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Dissemination of the quarantine weeds of the genus *Ambrosia* in the steppe zone of Ukraine

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Abstract: The article presents the results of many years of research for the period 2003-2020, which were aimed at studying the dissemination and expansion of plant groups of quarantine species of *Ambrosia* weeds in the eastern steppe of Ukraine. It has been established that the intensive dissemination of the species of the quarantine ragweed weed occurs both naturally and anthropically. Monitoring of the dissemination and growth of ragweed species is noted in all types of phytocenoses of the steppe. The increase in the areas of dissemination of aggressive species of ragweed weeds poses a widespread threat to all plant populations. Studies show a tendency to increase the number of ragweed plants in such plant groups as agrophytocenoses, phytocenoses of planted forests, phytocenoses of urban areas, meadows and pastures. For the period 2011-2002 the number of ragweed plants increased in meadows by 7.5 times, in pastures by 14.8 times, in agrophytocenoses by 2.95 times, in phytocenoses of urban areas by 1.68 times, in phytocenoses of planted forests by 1.28 times. Due to the lack of control over the dissemination and appropriate eradication measures, the largest increase in the number of ragweed plants over the past 10 years has been observed in meadows and pastures. It is recommended in phytocenoses of planted forests and urban areas in meadows and pastures, total mowing of ragweed plants before their flowering 5-7 times during the growing season in order to prevent replenishment of the seed stock of this weed in the soil during the growing season.

Key words: *Ambrosia*; quarantine weed; phytocenosis type; dissemination; number

Razširjanje karantenskih plevelov iz rodu *Ambrosia* v območju step v Ukrajini

Izvleček: Članek predstavlja rezultate večletne raziskave, izvedene v obdobju 2003-2020, katere namen je bil preučevanje razmnoževanja in razširjanja karantenskih plevelnih vrst iz rodu *Ambrosia* v vzhodnih stepah Ukrajine. Ugotovljeno je bilo, da poteka intenzivno razmnoževanje in razširjanje karantenskih plevelnih vrst ambrozije naravno in antropogeno. Sledenje razmnoževanja in rasti vrst ambrozije je bilo izvedeno v vseh stepskih fitocenozah. Povečanje območij razširjenosti teh agresivnih vrst plevelov predstavlja veliko grožnjo vsem populacijam rastlin. Raziskave kažejo tendenco povečanja števila rastlin ambrozije v rastlinskih združbah kot so agrofitocenoze, združbe gojenih gozdov in urbanih območij in travišča (travniki in pašniki). V obdobju 2011-2002 se je število rastlin ambrozije povečalo v travnikih za 7,5 krat, na pašnikih za 14,8 krat, v agrofitocenozah za 2,95 krat, v združbah urbanih območij za 1,68 krat in za 1,28 krat v združbah gojenih gozdov. Zaradi pomanjkanja nadzora razmnoževanja in neprimernih ukrepov iztrebljanja je največje povečanje v številu rastlin ambrozije v zadnjih 10 letih opaženo na travnikih in pašnikih. Za zatiranje ambrozije v gozdnih združbah, združbah urbanih območij, na travnikih in pašnikih je priporočena košnja ambrozije pred cvetenjem, 5-7 krat v rastni sezoni, da se prepreči nastanek semenske banke v tleh med rastno sezono.

Ključne besede: *Ambrosia*; karantenski plevel; vrste fitocenoz; razmnoževanje; številčnost

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1 INTRODUCTION

One of the factors that reduce the efficiency of technologies for growing agricultural crops is the weediness of agrocenoses of varieties and hybrids. The coefficient of harmfulness of weeds growing in agrocenoses depends on the degree of weediness of agrocenoses and on biological weed species, the rate of their growth and development (Aksyonov, 1997).

Cultivation of field crops is always accompanied by the appearance of dominant groups of weeds in their agrocenoses, which have a multifaceted negative effect on plants of varieties and hybrids, complicating the phytosanitary situation in agricultural production (Sibikeeva and Borisov, 2013).

One of the reasons for the decline in the effectiveness of weed control is the high ecological plasticity of some of them (Aksyonov, 2010).

A particularly high ecological plasticity is characteristic of plants of foreign origin, that are, quarantine weeds (Zakharenko & Zakharenko, 2004).

All over the world there is an acute problem of the expansion of alien plants, causing colossal economic damage. Their invasion leads to floristic pollution of the territory and is a serious environmental problem. They often become harmful weeds of fields and other lands, some pose a danger to human health (Abramova, 2011a).

The problem of invasions of alien weed species is relevant for Ukraine and especially for the steppe zone of the country.

The overwhelming majority of invasive species are from North America, less often East Asian or Mediterranean species.

Of the invasive species, the most dangerous are weed species from the genus *Ambrosia*.

It was revealed that ragweed species with a wide ecological range are introduced into a variety of cenoses - from one-year pioneer communities to floodplain pastures and disturbed steppes, forming a series of replacement communities (Abramova, 2011b).

Among all types of weeds of the genus *Ambrosia,* which grow in Ukraine, one of the most harmful weeds is the species *Ambrosia artemisiifolia* L., classified as a type of quarantine weed.

Ambrosia is extremely harmful. It causes biological and ecological damage to the environment and causes allergies in humans.

The current state of the flora of Ukraine, which is under the constantly growing anthropic pressure, is characterized by a change in the species composition and structure of vegetation, a significant increase in its role as an anthropophilic element. Large economic activity of human creates the preconditions for the transformation of local vegetation into depleted and less valuable, partially or completely formed from synanthropic species, many of which are quarantine weeds. The invasion and further active dissemination, and in some cases the dissemination of species of the adventive fraction of the flora, occurs both naturally and anthropically (Fisyunov et al., 1970).

The geographical location of Ukraine in Europe is favorable for various types of transport links and transportation of goods, both by land, air and sea transport. Active economic ties contribute to the intensive propagation of various groups of goods (including agricultural products) imported from other countries. But the process of delivery of imported products in the form of seeds of agricultural crops, seedlings of fruit and flowers, overshadows the fact that quarantine organisms enter Ukraine and their further dissemination and aggressive behavior is dangerous (Maryushkina, 2001).

Unfortunately, such a vivid example for Ukraine is the entry into its territory of the North American species of weeds *Ambrosia artemisifolia* L., introduced to Ukraine at the beginning of the 20th century. Weed plants of the species *Ambrosia artemisifolia* L. spread at a high speed and, therefore, it is no coincidence that they were included in the A-2 list - quarantine microorganisms that are limitedly disseminated in Ukraine (Maryushkina, 1986).

In the steppe zone of Ukraine, the emergence and dissemination of quarantine weeds poses a widespread threat, since aggressive quarantine species, such as *Ambrosia artemisifolia* L., grow in all types of phytocenoses of agricultural crops and beyond, and their dissemination areas are increasing every year.

For the first time in Ukraine, *Ambrosia artemisifolia* L. was discovered in 1914 in the village Kudashevka, Dnepropetrovsk region (German agronomist Krikker grew it as a substitute for cinchona), and in 1925 – in the vicinity of Kiev (on the territory of an elevator) (Dobrochaeva et. al., 1987).

Currently, this quarantine weed is common in all regions of the country. The largest areas of dissemination of *Ambrosia artemisifolia* L. are noted in the regions of the steppe zone of Ukraine: Zaporozhskaya – 1338.5 thousand hectares, Donetskaya – 1087.8 thousand hectares, Dnepropetrovskaya – 425.0 thousand hectares, Kirovogradskaya – 306.2 thousand hectares, Khersonskaya – 290.7 thousand hectares, Nikolaevskaya – 77.9 thousand hectares (Podberezko, 2012).

The most important task of land users, due to the high severity of weeds of the genus *Ambrosia*, is to prevent the dissemination of contamination of areas with this dangerous quarantine weed.

During flowering, each individual plant of *Ambrosia* forms billions of pollen grains (pollen), which are carried

by the wind over long distances, causing hay fever in sensitive people: loss of performance is observed, swelling of the mucous eyes and upper respiratory tract appears, asthma develops. The ragweed pollen contains special proteins - antigens E and K. Through the mucous membrane, they enter the lymph and blood, causing disease. Leaf allergens cause dermatitis (Mirkin, 1986; Nadtochyi, 2007).

Weeds of the genus *Ambrosia*, as plants imported from another continent, do not have natural enemies in Ukraine (animals do not eat ragweed, agricultural crops cannot compete with ragweed in agrocenoses) and are distinguished by significant biological activity (Gavrilyuk and Aksyonov, 2013).

Introduced to new habitats, invasive weed species find themselves far from the press of their predators, parasites and diseases that could keep their populations in a balanced state. As a result of the loss of natural biological control, these types of weeds often become very harmful in those places where they have settled and spread (Neronov V. M. and Lushchekina, 2001).

Weeds of all *Ambrosia* species are able to suppress and displace not only cultivated but also wild plants, thus capturing new areas and areas. In one year, the weed of the genus *Ambrosia* can spread over an area of almost 5 km (Makoveev and Luchinskyi, 2008c.)

The economic damage from weeds of the genus *Ambrosia* in the areas of its mass distribution is extremely high.

Weeds of the genus Ambrosia consume significant reserves of productive moisture for the development and formation of a powerful aboveground mass and root system. For example, weeds of the species *Ambrosia artemisifolia* L. consume soil moisture for the formation of a unit of dry matter, on average, 2 times more in comparison with cereal crops, which leads to drying out of the soil; decrease in soil fertility, suppression of cultivated plants in crops. With a low level of agricultural technology for growing crops, ragweed in agrocenoses outgrows plants of varieties and hybrids, strongly suppresses them. This leads to a sharp decrease in productivity, and in some cases to the complete death of crops of cultivated plants. Biochemical studies have shown that plants of the genus *Ambrosia* synthesize chlorogenic and isochlorogenic acids, an ester of glucose and caffeic acid, which suppress the germination and growth of many plant species ((Maryushkina, 1986; Glubsheva and Karpushina, 2009).

The damage that genus *Ambrosia* inflicts on agriculture has a number of economic factors as well: a decrease in the quality indicators of seed, a deterioration in the quality of crop production; decrease in the productivity of pastures; an increase in additional costs for seed cleaning and the purchase of herbicides, additional agrotechnical measures in cultivation technologies, including the application of herbicides (Luchinskyi and Knyazeva, 2010b; Makoveev and Luchinskyi, 2008b).

The vector of competitive relations in agrocenoses between plants of varieties, hybrids and plants of genus *Ambrosia*, which aggravate the harmfulness of the weed, is strongly influenced by the climate of the area, the weather conditions of the growing season, and the cultivated crop. In addition, fluctuations in abundance of autonomous origin are inherent in many weeds (Coble, 1981; Cousens and Mortimer, 1995).

Even if there are two plants of the weed of the genus *Ambrosia* per 1.0 m^{-2} in the agrocenosis, the yield of soybean grain can be reduced to 15.2 % in comparison with agrocenoses in which these do not grow. A further increase in the number of genus *Ambrosia* plants in soybean agrocenoses is accompanied by significant decreases in yield. If there are 10 *Ambrosia* plants in the agrocenosis per 1.0 m^2, the soybean yield decreases up to 30.0 %. When weeds of *Ambrosia* grow in the agrocenosis of soybeans with density of 35-40 plant m^{-2}, the maximum yield decreases is 55.0-63.0 %.

Due to the low competitiveness of soybeans in relation to weeds in soybean agrocenoses, *Ambrosia* plants produce almost twice as many seeds as in sunflower and corn agrocenoses, which is one of the reasons for the low yield of soybeans in Ukraine (Storchous, 2017).

The weak competitive ability of cultivated plants to weeds, including ragweed, is one of the main reasons for the formation of low yield levels by varieties and hybrids.

Thus, it is known that the low competitiveness of oil flax to weeds is due to slow growth in the initial phases of flax development, as well as a botanical feature of oil flax plants – small leaves on the plant (Dryakhlov, 2002).

Sunflower has a relatively high competitiveness in relation to weeds. Nevertheless, one of the reasons for the decline in sunflower yields is its high infestation with quarantine weeds of the genus *Ambrosia*.

The most harmful (quarantine) weed in sunflower crops is *Ambrosia artemisifolia* L. The economic threshold of harmfulness, depending on the botanical and biological characteristics of sunflower plants, is within 5.5-8.4 weeds of *Ambrosia artemisifolia* L. plant m^{-2}. With infestation of crop plants with this weed in sunflower crops in the amount of 5 plant m^{-2}, the loss of yield when applying different doses of fertilizers increases from 0.15 to 0.41 t ha^{-1}, with the number of weeds of 10 plant m^{-2} losses increase from 0.69 to 1.09 t ha^{-1}. With an increase in the number of *Ambrosia artemisifolia* L. plants in sunflower agrocenoses to 20-30 plant m^{-2}, a decrease in the level of profitability of cultivation of this oilseed crop is noted (Luchinskyi S. and Luchinskyi V., 2010a; Makoveev et. al., 2008a).

If there are 1-2 ragweed plants in corn crops per 1 m^2, 250-500 thousand seeds get into the soil during the growing season, and more than 1 billion grains of pollen of this weed get into the air. The decrease in the yield of corn grain at this level of contamination of crops with ragweed is up to 0.7 t ha^{-1}. With an even higher density of ragweed plants in maize agrocenoses (3-5 plant m^{-2}), the yield decreases by 35.0 %.

Control over the dissemination of ragweed plants growing in agrocenoses is relevant and rather difficult. There are many effective scientific developments and developed methods for controlling ragweed using the following methods: manual (when each ragweed plant is pulled out by hand), manual and mechanical mowing, chemical, biological, agrotechnical.

The agrotechnical method is the most effective. Agrotechnical methods of controlling ragweed plants include: compliance with crop rotations, basic tillage (disc plowing of stubble after harvesting the main crop, disc loosening of the soil in 2-3 tracks, plowing, cultivation as weeds grow, etc.), pre-sowing tillage (cultivation and harrowing as weeds emerge in the cotyledon phase).

Unfortunately, the use of agrotechnical and other methods of combating ragweed does not provide a high efficiency of suppression of this type of weed in agro- and phytocenoses.

Given the exceptional viability, resistance of ragweed to unfavorable environmental conditions, the incomplete effectiveness of measures aimed at suppressing ragweed plants, it becomes necessary to conduct studies on the spread and control of weeds of the genus *Ambrosia* in the steppe of Ukraine.

2 MATERIALS AND METHODS

In order to study cultivated plant groups and establish the abundance and dissemination of weeds of the genus *Ambrosia* in the Steppe of Ukraine, long-term studies were carried out during 2003-2020.

The survey of the species composition of weeds and the ways of weediness and soil infestation was carried out using the route-expedition method.

The species composition of weeds growing in fields, gardens, parks, forest belts, meadows, and pastures, their seed productivity and abundance were studied using conventional methods (Ivashchenko, 2001; Kamyshev, 1970; Fisyunov et al., 1974; Fisyunov, 1983).

During the survey of the species composition of weeds, phytocenoses were classified into:

agrophytocenoses – fields, vegetable gardens;

sylvophytoculturecenoses – artificial forest plantations, forest protective belts (phytocenoses of planted forests);

urbophytoculturecenoses – parks, gardens, flower beds (phytocenoses of urban areas).

Meadows and pastures were identified as separate cultural phytocenoses.

The abundance of weed plants in culture phytocenoses was determined by the two most common methods:

- the number of weed species was assessed visually (a point scale of N. F. Komarov was applied);
- direct counting of the number of weed specimens per unit area (1.0 m^2).

When studying the species diversity of weeds, the classical comparative ecological and morphological method was used, based on the analysis of mass herbarium material, observations and accounting in nature (Siniwardana, 1984).

The species composition of weeds was determined using atlases and keys (Kondratyuk, 1985; Maysuryan, 1978).

About 260 short-term expeditionary route trips were made, about 500 sheets of herbarium were collected, stored at the Lugansk National University named after Taras Shevchenko.

The survey of culture phytocenoses was carried out during the periods:

- the beginning of the growing season (spring);
- mid-summer;
- end of the growing season (autumn).

3 RESULTS AND DISCUSSION

When examining the dissemination areas of ragweed, it was found that three species of weeds of the genus Ambrosia grow in the Steppe of Ukraine: ragweed *Ambrosia psilostachya* L., ragweed *Ambrosia trifida* L., ragweed *Ambrosia artemisiifolia* L.

The study of the dissemination areas of weeds of this genus made it possible to carry out a botanical description of the plants of the established ragweed species.

Ragweed *Ambrosia psilostachya* L. is a perennial plant up to 180 cm high with creeping rhizomes, characterized by the highest frost resistance.

Seedlings with a developed, thickened hypocotyledonous part, colored in reddish-purple color of various shades.

Leaves are opposite and alternate, deeply divided or pinnately dissected. The first leaves are opposite, whole or divided. Lobes of leaves lanceolate or linear-lanceolate, acute, pointed, serrated.

Stem straight, branched, rounded, rough. The surface of leaves, stems and branches is covered with short, stiff hairs.

Flowers are heterosexual, form heads, collected, in turn, in a brush. Male flowers are larger with a bell-shaped corolla, tightly collected in a brush 7.0-15.0 cm long, include up to 100 heads. The anther is oblong with a curved tip at the apex. Female flowers are few, single. The female flowers are found in the axils of the upper leaves or at the base of the male inflorescences.

Head inflorescences in brushes. Shape of achene cover (false seed) are converse ovoid with a blunt nose at the top. The surface of the achene is heavily pubescent with green, easily abraded hairs, wrinkled and tuberous. The color of the achene is dark brownish-greenish or dark gray.

Plants of this ragweed species survive in the most difficult growing conditions. The propagation of plants by root suckers and seeds leads to a constant expansion of the growing areas of the weed.

Ragweed of *Ambrosia trifida* L., is an annual plant capable of rapidly growing green mass. Plant height from 1.0 to 3.0 m.

Weed seedlings with spoon-shaped or elliptical cotyledons, which are 1.2-4.0 cm long and 0.6-1.5 cm wide. The stem below the cotyledons is brilliant green with purple spots; first pair of leaves lanceolate with serrated edges; the second pair is deeply three-lobed and roughly hairy.

Leaves opposite from below, alternate from above; three-five-lobed, distinctly three-lobed, with sometimes oblong-lanceolate lobes. The edges are coarsely toothed; surface with a rough sandy texture.

The stem is straight, furrowed, slightly branched, coarse-haired, up to 3.0-4.0 cm thick, woody by the end of the growing season. Covered with short, coarse, coarse hairs.

The flowers are male or female, greenish. Male inflorescences in the form of brushes, located in the terminal ears, each of them is surrounded by 5-12 bracts and has three noticeable black ribs. Length up to 10.0 cm. Female flowers are one-flowered, located in clusters of one to four at the base of male flowers or in the axils of leaves, are 0.6-1.3 cm long. Flowers are pollinated by the wind, producing a large amount of pollen.

Achenes with a smooth surface, ovoid, grayish-brown, having a length of 0.6-0.8 cm, a width of 0.2-0.3 cm. The surface is smooth.

The root has a rod-like shape, branched.

Giant ragweed *Ambrosia trifida* L. was discovered somewhat later than common ragweed plants, but quickly spreads over many regions of Ukraine. Seeds are spread across the territory of Ukraine with grain, which is supplied from the southern, steppe regions. Three-part ragweed infests spring cereals, row crops, forage grasses, vegetable gardens, orchards, meadows. It grows abundantly on moist soils and low relief areas along the banks of rivers, gullies, ravines, floodplain lands, on the sides of railways, highways and dirt roads.

Ragweed of *Ambrosia artemisiifolia* L. is similar in appearance to common wormwood (*Artemisia vulgaris* L.*). Ambrosia artemisiifolia* L. is an annual, heat- and light-loving, drought-resistant plant. The height of the weed plants is from 0.2 m to 2.0 meters. Under favorable conditions, the plants reach a maximum height of 2.0 m.

This type of ragweed is propagated by achenes.

The upper leaves of *Ambrosia artemisiifolia* L. plants are alternate, feathery, dark green in color. The lower leaves are opposite, twice pinnately dissected, with elongated-lanceolate areas, pubescent below, have a bluish color.

The plant stem is strong, straight, spreading, branched in the upper part and has pubescence.

Flowers are dioecious, small, yellow in color, collected in dioecious green heads. Male flowers form cluster-like inflorescences located at the ends of stems and twigs. The female flowers are placed one at a time in the leaf axils or under the male inflorescences. Receptacle bristly-scarious.

The fruit is an achene. The achene is located inside the envelope and has an inverse ovoid shape. The achenes mass of 1000 is 1.5-2.0 g.

The root system of *Ambrosia artemisiifolia* L. is strong, pivotal, highly branched, and goes deep into the ground to a depth of 4 meters or more.

Ambrosia artemisiifolia L. infests all field crops, occurs in gardens, forest edges, household plots, along roadsides and ditches.

It was found that under the conditions of the Steppe zone of Ukraine, in particular in the northeastern part of the steppe, the species of the weed *Ambrosia artemisiifolia* L. grows in all types of cultivated communities that have been studied. The number of *Ambrosia artemisiifolia* L. plants varied depending on the type of plant grouping and the time of counting.

During the research during 2003-2020 there is an increase in the number of plants of *Ambrosia artemisiifolia* L. in all studied cultural phytocenoses of the eastern Steppe of Ukraine both in the first and in the second half of summer. The level of infestation of phytocenoses with *Ambrosia artemisiifolia* L. was determined by the type of phytocenosis and the period of the growing season of plants in phytocenoses. The level of emergence of ragweed plants was significantly lower in 2003-2010. The smallest number of plants of the quarantine species of the weed of *Ambrosia artemisiifolia* L. is observed in mead-

ows and pastures. On average for the period 2003-2010 the number of plants of this kind of weed in meadows was 4 plant m^{-2} in the first half of summer, 7 plant m^{-2} in the second half of summer, 1 and 5 plant m^{-2} on pastures, respectively (Table 1).

The weediness of meadows and pastures with the weed *Ambrosia artemisifolia* did not exceed 1 point. The frequency of occurrence of this species of weeds in meadows and pastures was very random.

Compared to the phytocenoses of meadows and pastures, the level of the number of ragweed plants was higher in agrophytocenoses, and in phytocenoses of planted forests and phytocenoses of urban areas it was at maximum. So, in the second half of growing season, the number of ragweed plants in 2003-2010 in agrophytocenoses was 24 plant m^{-2}, phytocenoses of planted forests 142 plant m^{-2}, and in phytocenoses of urban areas 128 plant m^{-2}. The number of ragweed plants in phytocenoses of planted forests and urban areas exceeded the number of weeds in agrophytocenoses, respectively, by 591.7 % and 533.3 %.

In surveys carried out for the period 2011-2020 a clear tendency of an increase in the dissemination of ragweed was established in all types of phytocenoses. Especially during this period, the maximum number of plants of this quarantine weed, 216 plant m^{-2}, was noted in phytocenoses of urbana areas in the second half of growing season.

The agrotechnical methods used in the technologies of growing field crops do not fully ensure the effectiveness of suppressing ragweed plants in agrophytocenoses. The average number of plants in these years of study in the second half of summer in agrophytocenoses was 71 plant m^{-2}.

The dynamics of the increase in the number of plants of the quarantine ragweed weed in all studied types of phytocenoses is shown in Figure 1.

In comparison with the period 2003-2010 the largest increase in the number of quarantine weed of *Ambrosia artemisiifolia* L. for the period 2011-2020 was noted in meadows and pastures. The lack of control over the spread of ragweed in these phytocenoses and, accordingly, the absence of measures to combat ragweed has led over the past 10 years to the uncontrolled spread of quarantine weeds in meadows. The number of weeds in meadows increased 7.5 times (or 751 %), on pastures - 14.8 times (or 1480 %).

The rates of dissemination of ragweed in agrophytocenoses remain quite high. The number of plants of *Ambrosia artemisiifolia* L. in agrophytocenoses for the period 2011-2020 increased 2.95 times (or 295 %). Until 2011, this type of quarantine weed in agrophytocenoses was quite rare and grew mainly on the sides, in some farms of the region, then already in 2011-2020. According to our monitoring data, ragweed plants were identified in stands of row crops, spring grain crops and even in agrocenoses of winter wheat, the most competitive agricultural crop in relation to ragweed among all crops grown in the eastern Steppe of Ukraine.

With the maximum number of plants of *Ambrosia artemisiifolia* L. in phytocenoses of planted forests and urban areas, it is observed for the same period of time 2011-2020 the smallest increase in the number of this type of quarantine weed. The increase in ragweed weeds in phytocenoses of planted forests was 1.28 times (or 128 %), in phytocenoses of urban areas – 1.68 times (or 168 %).

Apparently, the wider dissemination of the quarantine species of the weed of *Ambrosia artemisiifolia* L. in phytocenoses of planted forests is constrained by competitive relations between the main plant components of artificial forest plantations, forest protective belts and ragweed plants. However, this type of weed has already significantly entrenched itself in phytocenoses of planted forersts and a significant stock of ragweed seeds in the soil is capable of creating both high potential and actual weediness of agrocenoses. The close placement of artificial protective forest plantations near crop rotation fields is a significant factor that contributes to an increase in ragweed infestation of fields, since sufficient control over the growth and distribution of ragweed in phytocenoses of planted forests is not carried out. The ongoing control

Table 1: The level of infestation of phytocenoses with *Ambrosia artemisiifolia* L. of the eastern Steppe of Ukraine, plant m^{-2}

	Average for 2003-2010		Average for 2011-2020	
Phytocenosis type	first half of the growing season	second half of the growing season	first half of the growing season	second half of the growing season
agrophytocenoses	8	24	27	71
sylvophytoculturecenoses	79	142	136	175
urbophytoculturecenoses	64	128	98	216
meadows	4	7	23	53
pastures	1	5	31	74

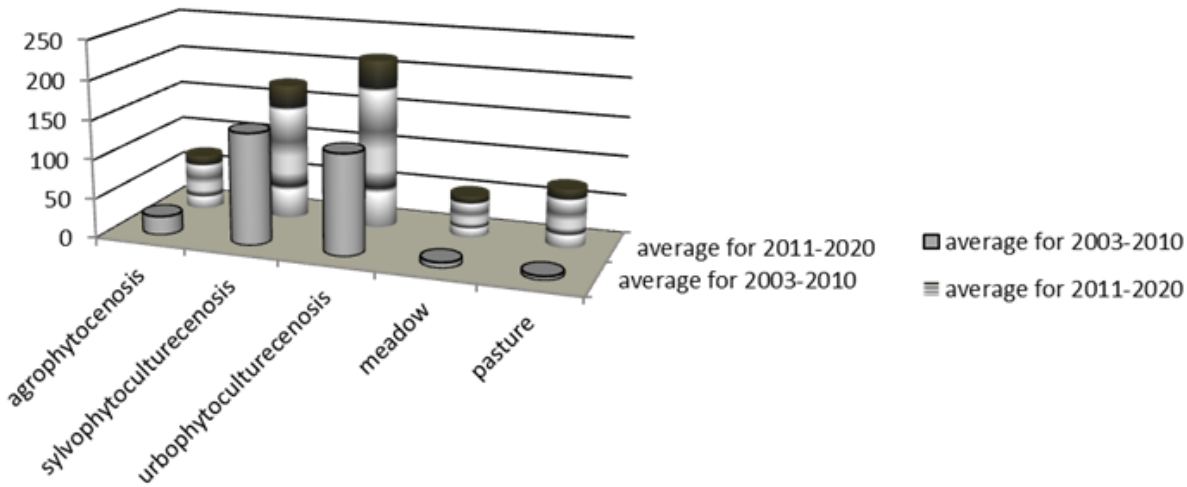

Figure 1: Dynamics of an increase in the number of ragweed plants in phytocenoses of the eastern steppe of Ukraine for the period 2003-2020 (data from the second half of the growing season are given)

measures to suppress ragweed in agrophytocenoses are clearly insufficient to reduce the level of the presence of *Ambrosia artemisifolia* L. in crop rotation fields.

In urbophytoculturecenoses, the wider dissemination of *Ambrosia artemisiifolia* L. is limited to manual measures used in parks, gardens, flower gardens by the population to control this type of weeds, as well as, to a certain extent, by the competition for survival factors between the main components of parks, gardens with ragweed plants.

Nevertheless, the level of the number of plants in phytocenoses of planted forests and urban areas shows that these types of plant communities in the eastern steppe of Ukraine are the main sources of the uncontrolled distribution of ragweed.

If in the fields, it is possible to suppress *Ambrosia artemisiifolia* L. plants with the help of glyphosate herbicides, then in parks and settlements the problem of quarantine weed control is not always effectively solved. At the beginning of the period of appearance of ragweed species, when they grew as single individuals in phytocenoses of planted forests and urban areas, no attention was paid to the plants of these weeds. As the growing areas expanded and the number of weeds of various ragweed species increased, ragweed became widespread. As a result of the spread of ragweed pollen during the flowering period, the population in cities and villages began to suffer massively from hay fever. Today, it is not easy to eradicate the quarantine weed *Ambrosia artemisiifolia* L. completely, because the soil has significant reserves of seeds that remain viable for more than 50 years, and introduced natural pests are ineffective in destroying ragweed, and the weed itself plastically adapts to local conditions.

In the initial period of the appearance of ragweed in the Ukrainian Steppe, herbologists attributed this type of weeds to the early spring type of weeds. Our long-term observations show that, depending on the weather conditions of the growing season in the eastern steppe of Ukraine, seedlings of ragweed plants appear simultaneously with the emergence of late spring weeds or in 1-2 weeks after the appearance of their seedlings. In the second half of summer, the quantitative and population indicators of ragweed species increase significantly, especially in those territories where systematic measures of control over the number and state of ragweed populations are not applied.

One of the preventive effective methods of suppressing the growth of weeds of all species of plants of the genus *Ambrosia* in agrophytocenoses is the observance of crop rotations and the requirements for the implementation of agrotechnical techniques in the technology of growing crops; in sylvophytoculturecenoses, urbophytoculturecenoses, in meadows and pastures, the main method of combating ragweed plants is the constant total mowing of the plants of this quarantine weed before their flowering in order to prevent the spread of weeds and replenish seed stocks in the soil.

4 CONCLUSIONS

1. The studies have shown that the agrobiological features of the extremely aggressive quarantine species of genus *Ambrosia* contribute to the rooting and further spread of its populations in new territories of the eastern steppe of Ukraine. These species form almost mono-

dominant communities, displacing native weed species in plant populations.

2. The spread of ragweed species is determined by the hardiness of the quarantine weed plants, adaptability to growing conditions and to conditions of persistent drought, which is consistently characteristic of the second half of the growing season in the steppe of Ukraine.

3. The absence of proper control over the growth and distribution of ragweed species in phytocenosesof planted forests leads to an increase in the number of ragweed plants in agrophytocenoses of agricultural crops.

4. *Ambrosia artemisiifolia* L. is no longer a quarantine species, which includes restrictedly distributed species. Currently, this weed is disseminated unlimitedly, it is a cosmopolitan, measures to limit the expansion of ambrosia are not yet effective.

5. In addition to constant monitoring of phytocenoses of planted forests and urban areas, meadows and pastures (groups where chemical methods of weed control cannot be applied), with the growth of plant of genus *Ambrosia*, constant total mowing of plants before flowering is one of the effective and recommended ways to control and prevent the further spread of this invasive species of weed.

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