БІОРІЗНОМАНІТТЯ ТА БІОБЕЗПЕКА ЕКОСИСТЕМ

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THE ENERGY LOAD AND ONTOGENETIC STRUCTURE OF *AMBROSIA ARTEMISIFOLIA* L. POPULATION IN PHYTCENOSES OF THE RESIDENTIAL AREAS AND AGRICULTURAL LANDSCAPES OF VINNYTSIA REGION

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На основі обліку вікового спектра, трапляння та рясності особин досліджено енергетичне навантаження амброзії полинолистої в фітоценозах селітебних територій та агроландшафтах. Вивчено онтогенетичну структуру популяції цього заносного виду. На основі індексів віковості (етативності) та ефективності популяції, а також класифікацій популяцій рослин проведено оцінку стану популяції. Визначено, що основна частина популяцій відноситься до молодих та перехідних, а також до інвазійних, нормальних молодих та нормально зрілих. Це свідчить про інвазійність досліджуваного виду та про високий сегетальний потенціал, за якого карантинний вид має значне енергетичне навантаження на популяції інших видів в угрупованнях фітоценозів агроландшафтів та селітебних територій.

Ключові слова: *популяція, енергетичне навантаження, амброзія полинолиста, агроландшафт, селітебна територія, заносний вид.*

Different age conditions of the same species are known to have different effects on the cultural plant as well as on the other species in the group. When assessing the negative impact of the quarantine species it is important to know the range of their age ontogenetic states as well as the diversity of species, occurrence and density of populations (abundance). On the basis of this L. Zhyvotovskyy proposed to determine the energy efficiency of a separate population [1]. In fact, the study of peculiarities the ontogenesis and structure of coenopopulations allows to speak about the prosperity or the oppression of one or another species in a specific location. To establish the capacity of brought species this indicator is of great importance.

The ability of adventive species to spread in agrocenoses as well as in natural phytocenosis, creating local populations, which are adapted to the abiotic and biotic and anthropogenic factors, and growth conditions, is of interest both for theoretical ecology and so from a practical point of view. Brought species, which is in the process of adaptation to new conditions of existence has acquired the ability to create local population of a wide age spectrum, has significant advantages comparing with species of the narrow ontogenetic amplitude.

The article attempts to assess the capacity of adventitious quarantine species according to the energy activity of their local populations. The analysis of the energy load of ambrosia populations in phytocenosis of Vinnytsia region was assumed as a basis of assessment. The information about the life cycle of brought species is of considerable importance for agroecology but this question remains poorly investigated, including the

lack of methodological approaches and specific methods. In our research for the first time for ambrosia the methodology of the spectra of age-related conditions study is applied, for determination the energy loads ambrosia on the groupings in phytocenosis of agro-landscapes and residential territories. Thus it is possible to determine the potential of antropophites in agricultural landscapes and to define their ecological threat of spreading.

MATERIALS AND METHODS

Exploring of ambrosia potential was done on the residential areas of the Vinnitsa region in eleven administrative districts (Bar, Vinnitsa, Haysyn, Zhmerynka, Lityn, Tomashpil, Pischanka, Mohyliv-Podilsky, Khmelnytsky, Yampil, Teplyk).

Detailed route survey were conducted by the method of G. Wittiker [2] during 2009–2011. The result of each route survey is data accounting for three environmental indicators: species richness, abundance and occurrence of local populations of all species phytobiotes, including ambrosia. The condition of cenopopulations was defined according to the method of M. Ageev [3], which was in establishing cenotic population of ambrosia in phytcenoses of agro-landscapes and residential areas, which occupies a specific area. 32 phytcenoses were studied in the different phases of plant vegetation.

In cenopopulations with the participation of ambrosia the accounting of individual number of different age states in 10 accounting plots with the area of 1 m^2 was held.

Ambrosia artemisifolia L. — is a kenofit of the North American origin, epekofit, from the core root system, annual, terofit, sinantropant, mezofit, poligemirob, antropofit. The species is characterized by high-frequent appearance and abundance.

The state of the population ambrosia was determined by the age index of the population (S) (A. Uranov) [4] and the effectiveness index of the population (L. Zhyvotovskuy) [1]. The assessment of the population state was carried out on the basis of the classification of the «Delta-omega», which is more precise because of detailed assessments of the age structure compared with morphological assessment. According to the classification of plant populations which was introduced by L. Zhukova [5], Uranov, and O. Smirnova [6], which is based on the basis of the criterion of absolute peak of the ontogenetic groups of adult plants.

The classification by T. Rabotnov, who divided the populations into invasive, normal and regressive, has also been used in the work [7].

RESEARCH RESULTS AND THEIR DISCUSSION

In a vertical structure of the investigated phytocenoses of ambrosia population in the period of the description were occupied by middle and upper storeys being edificators or dominants. Populations density in groups (number per 1 m^2) varied from 73 to 332 individuals in 2009, from 67 to 372 individuals in 2010, from 76 to 382 individual in 2011.

Such age states of beforegenerative and generative phase were present in phytcenoses of *Ambrosia artemisifolia* L. population as appearing, juvenile, imature, virginal, the beginning of flowering, mass flowering, mass flowering and fruiting. For such a diversity of age spectra and type density of energy load of ambrosia populations has a significant impact on the populations of other species in the community (fig. 1).

The greatest impact of the ambrosia had phytcenoses of residential territories of the Central districts of the region: Zhmerynka, Vinnytsia, Lityn and Pischanka areas. Where the energy load in 2009 was (129.8; 115.1; 92.0 and 91.6); in 2010 (105.2; 145.8; 110.3 and 126.3), in 2011 — (140.6; 180.8; 12.99 and 127.7), respectively. The least energy load from *Ambrosia artemisifolia* L. had ecosystems of the southern and northern regions, where the rate of energy load was not more than 30 and 44 during years of study.

The analysis of the results of Ambrosia population surveys according to their energy activity (the ratio of physical and effective density) shows that in the populations of this species the difference between these two indicators is essential. And this is the evidence

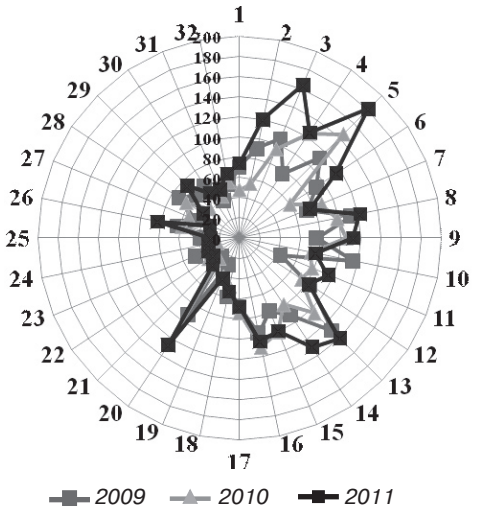

Fig. 1. Energy load from *Ambrosia artemisifolia* L. on plant species in communities of residential areas and agricultural landscapes phytocenoses in Vinnytsia region in 2009–2011

Note: * Studied areas: 1–Bar district., t. Bar; 2–11 — Vinnytsia district., t. Vinnytsa (2 — Repina Str., 3 — Pavlik Morozov Str., 4 — Paryz'koyi Comuny Str., 5 — Karl Marks Lane, school №12, 6 — Karl Maks Lane, school №13, 7 — Zaliznychna Str., 8 — Chekhov Str., 9 — Buchmy Str, 10 — Nemyriv highway, 11 — Bar highway); 12 — Haisyn district., vil. Bilopillia; 13 –Zhmerynka district, t. Zhmerinka; 14–16 — Lityn district (14 — t. Lityn, 15 — vil. Diakivtsi, 16 — vil. Malynivka); 17–20 –Pischanka district. (17 — vil. Kukuly, 18 — vil. Balan, 19 — vil. Dmytrashkovka, 20 — vil. Horodnytsya); 21–25 — Tomashpil district, vil. Vapniarka (21 — Kotsiubynskoho Str., 22 — Sonyachna Str., 23 — Myru Str., 24 — Gagarina Str., 25 — Lenina Str.); 26 — Yampil district, vil.Tsykynivka; 27 — Mohyliv-Podilskyy district, t. Mohyliv-Podilskyy, 28 — Teplyk district, t. Teplyk; 29 — 32 — Khmilnyk district, t. Khmilnyk (29 — Horkoho Str., 30 — Tchaikovskyy Str., 31 — Kotsiubynskyy Str., 32 — Lenina Str.).

that the populations of adventitious species are immature and capable to further expansion.

Efficiency and age indices of quarantine species *Ambrosia artemisifolia* L. populations varied within the following limits: the value of «ω» in 2009, from 0.27 up to 0.56; in 2010– from 0.24 to 0.48; in 2011– from 0.29 to 0.52; the value of «Δ» in 2009 — 0.14 — 0.33, in 2010 — 0.15–0.28, in 2011– 0.19 — 0.30.

We analyzed *Ambrosia artemisifolia* L. populations. Using the classification of the «Delta-omega», which is based on estimates of the indices (Δ & ω), which are obtained from the total data of the age distribution of individuals in the population, starting from the young crops and ending with the mass flowering and fruiting. According to the classification it was determined that all populations are subdivided into the following types: young, transitional, riping, ripe, ageing and old.

On the basis of this classification it was evaluated the state of *Ambrosia artemisifolia* L. population and found that the main part of them belongs to young and transition populations (fig. 2).

This testifies to the invasion of the studied species and high segetal potential in which the quarantine species has significant energy load on the populations on the other species in the groupings of agro-landscapes and residential territories phytocenosis.

As a result of our research it was also found that all studied *Ambrosia artemisifolia* L. populations according to the classification by T.A Rabotnov can be divided into invasive, which are represented by only individuals of pregenerative fraction and normal. We have not observed regressive cenopopulations, which consist of postgenerative fraction individuals mainly. This can be explained by the fact that ambrosia is monokarpik, belongs to annuals and senile individuals in their populations are lacking.

According to the classification by A. Smirnova, we identified two types of *Ambrosia artemisifolia* L. state in the studied territories:

- Invasive *Ambrosia artemisifolia* L. Population, ontogenetic spectrum of which is mainly represented by individuals of pregenerative period;
- Normal population with left-hand one vertex, or right-hand spectra.

Invasive coenopopulations of the quarantine species are mainly represented by individuals of pregenerative period (fig. 3a). Juvenile plants dominate in them (about 69%), and the plants of immature and virginal state make 14.3% and 12.6% respectively. We ob-

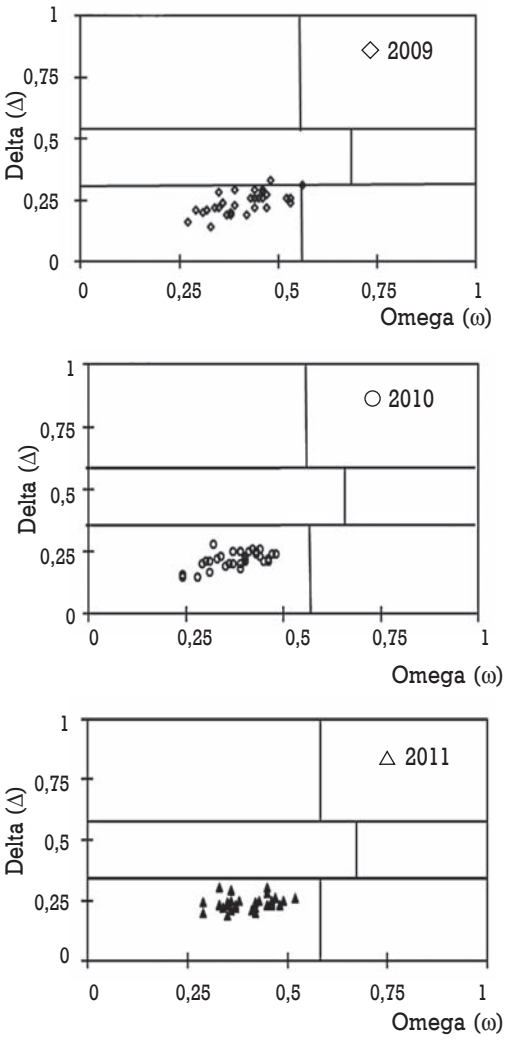

Fig. 2. Distribution of *Ambrosia artemisifolia* L. populations. in phytocenoses of agro-landscapes and residential areas in Vinnytsia region in 2009–2011

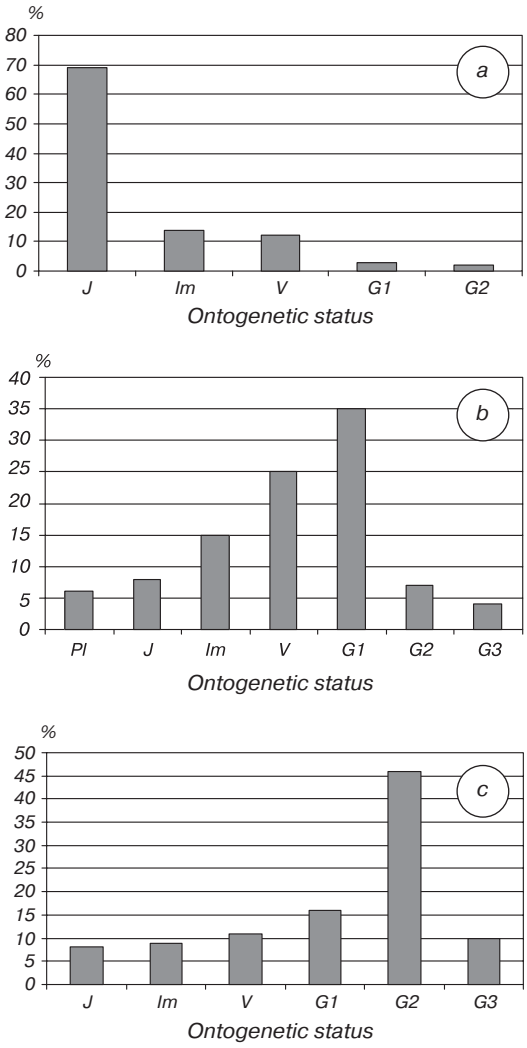

Fig. 3. Ontogenetic spectrum of *Ambrosia artemisifolia* L. coenopopulations: a) invasive; b) young normal; c) normal mature

served only one such coenopopulation on the residential territory of the southern district of Vinnytsia region.

In young normal *Ambrosia artemisifolia* L. populations (fig. 3b), the maximum is on the species of virginal or young generative state (on average 24.6% and 34.8%, respectively). In these populations almost 50% refer to the generative fraction. This fact of *Ambrosia artemisifolia* L. populations distribution was noted in the northern and central districts of the region.

We observed normal mature populations of *Ambrosia artemisifolia* L. in the southern and south-western districts of the region (figure 3c), in which the main part of more than 69.8% of individuals belongs to the group of generative plants.

It is established, that *Ambrosia artemisifolia* L. coenopopulations of different age states

dominate in the investigated areas. This demonstrates the firmness and ability of species to self-maintenance.

Thus, studying the features of spreading *Ambrosia artemisifolia* L. beside such ecological indicators as species diversity, occurrence and abundance an integral part of the monitoring of this advent is establishing the energy load and defining ontogenetic structure of this species. That will allow to set the state and predict its further distribution in phytocenosis, also to propose effective actions to combat against it.

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НОВИНИ

ЕКОЛОГІЧНА ОЦІНКА ТЕХНОЛОГІЙ ВИРОЩУВАННЯ ОВОЧЕВИХ КУЛЬТУР

Сквирським відділенням органічних агротехнологій ІАП НААН розроблено науково-методичні основи екологічної оцінки технологій вирощування коренеплідних овочевих культур у зоні Лісостепу на прикладі моркви посівної (*Daucus carota* L.) та буряку столового (*Beta vulgaris* L.). (Автори розробки: А.В. Вдовиченко, Ю.В. Терновий, Г.Г. Мельник, А.В. Мельник, А.М. Ліщук, Г.Д. Матусевич, Ю.О. Зацарінна, М.В. Драга, Т.М. Красільнікова, В.О. Монарх, О.П. Мельничук, Б.В. Нікітіна, В.М. Караульна).

Для проведення агроекологічної оцінки технологій вирощування овочевих культур (коренеплодів) було обґрунтовано та класифіковано такі основні критерії: відповідність кліматичних умов; забезпеченість ґрунту оптимальним вмістом гумусу, рухомими формами азоту, фосфору, калію; рівень кислотності ґрунту; фітосанітарний стан посівів; акумулятивні та міграційні процеси шкідливих речовин у ґрунті; якість та безпека овочевої продукції (біохімічні, санітарно-гігієнічні, біометричні та фізичні показники); наявність карантинних рослин і шкідливих домішок; продуктивність коренеплодів та економічна ефективність (собівартість і рентабельність).

Заключним етапом є визначення інтегрального показника методом експертних оцінок. Отже, для отримання якісної і безпечної овочевої продукції необхідно правильно використовувати біокліматичний потенціал сільськогосподарських територій, здійснювати контроль за технологіями їх вирощування та враховувати об'єкти, які можуть негативно впливати на сільськогосподарські угіддя (підприємства, ТЕС, автошляхи, захоронення, звалища тощо).