

Tortrix moth (Tortricidae)					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Cipermetrin+ Klórpirifosz	Local-systemic	Nurelle-D 50/500 EC	0,8 – 1,0 l/ha	60	red
Metidation	Local-systemic	Ultracid 40 WP	0,075 – 0,15 %	14	red
Fenoxikarb	Contact	Insegar	0,3 – 0,6 kg/ha	21	green
Indoxakarb	Contact	Steward 30 DF	0,17 kg/ha	7	green
Tiaklopid	Systemic	Calypso 480 SC	0,24 – 0,45 l/ha	14	-
Lufenuron	Contact	Match 50 EC	0,8 – 1,0 l/ha	28	green
Diflubenzuron	Contact	Dimilin 25 WP	0,3 – 0,5 kg/ha	14	green
Endoszulfán	Contact	Thionex 50 WP	1,2 – 2,0 l/ha	30	yellow
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

13. Table

The chemicals that generate gas or steam thin the moth really effectively so their usage can be involved in chemical control.

XI. A number of moth (Noctuidae spp.) species cause damage on fruit trees. Most of the species are poliphag pets, their caterpillars damage buds, leaves, flowres and young fruits in the foliage. Their significant representatives are the pug moth (Geometridae) reasuring worm.

Name of the pest: Operophtera brumata L. et
Erannis defoliaria

Casula organism: Operophtera brumata L. et
Erannis defoliaria

Host range: apple, pear, cherry, sour cherry, plum, walnut, several forest leafy trees, shrubs

Occurrence and importance:

These are European species. They are generally present all over Europe. Their population dynamics rather are changeable in space and time. They can be traced in plantations and orchard, mainly where in the neighbourhood of plantations oak and hornbeam trees can be found. The pests can cause serious damages in gradation years.

Symptoms:

The inchworms chew holes into the swollen, bursting buds. They perforate the buds, flowers and young immature fruits. After foliation they knot leaves with loose web. They leave behind asymmetrically chewed and perforated leaves but they can cause as serious damage as complete destruction. The damaged young fruits fall in considerable numbers depending on the extent of the damage. This way the pests trigger significant crop shortages in orchards.

Life cycle:

Annually one generation develops with swarming late autumn. The yellowish-orange coloured eggs are 0,5-0,8mm in diameter. They winter between the bud scales and on the branch parts and hatch out early. The green coloured winter inchworms are 15-20mm in diameter. They and the brown-spotted bigger winter inchworms chew the inside part of the buds, then go for further parts of the fruit tree. While the *Operophtera brumata* worms develop a web around leaves and seek shelter inside them, the *Erannis defoliaria* caterpillars live freely and feed mainly at night. They finish their development until mid-May. The fully developed caterpillars get into the ground and in the upper some centimetres they form a chrysalis in a soil-grained web cocoon. The individuals of *Erannis defoliaria* transform without a cocoon 10-14 cm deep in the soil. After the chrysalis stage in October the greyish-big winged males and the almost wingless females mate then the females crawl into the foliage of the trees and lay their eggs near the eggs. For the hatching of the moths precipitation is needed. That is why a rainy autumn brings along the danger of more intense swarming. The late spring frosts considerably thin the hatching larvae.

Control:

The small and big winter male inchworms are easy to catch by light trap because of their phototaxis so their swarming can be indicated with light traps beforehand. The identification of damage centres and probable damage – chiefly in the case of fruit plantations near forests – can be measured with the help of the long-known 'wormglue belts' method. It may even be employed as a protection method in smaller orchards. It is expedient to fasten the wormglue belts to the tree stems and to renew them constantly. It is necessary to record the number of the caught females and value

the results. Chemical control should be started with a thorough spraying before bud bursting against the wintering eggs.

Operophtera brumata L. et Erannis defoliaria					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Vaselineoil	Contact	Agrol Plus	30-60 l/ha	-	green
Calcium poliszulfid	Contact	Tiosol	10-15 %	-	green
Poliszulfid sulphur vaselineoil +	Contact	Vektafid S	20-50 l/ha	-	green
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

The optimal period of worm protection is between bud bursting and the white bud stage.

Operophtera brumata L. et Erannis defoliaria					
Name of the active ingredient	Effect method	Name of the product	Used rates	Catering sanitary waiting time	Integrated classic
Foszalon	Local-systemic	Zolone 30 WP	2-3 kg/ha	21	yellow
Diklórfosz	Gas	Unifosz 50 EC	0,1 %	5	red
Metilazinfosz	Systemic	Metil-Cotnion 25 WP	0,15-0,2 %	10	red
Green:	can be generally used in integrated plant protection without the danger of resistance				
Yellow:	can be used in integrated plant protection with restrictions				
Red:	can only be used along with the plant and soil protection service in integrated plant protection				

Weeds

The composition of the weed flora in apple plantations is determined by the soil type of the plantation (cohesion, pH, water management) and its geographical location (precipitation, temperature). Other influencing factors may be the age and planting system of the plantation. We can make a distinction between the weeds that regularly occur in the plantations on the basis of the effectiveness of weed control. So we take into consideration:

1. Creeping perennial monocotyledons: **Agropyron repens, Cynodon dactylon**
2. Creeping perennial dicotyledons: **Convolvulus arvensis, Cirsium arvensis, Cystegia sepium, Rubus caesius.**
3. Annual monocotyledon sprouting from seed: **Echinochloa crus-galli, Digitaria sanguinalis, Setaria glauca, Poa annua.**
4. Annual dicotyledon sprouting from seed: **Chenopodium album, Amaranthus retroflexus, Erygeron canadensis, Ambrosia elatior.**

The cultivation method may greatly influence the changes of the weed flora. The damage of the weeds can mainly be significant in young fruit plantations where nutrition and water deprivation, the transmission of viruses and other pathogenics pose the biggest danger. Protection consists of mechanical weed removing and supplementary chemical weed control.

Control:

The main points of protection:

- In every possible case the mechanical method must be preferred because of the protection of the environment. Chemical weed control may only be an emergency solution.
- The weed-free stripe may be as narrow as possible (50-80 cm).
- The herbicide should not be fitotoxic to the apple.
- When herbicide species occur on scattered places the mechanical methods must be preferred.
- In integrated programmes usually the herbicides should be promoted that get absorbed through the leaf.
- The area should be cleaned from perennial weeds so that they can not cause plant protection problems at least in the first year.

Protection-treatment:

During the chemical protection of plantations the sensitive developmental stages of both the cultivated plants and the weeds must be taken into consideration. The apple trees are the least sensitive to herbicides from falling of the leaves to bud bursting. Even after the formation of the full foliage they are able to bear several herbicides that disturb growing processes.

Against a weed population that consists of monocotyledons and dicotyledons sprouting from seed and stolons – in early spring, before bud bursting – and against annual and perennial dicotyledons sprouting later we can carry out a successful protection with the help of absorbing glyphosate and pendimethalin-containing chemicals and glyphosate ammonium, HCPA derivatives.

The substances are appreciated from environmental point of view. They do not accumulate in the soil and do not damage subsoil water and soil life. They do not influence the growing of fruit tree roots but when getting into the soil or to the plant leaves they hinder the growing of developing monocotyledon and dicotyledon roots in the case of many weeds and destruct them.

It is essential that during application the weeds should not be more developed than 15-20 cm because this way the whole plant can be covered. In apple plantations it is enough to carry out treatment 2-3 times depending on precipitation frequency. Another vital factor is non-distracted spraying. Otherwise, serious damage may occur in the cultivated plants and its surroundings.

I. Name of the weed: *Agropyron repens (L.) Beauv***Biology:**

The weed is a vivid green perennial monocotyledon with long stolons. It covers huge areas. Its ear flower is 10-15 cm long whereas its seeds are 5-7 mm long. The stem is erected and 20-120 cm long. The leaves are delicately veined. The wind transports the light seeds to new areas but in their quick settlement and reproduction the roots developing from the stem knots of stolons play an essential role. Even the smallest piece of root remnant is viable and develop new sprouts.

Host range: (Spreading-importance)

It is widely spread in Africa, Asia and Europe. The weed can be also found as an introduced plant in North-America. It causes serious and considerable damage on cultivated areas. It obtains a large amount of water and nutrients from the soil. It thrives on every kind of soil but develops and multiplies very intensively on fresh middle-solid soil.

Control:

Permanent effectiveness can not be carried out by mechanical control so it is more advisable to employ absorbing Glialka 70 WSP or/and Finale 14 SC with scorching effect in vegetation control. Both herbicides are considered advantageous from environmental point of view.

II. Name of the weed: *Convolvulus arvensis L.***Biology:**

It is an aggressive perennial dicotyledonous stolon. Its main roots and side roots 2-3 metres in the ground. They are spiral. New roots and sprouts develop from their auxiliary buds. The rolled stem of the weed can grow 2 metres high lies on the ground or twists around other plants.

The leaves of the weed have various shapes. Its flower is a white or pink fragrant funnel which 4-5, 3-4 mm big, black, eggs-shaped seeds – can be found. In warm and wet soil the germinating seeds develop long roots deep into the ground very quickly. Its incredible reproduction capability is due to the intensive sprouting ability of root pieces.

Spreading-importance:

Originally the weed used to be indigenous to the warmer areas of Europe and Asia but up to present days it has spread all over the world. Its damage does not only involves nutrition sapping and place occupation but it hinders the development of plant culture by shadowing and tight entwining as well.

Control:

If the technology of mechanical control is used the frequent interventions may weaken the weed population to a great extent but more efficient protection requires chemical intervention (herbicides...).

III. Name of the weed:**Echinochloa crus-galli (L.) P. Beauv****Biology:**

It is an annual monocotyledon that grows high and adapts very well. Its stem is flattened, the leaves are 1-2 cm broad. They are thread-like and the edges of the leaves are sharp. The weed blooms from June until late autumn. Its flower is often a violet, so-called stringy cluster on which one-seed ears can be found. The egg-shaped, light grey and shiny seeds germinate well both in wet and dry soil.

Spreading-importance:

It is a cosmopolitan plant. It mainly appears in wet or irrigated places. The weed adapts well so it turns up both on cultivated and fallow areas.

Control:

Its damage can be considerably limited by mechanical weed control, because of efficient usage of herbicides (chemicals...). It is important that the weeds should not be more developed than 15-20 cm.

IV. Name of the weed:

Chenopodium album (L.)

Biology:



It is one of our most known weeds. It has strong main and side roots while its stem is erected and richly ramified. The weed is 20-150 cm high and green. It germinates in wet soil in 3-5 cm depth maintaining its sprouting ability for 8-10 years.

It greatly varies in flower and shape of leaves so its many varieties have been described. The weed has the raceme and one-seed fruit. It brooms from the middle of June until the fogs and constantly ripens seeds.

Spreading-importance:

It is spread all over the world. It appears on every sort of soil and cultivated cultures where humus and upstirred soil can be found. As the weed grows very fast it intensively saps water and nutrients from the different cultivated plants.

Control:

Between the apple tree lines regular mechanical cultivation may control the overgrowth of the weed population. But in the lines only chemical intervention can be effective. The weed is sensitive to herbicides so it should be destroyed when it is young.

The following herbicides can be used in chemical weed control:

Name of the active ingredient	Name of the product	Used rates	Weeds
Glukozinat-ammonium	Finale 14 SL	4,0 – 6,0 l/ha	Monocotyledons and dicotyledons sprouting from seed
Terbutinazin + glifozát	Folar 525 SC	6,0 – 8,0 l/ha	Monocotyledons and dicotyledons sprouting from seed
Glifozát	Glialka 70 WSP	8,0 – 12 l/ha 2,3 – 3,4 kg/ha	Deeply rooted monocotyledons
Glifozát	Medallon premium	3,0 – 5,0 l/ha	Monocotyledons and dicotyledons sprouting from seed and perennials
Linuron + diuron + terbutilazin	Nikesuper Combi 600 FW	6,0 l/ha	Weeds sprouting from seed
Pendimetanin	Stomp 330 400 SC	4,0 – 6,0 l/ha 3,5 – 4,0 l/ha	Monocotyledons sprouting from seed and a few dicotyledons sprouting from seed
Glifozát + izopropilamin salt	Roundup bioaktív GC	3,0 – 4,0 l/ha 2,0 – 3,0 l/ha	Weeds sprouting from seed perennial monocotyledons and dicotyledons
MCPA	U-46 M Fluid SL	1,5 – 2,0 l/ha	Dicotyledons weeds
Fluazifor-P-Butil	Fusilade Forte	2,6 – 2,8 l/ha	perennial monocotyledons weeds
Diklobenil	Casoron G	40 – 70 kg/ha	Monocotyledons and dicotyledons sprouting from seed
MCPA (dimetilamin salt)	Jambol M 750 SL	0,6 – 1 l/ha	Dicotyledons weeds

14. Table