the territory of the Ukrainian Carpathians are park-monuments of landscape garden art – 60, and the least – botanical gardens (two). Zoological parks are absent.

Among the areas where artificial protected objects are located, the pre-Carpathian hill region is the most represented. The least, one object, is Vododilno-Verhovinsky, Volcanic-intermontane-basin and Transcarpathian lowland area. The intermediate position is occupied by the Outer Carpathians (eight park-monuments of landscape architecture) and Polonino-Chornohorska (two artificial protected sites: one park-monument of landscape architecture and one dendrological park) of the region. Rakhiv-Chyvchyn region is't represented by any artificially created protected object.

Keywords: *artificially created protected objects, parks-monuments of landscape gardening, dendrological parks, botanical gardens, Ukrainian Carpathians, physical and geographical zoning.*

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THE HARMFUL ENTOMOFAUNA OF PLANTS GENUS *ULMUS L*.

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Abstract*. A decrease in physical activity of affected trees helps to populate them with representatives of the harmful entomofauna, damaging vegetative and generative organs of* Ulmus sp. Total number of phytophage insects that trophically associated with elm stands exceeds 50 names and *no more than 20 among them are of the greatest potential and actual threat. As a rule, such trees are intensively populated by phytophages of other trophic groups – by tree trunk xylophage pests and other phytopathogens. A detailed analysis of the harmful entomofauna and pathological changes caused by insects on trees genus* Ulmus L. *is provided. Harmful entomofauna representatives which activity significantly weakens growth, development and reduces qualitative characteristics of elm wood are described. The research of infectious pathology indicates the explicit role of* phytophage insects, which are directly or indirectly ecologically and trophically associated with Ulmus L.*, being vectors in the spread and accumulation of an infectious background.*

Keywords*: harmful etnomofauna, pathogenesis, incidence of diseases, tree damage, harmfulness.*

Relevance. At present, there are eight wild species of the Elm family *Ulmaceae* Mirb., the Elm genus *Ulmus* L. in Ukraine. Naturally prevalent is Wych elm (*Ulmus glabra* Huds.) or Scotch elm (*U. scabra* L.); Europian white elm (*U.*

laevis Pall.); Siberian elm (*U. pumila* L.), which is widely cultivated in our country under the name of the Turkestan elm. The indicated species have appropriate decorative forms, which differ in the height and the tree crowns structure – pyramidal, drooping, rounded, low; in the size and the leaf shape –large, curly, horned; in the leaves color – yellowish, bright yellow, purple, dark purple, bright golden and silver, red; in the leaf structure – pinnatisected. All of them, in appropriate proportions, are recommended for the creation of single and group plantings, alleys, squares, green shaped hedges, quick landscape gardening of new buildings and small forests along with other broadleaved species.

Biostability and productivity of forest stands depend not only on the plantation establishment and shaping technology, but also on other factors including primarily harmful insects. A decrease in physical activity of affected trees helps to populate them with representatives of the harmful entomofauna*,* which damage Ulmus *sp.* seeds, leaves and trunks. Total number of phytophage insects that trophically associated with elm plantings exceeds 50 names, among them 15 at most are of the greatest potential and actual threat. [3, 6, 11, 13,]. This is primarily a complex of leaf-eating insects, caterpillars of which cause damage to buds, flowers and a leaf apparatus. As a result, defoliation of one third of the leaves is accompanied by a number of negative consequences, which as a result lead to disorder of photosynthesis, fruit development, and most importantly - to the loss of tolerance for winter conditions. [4]. As a rule, such trees are intensively populated by phytophagous of other trophic groups - trunk pests - xylophagous, as well as various phytopathogens. The insect species feed on plants reproductive organs constitute a particular danger.

Most of the phytophagous insects in mixed plantings prefer *Quercus robur* and migrate to *Ulmus sp.* in the absence of the main nutritive base. [6, 13]. Damage to leaves is caused by Elm Leaf Beetle *(Galerucela luteola Mull.*), Elm Sawfly *(Trichiocampus L.)* and Ulmus Sawfly *(T. eradiatus* Htg*.),* Saddle-backed Looper *(ulmi Boarmia crepuscularia* L.), Clouded Magpie *(Abraxas sylvata* Sc.), Gypsy Moth (*Ocneria dispar* L.), Exaereta Ulmi (*Exaereta ulmi* Schiff), Mottled Umber *(Erannis defoliaria* Cl.), Winter Moth (*Operophthera brumata* L.), Elm Leaf-mining Weevi (*Rhynchaenus rufus* Schr.), caterpillars of Tortrix Moths (*Tortricidae*), Aphids (*Aphididae*), Mites (*Eriophyidae*) [1, 3, 5, 6, 13, 14].

Shoot pests – Elm Sucker (*Psylla ulmi* L.), Elm scale *(Gossyparya spuria Mod.*), Lampra decipiens (*Anthaxia manca* F.) [1, 3, 6, 9, 11, 13, 14].

Bark beetles species on elm trees are represented by Scolytus Ensifer (*Scolytus ensifer* Eichh.), Scolytus Kirschi (*S. kirschi* Skal.), Calosoma beetle (*S. multistriatus* Marsh.), Scolytus pygmaeus (*S. pygmaeus* F.), Large elm bark beetle (*S. scolytus* F., *S. sulcifrons* Rey.), Pteleobius vittatus (*Pteleobius vittatus* F.), European shot-hole borer (*Xyleborus dispar* F., *X. saxeseni* Ratz.) [4, 7]. But mass reproduction centers are mostly formed by *Scolytus multistriatus* Marsh., *S. pygmaeus* F., and *S. scolytus* F.

Trunk pest proliferation and amount of damage they cause depends significantly on timely cultural control and special sanitary measures in forests taking into account biological and ecological characteristics of certain species of pests [7, 8]. The Dutch elm disease centers often become breeding colonies for

trunk insects, which are infection carriers and contribute to emergence of new disease outbreaks. A Dutch disease area coincides with bark beetles areal, namely: *Scolytus multistriatus* Marsh., *Scolytus scolytus* F. and *Scolytus pygmaeus* F. Annual changes in number of elm bark beetles are largely dependent on weather conditions. Overwintering conditions and a sum of positive temperatures (from May until end of July – during the beetle emergence period after overwintering of the younger generation, during the intensive emergence period, additional nutrition and the attack period) are critical for elm bark beetles. In a hot summer, elm bark beetles undergo all stages of development and overwinter in a young beetle phase, which in turn increase elm bark beetles viability during overwintering and next year emergence.

Numerous primary sources indicate insects trophically and ecologically associated with Ulmus *L. plantings* in the context of accumulation, conservation and primary attack on trees by various phytopathogens [4, 9]. At the same time, it is emphasized, that there is strict connection in the "trees-phytopathogens-insects" system. It is a succession process in plantings as a consequence of partial species substitution. [4]. Often in addition to direct action on a plant insects become carriers of microorganisms and infect plants by gnawing through.

Thus, fragmentary research in infectious pathology indicates the explicit role of phytophage insects that are either directly or indirectly ecologically and trophycally associated with *Ulmus L.*, being vectors in the spread and accumulation of an infectious background.

The object of research – examination of species composition of the harmful entomofauna of the elm species of Kyiv Polissya Region, analytic generalization thereof, identification of their species diversity, spreading and harmfulness.

Materials and methodology of research. The trees genus *Ulmus* with characteristic figures of damage by entomophages were selected as the object of research.

Material for analysis was collected in conditions of Kyiv Polissya, Ukraine, during examination reconnaissance and detailed methods of forest-pathological surveys according to common methodology were used [2].

We also determined the attack rate (AR) that designates the percentage of plants on which the blights of different insect species are observed according to formula [10]:

$$AR = \frac{m * 100\%}{n}, \qquad (1)$$

where m – amount of trees on which given specimen is observed;

n – total amount of examined samples.

Research results. Pathology of plants genus *Ulmus* L. is a multifactor phenomenon based on the infectious and non-infectious processes. Unobvious etiology of the elm stands pathology was confirmed by our observations of the large forestlands. Possible causes of diseases are so interconnected that it is hard to identify what is the prime cause of the pathological processes. Visual display of the pathology effects depends entirely on hydrothermal factors of the current year, the physiological condition of the trees and the presence of phytophage insects.

According to our observations, elm woods weakened by the influence of abiotic and biotic, including parasitic, factors lost their resistance (individual and group) that resulted in such condition when they could not resist the phytophage insects, poorly restored leaf apparatus, the process of photosynthesis abruptly stopped, reserve plastic and protective compounds did not formed, etc. We have experimentally confirmed the well-known principle that the phytophage insects are just one of the elements of the successive process. Their spread and species composition are peculiar informative factors followed by more important processes.

In the elm woods of the research region, we identified activity of more than 10 species of phytophagous insects. There are representatives of *Coleoptera, Hemiptera, Homoptera* and *Lepidoptera* series. The areas of the majority of the species have episodic or migrational character and cause physiological damage to the trees.

Importance of insects in the life of biocenosis is determined not by its total population but by amount of insects per unit area of biotype i.e. population density. In forest entomology as a density index the percentage of trees inhabited by a certain phytophage is usually used. It should be noted that recently the proliferation of sawflies - elm (*Trichiocampus ulmi* L.) and ulmus (*T. eradiatus* Htg.) - that damage the trees in urban plantations in Kyiv region has the most density (within 20%) among pests of the assimilation apparatus of the trees. After damage the limbs of the trees usually restore their condition but there are many dead shoots.

Some species *(Exaereta ulmi* Schiff) occur casually making it difficult to evaluate their harmfulness (table 1).

1. Harmful entomofauna of the trees *Ulmus* L. in the forests of Kyiv Polissya

Damaged plant organs	Phytophage spesies		Occupancy rate,%
Leaves and gemmas	Mottled umber	*Erannis defoliaria* Cl.	10.0
	Exaereta ulmi	*Exaereta ulmi* Schiff.	5.6
	Winter moth	*Operophthera brumata* L.	10.4
	Elm leaf beetle	*Galerucela luteola* Mull.	5.3
	Elm sawfly	*Trichiocampus ulmi L.*	20.8
	Ulmus sawfly	*Trichiocampus eradiatus* Htg.	20.1
	Elm white moth	*Nepticula viscerella* Herr.	5.2
Branches and trunks	Elm sucker	*Psylla ulmi* L.	5.4
	Elm scale	*Gossyparya spuria* Mod.	10.7
	Lampra decipiens	*Anthaxia manca* F.	5.1
	Calosoma beetle	*Scolytus multistriatus* Marsh.	33.4
	Large elm bark beetle	*Scolytus scolytus* F.	12.4
	Scolytus pygmaeus	*Scolytus pygmaeus* F.	16.7

On shoots, there is a significant number of small insects of the elm sucker (Psylla ulmi L.) which is sucking leaf juice. On the underside of the leaves, there were thrown off skins and small insects jumped.

Young larvae of the elm (Trichiocampus ulmi L.) and ulmus (T. eradiatus Htg.) sawfly eat away the leaves in the form of longitudinal holes between the lateral veins that is considerably typical for this species. Adult individuals eat leaves completely leaving only the main vein. Elm scale (Gossyparya spuria Mod.) sucks off vegetable juices from the trunk.

Dutch elm disease of the elm species and woods is the one of the most dangerous vascular infectious diseases of the elm species that affects life of the plants. Developing both in natural forests and in elm stands in the city, the Dutch disease leads to massive drying of the trees and destruction of woodlands. The exclusive role in the spread of the disease is played by the Scolytus laevis of family Scolytidae. The species composition of the bark beetles on the elm is represented by the Scolytus ensifer (Scolytus ensifer Eichh.), Scolytus kirschi (S. kirschi Skal.), Calosoma beetle (S. multistriatus Marsh.), Scolytus pygmaeus (S. pygmaeus F.), large elm bark beetle (S. scolytus F., S. sulcifrons Rey.), Pteleobius vittatus (Pteleobius vittatus F.), European shot-hole borer (Xyleborus dispar F., X. saxeseni Ratz.) [4, 7]. It was found that Scolytus multistriatus Marsh., Scolytus scolytus F. and Scolytus pygmaeus are the most widespread and the attack rate of these species is determined as 33.4%, 12.4% and 16.7% respectively.

In the context of the presented work, the main emphasis of our research is on those types of phytophages that are directly or indirectly ecologically and trophically associated with the primary areas of the occupancy, spread and accumulation of phytopathogene populations. Describing this problem from the standpoint of succession of forest stands it should be noted that all these components (trees-phytopathogens-insects) are constituents of ecosystems and forest biocoenosises. Each of these groups of insects and microorganisms has its own specific ecological niche and participates in the overall trophic and informational regime of ecosystems. Their expressed negative effect in relation to producers is manifested only as a result of stress factors. These are, first of all, synoptic anomalies as well as various anthropogenic factors related to economic activity.

Conclusions and perspectives. The resistance of trees to damage by insects or affection by pathogens is associated with two mechanisms. Due to one of them (resistance) the tree avoids damage or affection due to the features of morphology, physiology or a certain shift in the life cycle. The second mechanism (tolerance) shows the tree’s ability to restore the growth rate or reproduction after the damage.

Problems of phytophagous insects and pathogens of forest diseases, in particular the priority of tree occupancy by insects and affection by diseases, the mechanisms of insect-borne pathogens transference, the mutual negative impact of insects and pathogens on the condition and growth of plantings, are becoming important. As a result of research, the dominant species of phytophagous insect that are trophically associated with the vegetative organs of tree plants of the genus Ulmus L. have been identified. Based on the analytical analysis of these relationships we have noted the existence of possible ecological and trophic links between insects (in particular cambium

beetles) and Dutch disease agents Graphium ulmi S. as a constituent of circulatory processes in ecosystems. It is about the role of insects in the process of accumulation of primary infection, conservation and transformation with subsequent damage of plants. It is likely that the primary affection of the trees of the genus Ulmus L. by Dutch disease pathogen occurs with the participation of cambium beetles populations.

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ШКОДОЧИННА ЕНТОМОФАУНА РОСЛИН РОДУ ULMUS L.

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***Анотація**. Зниження фізіологічної активності уражених дерев сприяє заселенню їх представниками шкодочинної ентомофауни, які пошкоджують вегетативні та генеративні органи* Ulmus sp. *Загальна кількість комах-фітофагів, що трофічно пов'язані з ільмовими насадженнями, перевищує 50 найменувань, серед них найбільшу потенційну та реальну загрозу становить не більше ніж 20. Як правило, такі дерева інтенсивно заселяються фітофагами інших трофічних груп – стовбуровими шкідниками-ксилофагами, а також різноманітними фітопатогенами. Наведено детальний аналіз шкодочинної ентомофаунита та патологічних змін, спричинених комахами на деревах роду* Ulmus L. *Описано представників шкодочинної ентомофауни, що внаслідок своєї діяльності суттєво послаблюють ріст, розвиток і знижують якісні характеристики деревини в'яза. Дослідження інфекційної патології вказують на безпосередню роль комах-фітофагів, які прямо або опосередковано екологічно та трофічно пов'язані з* Ulmus L.*, як векторів у поширенні та накопиченні інфекційного фону.*

***Ключові слова:** шкідлива ентомофауна, патогенез, поширеність хвороб, пошкодження, шкодочинність.*

ВРЕДОНОСНАЯ ЭНТОМОФАУНА РАСТЕНИЙ РОДА ULMUS L.

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***Аннотация**. Снижение физиологической активности пораженных деревьев способствует заселению их представителями вредоносной энтомофауны, которые повреждают вегетативные и генеративные органы Ulmus sp. Общее количество насекомых-фитофагов, трофически связанных с ильмовыми насаждениями, превышает 50 наименований, среди них наибольшую потенциальную и реальную угрозу представляют не более 20. Как правило, такие деревья интенсивно заселяются фитофагами других трофических групп – стволовыми вредителями-ксилофагами, а также разнообразными фитопатогенами. Приведен подробный анализ вредоносной*

ентомофауны и патологических изменений, вызванных насекомыми, у деревьев рода Ulmus L. Описаны представителей вредоносной энтомофауны, которые в результате своей деятельности существенно ослабляют рост, развитие и понижают качественные характеристики древесины вяза. Исследование инфекционной патологии указывает на непосредственную роль насекомых-фитофагов, которые прямо или косвенно экологически и трофические связаны с Ulmus L., как векторов в распространении и накоплении инфекционного фона.

Ключевые слова: *вредоносная энтомофауна, патогенез, распространенность болезней, повреждения, вредоносность.*