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DAMAGE CAUSES OF EUROPEAN ASH IN THE PERMANENT SAMPLING PLOTS IN KHARKIV REGION

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European (common) ash (*Fraxinus excelsior* L.) health condition and occurrence of certain damage types were estimated in permanent sampling plots in Kharkiv region. The following eight types of damage were revealed in inspected ash stands: frost cracks, mechanical damage of stems, epicormic shoots, branch dieback, symptoms of the bacterial disease and butt rot, signs of wood destroying fungi and insect feeding. Branch dieback and butt rot dominated with occurrence of 52 and 39 % respectively. In the stands of vegetative origin in fresh fertile forest site conditions, stand age correlation with forest health condition, with an occurrence of bacterial disease, branch dieback, and insect damage was significant. Percentage of trees with butt rots, branch dieback, and epicormic shoots was significantly higher in humid fertile forest site conditions than in fresh fertile forest site conditions. In young stands (20–30 years old) significantly higher occurrence of the bacterial disease of ash, epicormic shoots, butt rot and mechanical damage of stems was registered more often in humid relatively fertile forest site conditions than in fresh relatively fertile forest site conditions.

Key words: health condition, types of damage, forest site condition, stand age, stand origin.

Introduction. European (common) ash (*Fraxinus excelsior* L.) is one of the main forest-forming species in broadleaved forests of the Left-bank Forest Steppe of Ukraine (Borysova 2016, Davydenko & Meshkova 2014, 2017). The health condition of ash species recently has attracted increased attention, because of its large-scale decline in many European countries, mainly as a result of ash dieback disease caused by invasive fungus *Hymenoscyphus fraxineus* (Metzler et al. 2012, Nguyen et al. 2016, Cleary et al. 2017). This disease is proved to spread in the region of our research, but the occurrence is relatively low or is poorly diagnosed (Davydenko et al. 2013, Davydenko & Meshkova 2017). Apart from this disease, wood decay fungi (Matsiakh & Kramarets 2014), foliage browsing (Meshkova et al. 2017) and xylophagous insects (Davydenko & Meshkova 2017), as well as bacterial cancer (Goychuk & Kulbanska 2014) play an appreciable role in ash decline. However, the spread of different causes of ash decline in the same stands was not studied before in the Left-bank forest-steppe.

The aim of the research was to estimate European ash health condition and occurrence of certain damage types in permanent sampling plots in Kharkiv region

Materials and methods. Investigations were carried out in 2016–2017 on 22 permanent sampling plots in forest stands with European ash participation of Skrypayivske Training & Experimental Forest Enterprise and Chuguyevo-Babchanske Forestry Enterprise (Kharkiv region).

The survey covered 2,112 trees of European ash of 18–110 years old in the stands with 0.3–0.8 density of stocking and 2–6 units of ash in forest composition. Type of forest site conditions was estimated according to Ukrainian typology (Ostapenko & Vorobjov 2014). Fresh and humid relatively fertile forest site conditions (C_2 and C_3 respectively), as well as dry, fresh and humid fertile forest site conditions (D_1, D_2, and D_3 respectively) have been inspected.

Defoliation of ash was evaluated visually with an accuracy of 5 % at the end of June (after insects-defoliators completing feeding in this tree species).

Category of health condition was evaluated on a range of visual characteristics (crown density and color, the presence and proportion of dead branches in the crown etc.) according to "Sanitary Forests Regulations in Ukraine" (Sanitarni pravyla 1995). Each tree was referred to one of six categories of health condition (1^{st} – healthy; 2^{nd} – weakened; 3^{rd} – severely weakened; 4^{th} – drying; 5^{th} – recently died; 6^{th} – died over a year ago). Index of health condition (I_c) for a forest stand was calculated as mean weighted from trees number of each category of health condition.

Each tree was inspected and all visible symptoms and signs of damage were registered. Insects and fungi in the sampling plots were identified by symptoms (defoliation, discoloration, and necrosis) and signs (insect galleries, fungal fruiting bodies, spores etc.).

The occurrence of each type of damage was evaluated as the part of trees with respective symptoms or signs.

Weather parameters were taken from Zmiyiv meteorological station in Kharkiv region (49°41′ N, 36°21′ E).

The statistical analyses included calculation the mean and standard error of estimated parameters, as well as correlation between tree age and occurrence of different damage types (*MS Excel*).

Results and discussion. In the region of our research, the weather conditions in 2017 were characterized with higher air temperature for the year and for vegetation period (9.7 and 18.2 °C respectively), which is 1.6 °C and 1.5 °C higher than by long-term data (8.1°C and 16.7 °C). Precipitation for the year and vegetation period (410.1 and 163.9 mm) in 2017 was 106.9 mm and 130.1 mm less than by long-term data (517 mm and 294 mm respectively) (Fig. 1). Such weather conditions were unfavorable both for forest growth and for fungi development.

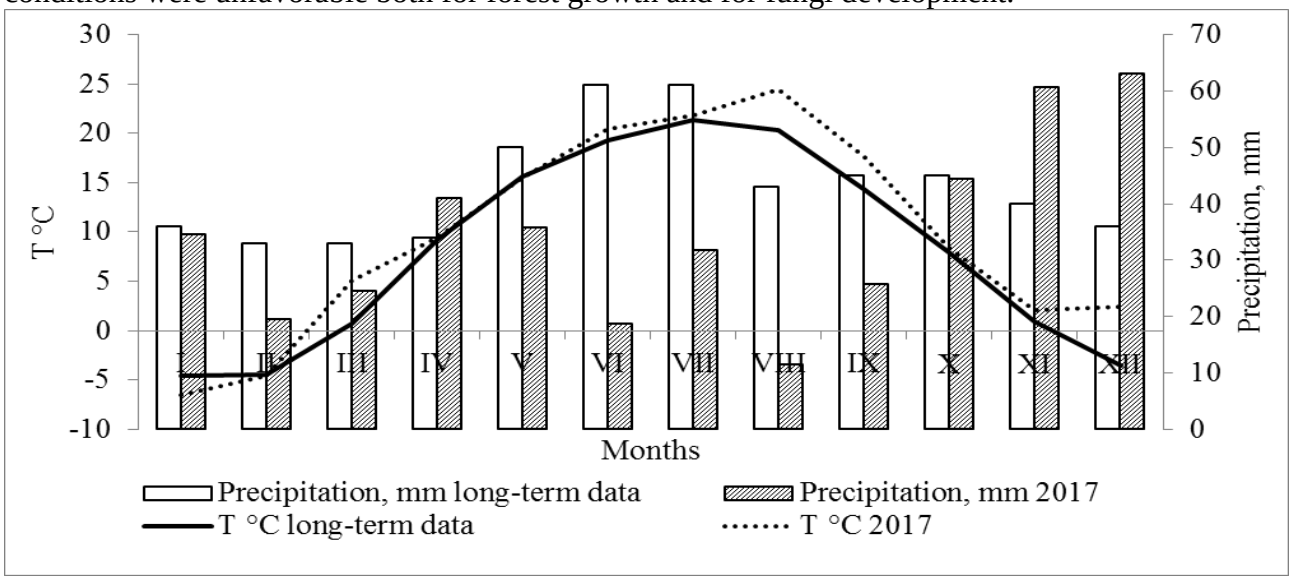

Fig. 1 – Air temperature (T, °C) and precipitation (mm) in 2017 and for long-term data (meteorological station Zmiyiv)

In 2017 the trees of the 6th category of health condition were absent in our permanent plots because we did not include them in the enumeration when laying permanent sampling plots in 2016 (Meshkova & Borysova 2017). Recently died trees (of the 5th category of health condition) were found in 12 sampling plots. There were 6 plots with one dead tree, 5 plots with two dead trees and 1 plot with one dead tree.

The worst health condition characterized by I_c = 4 in 2016 and I_c = 3.2 in 2017, and the best health condition characterized by I_c = 2.2 in 2016 and I_c = 2.1 in 2017 (Fig. 2). Mean index of health condition (I_c) of inspected ash stands in 2017 was 2.4, which is lower than in 2016 (2.8). That is ash stands still remain weakened.

The following eight types of damage were revealed in inspected ash stands: frost cracks, mechanical damage of stems, epicormic shoots, branch dieback, symptoms of bacterial disease (“bark roses”) and butt rot, signs of wood decay fungi (fruit bodies) and insect feeding (holes in the leaf lamina) (Fig. 3).

Frost cracks are usually caused by different compression rates of inner and outer stem layers under influence of very low temperature (Tubeuf 1936).

Mechanical damage may be caused by a fallen neighboring tree or branch, by wild animals, forest management operations or human vandalism. Mechanical damage of stems (4 % of inspected

trees) was sometimes caused by wild animals in the plots located in the flood-plain part of the forest.

Epicormic shoots are known as one of the symptoms of ash dieback but can develop in other cases too. Epicormic shoots can develop within the live crown or on the clear bole from epicormic buds, which are normally dormant. Epicormic shoots occurred on average in 26 % of inspected trees and maximal in 60 % of trees (see Fig. 3).

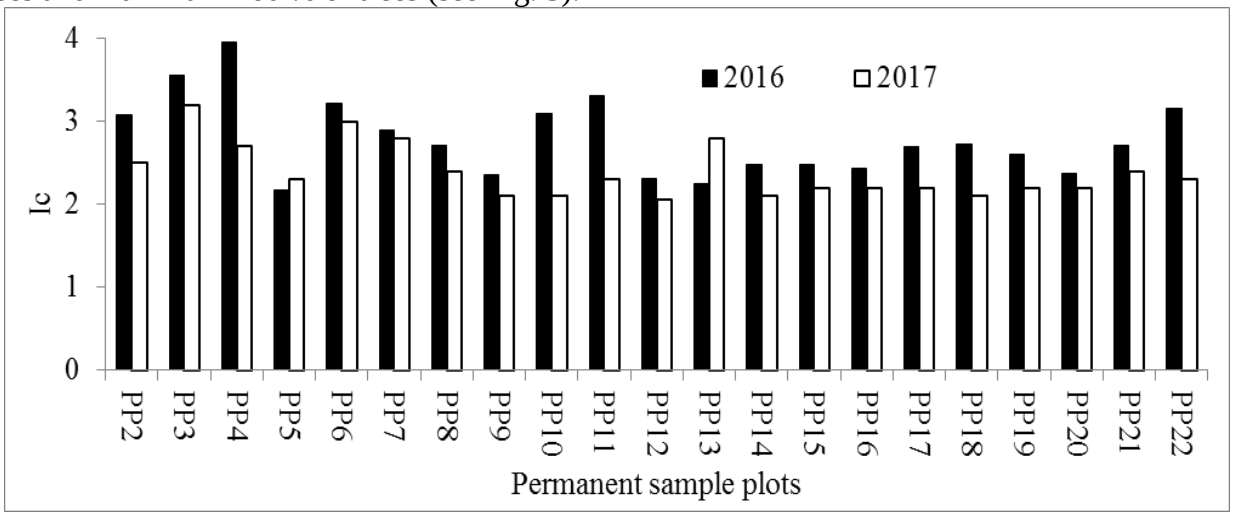

Fig. 2 – Index of health condition of ash trees in the permanent sampling plots in 2016 and 2017

Branch dieback is also one of the symptoms of ash dieback but can develop in other cases too. Long-term preservation of dry branches in crowns is characteristic of many hardwood species, particularly oak, birch, and ash. Branch dieback was registered the most often (mean 52 % and maximal 100 % of trees in the plot) (see Fig. 3).

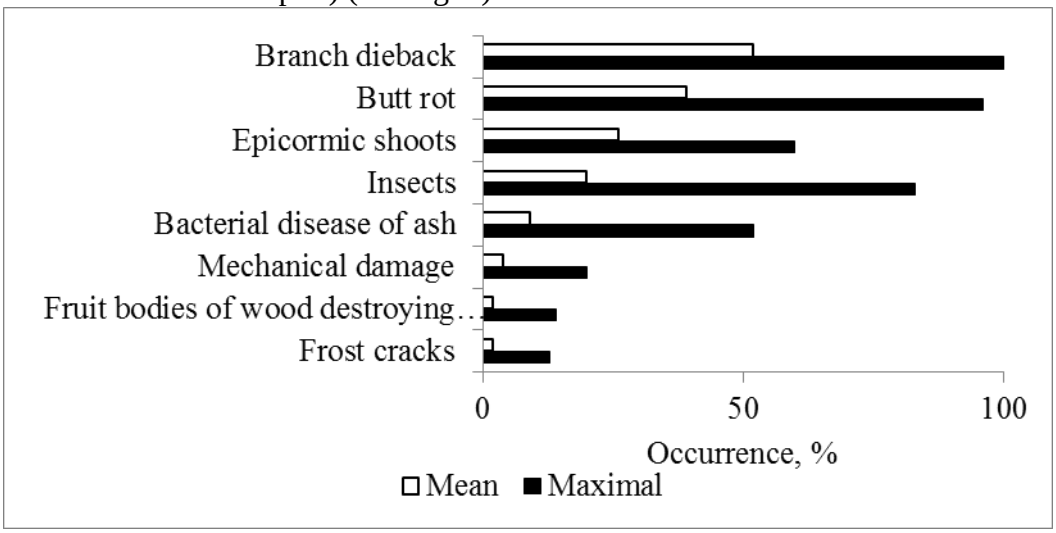

Fig. 3 – Mean and maximal occurrence of different symptoms and signs of European ash damage in the permanent sampling plots

The bacterial disease of ash (tuberculosis) was recognized by flat, furrowed swellings on the stem surface (so cold “bark roses”). The disease is caused by *Pseudomonas syringae* pv. *savastanoi* (Smith) Gardan, Bollet, Abu Ghorrah, Grimont and Grimont (Tubeuf 1936, Janse 1982). Symptoms of the bacterial disease of ash were observed on average in 9 % of inspected trees and maximal in 52 % of trees in the sampling plots.

Symptoms of butt and stem rots often are not visible until fruiting bodies appear. Rhizomorphs of *Armillaria* sp. were found under the bark of some trees but fruit bodies were not formed in 2017 because of very dry weather. The butt rot was in the second place by occurrence (mean 39 % and maximal 96 % of trees in the plot) after branch dieback.

Fruit bodies of wood decay fungi were found relatively seldom (only 2 % of trees, maximal 14 %), which can be connected with the very dry weather. The most spread species were *Fomes fomentarius* (L.) Fr., *Ganoderma lipsiense* (Batsch) G.F. Atk., *Laetiporus sulphureus* (Bull.) Murrill, *Oxyporus populinus* (Schumach.) Donk, *Phellinus nigricans* (Fr.) P. Karst. and *Schizophyllum commune* Fr. Analysis of their occurrence will be presented in a separate paper.

Insect damage was rather rare (mean 20 % and maximal 83 % of trees in the plot). There were mainly species from Lepidoptera, Hymenoptera, and Coleoptera which did not cause severe defoliation. Stem insects were not registered because any tree was cut or dissected.

Ash weevil (slimy ash weevil) *Stereonychus (Cionus) fraxini* (DeGeer, 1775) (Curculionidae) was the most spread defoliator in 2017. It is considered one of the most harmful defoliating insects on ash species in Southeast Europe (Blaga 2010, Drekić et al. 2014) but is poorly known in Ukraine. In our research in 2017 mean defoliation of ash in all inspected plots was 12.1 % with maximum 33.6 % per plot.

Correlation between stand age and occurrence of different types of tree damage was reliable but not high. In the total sample of plots the highest correlation with age was evaluated for bacterial disease of ash (tuberculosis) ($r = 0.30$; $r_{0.05} = 0.29$) and frost damage ($r = 0.32$; $r_{0.05} = 0.29$) (Figs. 4, 5).

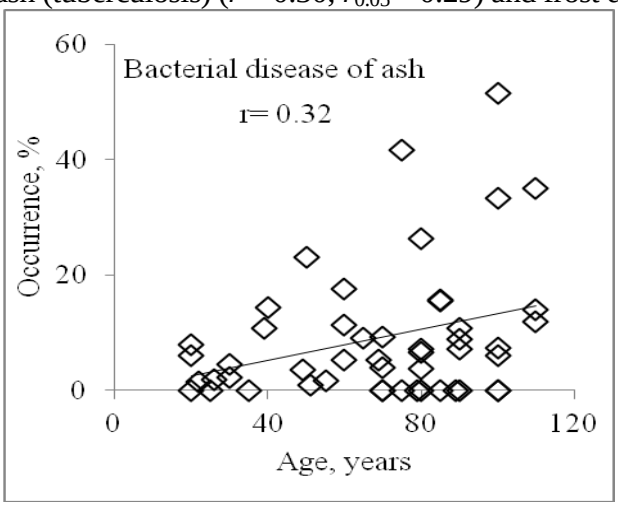

Fig. 4 – Correlation between forest age and occurrence of bacterial disease of ash (total sample of plots)

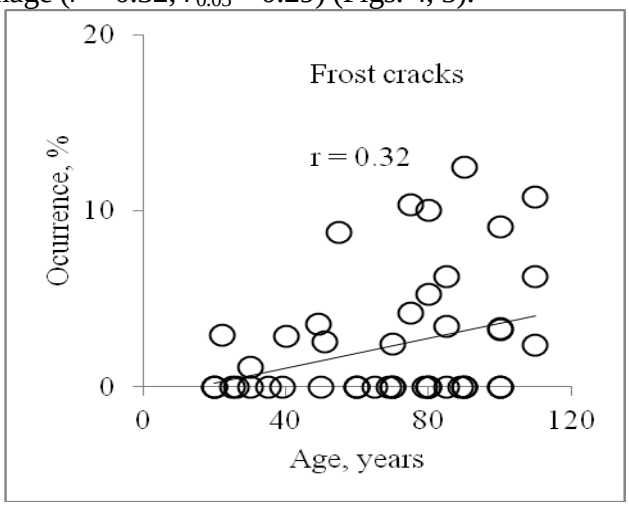

Fig. 5 – Correlation between forest age and occurrence of frost cracks (total sample of plots)

Correlation with age was stronger for the group of plots with stands of vegetative origin in fresh fertile forest site conditions (Figs. 6–9).

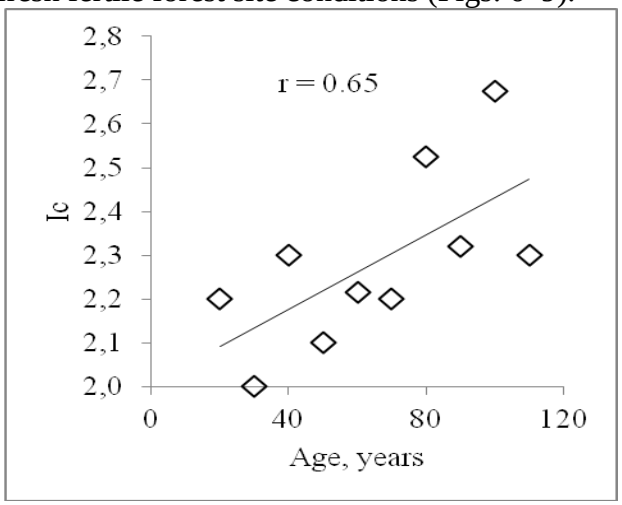

Fig. 6 – Correlation between forest age and index of forest health condition for stands (I_c) of vegetative origin in fresh fertile forest site conditions (D_2)

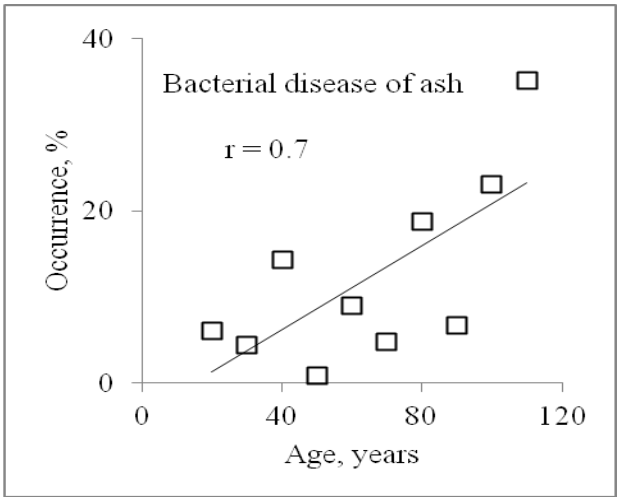

Fig. 7 – Correlation between forest age and occurrence of bacterial disease of ash for stands of vegetative origin in fresh fertile forest site conditions (D_2)

In such stands correlation index *r* of stand age with forest health condition index is 0.65, with the occurrence of bacterial disease is 0.70, with the occurrence of branch dieback is 0.64, and with the occurrence of insect damage is 0.65 ($r_{0.05}$ = 0.63).

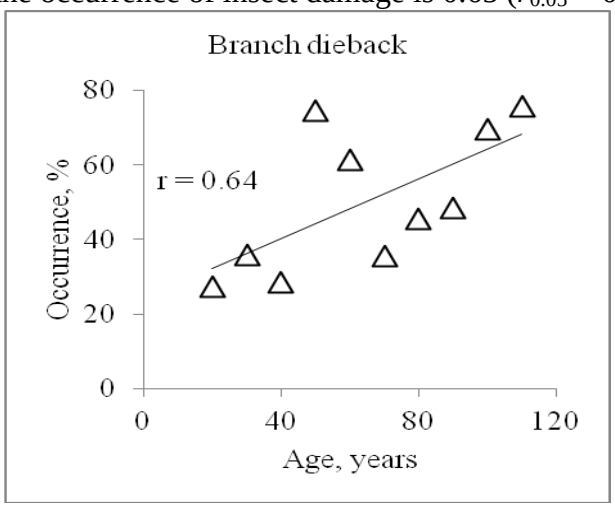

Fig. 8 – Correlation between forest age and occurrence of branch dieback for stands of vegetative origin in fresh fertile forest site conditions (D_2)

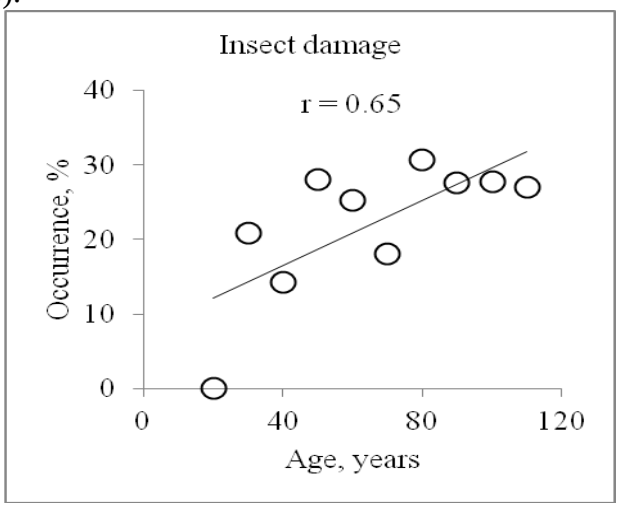

Fig. 9 – Correlation between forest age and occurrence of insect damage for stands of vegetative origin in fresh fertile forest site conditions (D_2)

The stands of vegetative origin characterized by worse health condition than stands of seed origin (I_c is 2.2 for seed and 2.7 for vegetative stands), higher defoliation (9.5 and 12.2 % respectively), a large proportion of trees with epicormic shoots (11.5 % and 27.4 %), and insect damage (9 and 20.4 %). The proportion of trees with butt rot, frost damage and mechanical damage differ to a lesser extent (Table 1). At the same time, the differences between all pairs of parameters are not significant.

Table 1

Health condition of trees and occurrence of certain symptoms and signs of damage in ash stands of vegetative and seed origin

Parameters of health condition and damage types	Origin of stands		t_{fact}
	Seed	Vegetative	
Index of health condition	2.2 ± 0.07	2.7 ± 0.04	1.2
Defoliation, %	9.5 ± 2.76	12.2 ± 0.89	0.4
Crown discoloration, %	2.8 ± 0.77	4.1 ± 0.39	1.1
Trees with epicormic shoots, %	11.5 ± 6.47	27.4 ± 2.26	1.8
Trees with branch dieback, %	50.9 ± 3.13	59.7 ± 13.66	0.8
Trees with bacterial disease of ash, %	9.2 ± 1.79	8.1 ± 4.10	0.4
Trees with frost cracks, %	1.0 ± 0.81	2.4 ± 0.55	0.6
Trees with butt rot, %	33.8 ± 17.34	38.8 ± 2.42	0.5
Trees with mechanical damage, %	3.0 ± 1.63	3.7 ± 0.82	0.4
Trees with insect damage, %	9.0 ± 6.0	20.4 ± 2.95	0.6
Recently died trees (the 5th category of health condition, %)	2.0 ± 0.79	0.8 ± 0.25	1.2
Trees with fruit bodies of wood decay fungi, %	3.8 ± 2.24	1.9 ± 0.53	1.4

Note. $t_{0.05}$ = 2.01.

Fresh fertile forest site conditions (D_2 and D_3) are the most spread types of forest site conditions in the region (Borysova 2016). Occurrences of different types of ash damage were compared in fresh and humid fertile forest site conditions (Table 2).

Percentage of trees with symptoms of the bacterial disease, butt rots, branch dieback and epicormic shoots as well as with insect damage was higher in humid fertile forest site conditions (D_3). However, the differences between the most parameters are insignificant, except the percentage

of trees with butt rot and branch dieback. Both types of damage may be caused by fungi, which prefer more humid conditions than occurred in 2017.

Table 2

Health condition of trees and occurrence (% of trees) of certain symptoms and signs of damage in fresh and humid fertile forest site conditions

Parameters of health condition and damage types	Type of forest site conditions		t_{fact}
	Fresh fertile – D_2	Humid fertile – D_3	
Index of health condition	2.1 ± 0.04	2.1 ± 0.02	0.5
Defoliation, %	10.8 ± 1.89	10.8 ± 0.86	0.4
Crown discoloration, %	3.3 ± 0.69	3.8 ± 0.64	0.5
Trees with epicormic shoots, %	17.1 ± 4.97	29.0 ± 3.75	1.1
Trees with branch dieback, %	35.4 ± 4.66	58.5 ± 6.46	2.4*
Trees with bacterial disease of ash, %	6.7 ± 2.19	6.0 ± 1.57	0.2
Trees with frost cracks, %	1.8 ± 0.66	3.0 ± 1.12	1.1
Trees with butt rot, %	23.7 ± 7.94	50.0 ± 4.6	2.4*
Trees with mechanical damage, %	3.6 ± 1.42	3.8 ± 1.42	1.5
Trees with insect damage, %	6.3 ± 3.25	17.1 ± 6.27	1.8
Recently died trees (the 5th category of health condition, %)	1.1 ± 0.83	0	–
Trees with fruit bodies of wood decay fungi, %	2.1 ± 1.28	2.1 ± 0.87	0.2

*$t_{0.05}$ = 2.01

A comparison of health condition parameters for young stands (20–30 years old), growing in fresh and humid relative fertile forest site conditions, shown the higher occurrence of the bacterial disease of ash, epicormic shoots, butt rot and mechanical damage of stems in humid relatively fertile forest site conditions (Table 3).

Table 3

Health condition of trees and occurrence (% of trees) of certain symptoms and signs of damage in young stands of vegetative origin in fresh and humid relatively fertile forest site conditions

Parameters of health condition and damage types	Type of relatively fertile forest site conditions		t_{fact}
	Fresh – C_2	Humid – C_3*	
Index of health condition	2.3 ± 0.03	2.2 ± 0.03	0.4
Defoliation, %	10.2 ± 1.35	8.4 ± 0.52	1.4
Trees with epicormic shoots, %	7.0 ± 2.13	60.0 ± 5.12	9.6*
Trees with branch dieback, %	46.5 ± 4.21	56.0 ± 6.15	1.3
Trees with bacterial disease of ash, %	0	8.0 ± 1.35	–
Trees with butt rot, %	16.3 ± 7.32	44.0 ± 4.32	3.3*
Trees with mechanical damage, %	14.7 ± 1.36	20.0 ± 1.26	2.9*
Trees with insect damage, %	2.3 ± 0.78	7.1 ± 5.84	1.8
Recently died trees (the 5th category of health condition, %)	2.3 ± 0.65	0	–

*$t_{0.05}$ = 2.1

It is interesting that means of defoliation are almost the same in fresh and humid fertile forest site conditions (see Table 2) and fresh and humid relatively fertile forest site conditions (see Table 3). At the same time, the occurrence of trees with insect damage is about 3 times higher in humid conditions. This issue must be investigated separately the next season.

Conclusions. The following eight types of ash damage were revealed in inspected ash stands: frost cracks, mechanical damage of stems, epicormic shoots, branch dieback, symptoms of the bacterial disease and butt rot, signs of wood destroying fungi and insect feeding. Branch dieback and butt rot dominated with occurrence 52 and 39 % respectively.

In the stands of vegetative origin in fresh fertile forest site conditions stand age correlation with forest health condition, with the occurrence of bacterial disease, branch dieback, and insect damage was significant.

The percentage of trees with butt rots, branch dieback, and epicormic shoots was significantly higher in humid fertile forest site conditions than in fresh fertile forest site conditions.

In young stands (20–30 years old) the higher occurrence of the bacterial disease of ash, epicormic shoots, butt rot and mechanical damage of stems was registered more often in humid relative fertile forest site conditions than in fresh relative fertile forest site conditions.

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REFERENCES – ПОСИЛАННЯ

Blaga, T. 2010. Research on the *Stereonychus fraxini* De Geer insect (Curculionidae – Coleoptera) in the Siret basin stands. Summary of the PhD Thesis. Braşov, 90 p. (in Romanian).

Borysova, V. L. 2016. Poshyrennya yasena zvychaynoho u lisovykh nasadzhennyakh lisostepovoyi chastyny Kharkivs'koyi oblasti [Spread of European ash in forest stands of the forest-steppe part of Kharkiv region]. Lisivnytstvo i ahrolisomelioratsiya [Forestry and Forest Melioration], 128: 12–19. (in Ukrainian).

Cleary, M., Nguyen, D., Stener, L. G., Stenlid, J., Skovsgaard, J. P. 2017. Ash and ash dieback in Sweden: A review of disease history, current status, pathogen and host dynamics, host tolerance and management options in forests and landscapes. In: Dieback of European Ash (Fraxinus spp.): Consequences and Guidelines for Sustainable Management, p. 195–208.

Davydenko, K., Vasaitis, R., Stenlid, J., Menkis, A. 2013. Fungi in foliage and shoots of *Fraxinus excelsior* in eastern Ukraine: a first report on *Hymenoscyphus pseudoalbidus.* For. Path., 43: 462–467.

Davydenko, K. and Meshkova, V. 2014. European ash (*Fraxinus excelsior*) dieback – situation in Europe and Ukraine. [Electronic resource]. Forestry and landscape gardening, 5. Available from: http://journals.nubip.edu.ua/index.php/Lis/article/view/9868 (last accessed date 12.10.2017).

Davydenko, K. and Meshkova, V. 2017. The current situation concerning severity and causes of ash dieback in Ukraine caused by *Hymenoscyphus fraxineus*. In: R. Vasaitis & R. Enderle (eds), Dieback of European Ash (*Fraxinus* spp.): Consequences and Guidelines for Sustainable Management. Uppsala, p. 220 – 227.

Drekić, M., Poljaković Pajnik, L., Vasić, V., Pap, P., Pilipović, A. 2014. Contribution to the study of biology of ash weevil (*Stereonychus fraxini* De Geer). Šumarski list, 138(7–8): 387–395.

Goychuk, A. and Kulbanska, I. 2014. Etiology of common Ash diseases in Podolia. [Electronic resource]. Scientific Herald of NULES of Ukraine. Series: Forestry and decorative gardening, 198(1): 223–227. Available from: http://ejournal.studnubip.com/wp-content/uploads/2014/01/1_Gojchuk.pdf (last accessed date 12.10.2017).

Janse, J. D. 1982. The bacterial disease of ash (*Fraxinus excelsior*), caused by *Pseudomonas syringae* subsp. *savastanoi* pv. *fraxini.* III. Pathogenesis. Forest Pathology, 12(4–5): 218–231.

Matsiakh, I. P. and Kramarets, V. O. 2014. Declining of Common Ash (*Fraxinus excelsior* L.) in Western Ukraine. Scientific Bulletin of UNFU**,** 24.7: 67–74 (in Ukrainian).

Meshkova, V. L. and Borysova, V. L. 2017. Sanitarnoye sostoyaniye yasenya obyknovennogo (Fraxinus excelsior L.) v lesakh lesostepnoy chasti Khar'kovskoy oblasti Ukrainy (Health condition of European ash (*Fraxinus excelsior* L.) in the forest stands of the forest-steppe part of Kharkov Region of Ukraine). Izvestia Sankt-Peterburgskoy Lesotehnicheskoy Akademii, 220: 140–154. DOI: 10.21266/2079-4304.2017.220 (in Russian).

Meshkova, V., Kukina, O., Zinchenko, O., Davydenko, K. 2017. Three-year dynamics of common ash defoliation and crown condition in the focus of black sawfly *Tomostethus nigritus* F. (Hymenoptera: Tenthredinidae). Baltic Forestry, 23(1): 303–308.

Metzler, B., Enderle, R., Karopka, M., Topfner, K., Aldinger, E. 2012. Development of Ash dieback in a provenance trial on different sites in southern Germany. Allgemeine Forst Und Jagdzeitung, 183(7–8): 168–180.

Nguyen, D. T., Cleary, M. R., Enderle, R., Berlin, A., Stenlid, J. 2016. Analyses of the ash dieback pathogen, *Hymenoscyphus fraxineus*, suggest role of tree species diversity on colonization and population structure differentiation. Forest Pathology, 46(1): 82–84.

Ostapenko, B. F. and Vorobyov, D. V. 2014. Osnovy lesnoy tipologii. [The base of forest typology]. Kharkiv, KHNAU, URIFFM, 362 p. (in Russian).

Sanitarni pravyla v lisakh Ukrayiny [Sanitary Forests Regulations in Ukraine]. 1995. Kiev, 11 p. (in Ukrainian).

Tubeuf, C. V. 1936. Tuberculosis, canker, and cortical scab of Ash (Fraxinus) species and the responsible bacteria, *Nectria* spp., and bark beetles. Zeitschrift fur Pflanzenkrankheiten, Pflanzenpathologie und Pflanzenschutz, 46(10): 449–483.

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ПРИЧИНИ ПОШКОДЖЕННЯ ЯСЕНА ЗВИЧАЙНОГО НА ПОСТІЙНИХ ПРОБНИХ ПЛОЩАХ У ХАРКІВСЬКІЙ ОБЛАСТІ

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Оцінювали санітарний стан ясена звичайного (*Fraxinus excelsior* L.) та поширення окремих типів його пошкодження на постійних пробних площах у Харківській області. В обстежених насадженнях виявлено вісім типів пошкодження: морозобоїни, механічні пошкодження стовбурів, водяні пагони, відмирання гілок, симптоми бактеріозу та окоренкової гнилі, ознаки дереворуйнівних грибів та живлення комах. Відмирання гілок і окоренкові гнилі домінували із середньою поширеністю 52 і 39 % відповідно.

У насадженнях вегетативного походження у свіжій діброві виявлено достовірно кореляцію віку насаджень із поширенням бактеріозу, відмиранням гілок і пошкодженням комахами. Частки дерев із окоренковими гнилями, відмиранням гілок і водяними пагонами були достовірно більшими у вологій діброві, ніж у свіжій. У молодняках (віком 20–30 років) зареєстровано достовірно більше поширення бактеріозу ясена (туберкульозу), водяних пагонів, окоренкових гнилей і механічних пошкоджень у вологих сугрудах, ніж у свіжих сугрудах.

К л ю ч о в і с л о в а : санітарний стан, типи пошкодження, лісорослинні умови, вік насаджень, походження насаджень.

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ПРИЧИНЫ ПОВРЕЖДЕНИЯ ЯСЕНА ОБЫКНОВЕННОГО НА ПОСТОЯННЫХ ПРОБНЫХ ПЛОЩАДЯХ В ХАРЬКОВСКОЙ ОБЛАСТИ

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Оценивали санитарное состояние ясеня обыкновенного (*Fraxinus excelsior* L.) и распространение отдельных типов его повреждения на постоянных пробных площадях в Харьковской области. В обследованных насаждениях обнаружено восемь типов повреждений: морозобоины, механические повреждения стволов, водяные побеги, отмирание ветвей, симптомы бактериоза и комлевой гнилі, признаки дереворазрушающих грибов и питания насекомых. Отмирание ветвей и комлевые гнили доминировали со средней распространенностью 52 и 39 % соответственно.

В насаждениях вегетативного происхождения в свежей дубраве обнаружена достоверная корреляция возраста насаждений с распространением бактериоза, отмирания ветвей и повреждений насекомыми. Доля деревьев с наличием комлевых гнилей, отмирания ветвей и водяных побегов была достоверно большей во влажной дубраве, чем в свежей. В молодняках (возрастом 20–30 лет) зарегистрировано достоверно большее распространение бактериоза ясеня (туберкулеза), водяных побегов, комлевых гнилей и механических повреждений стволов во влажных сугрудках, чем в свежих сугрудках.

К л ю ч е в ы е с л о в а : санитарное состояние, типы повреждений, лесорастительные условия, происхождение насаждений.

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