UDC 581.526.34:332.32

THE SYNANTROPIZATION ANALYSIS OF FLORA OF LONG-FALLOW LANDS IN THE FOREST-STEPPE OF THE KYIEV REGION

B. Ye. Yakubenko, *Doctor of Biological Sciences*
A.M. Churilov , A. P. Tertyshnii , A. K. Yarmolenko, *PhD of Biological Sciences*
National University of Life and Science of Ukraine

The synantropization analysis of the long-fallowlands of the Forest-Steppe of the Kyiev region wereconducted for the first time. The synanthropic part consists of 181 spesicies of the higher vascular plants, which applicable to 44 families and 137 genera (52 % of all species number). Origins, natural habitats, biological and ecological peculiarities of the synanthropic species of the region were analyzed.

Nowadays one of the most important problems are the invasion of alien species, which recently devoted numerous publications [1, 3, 5, 6, 9, 10, 15]. The intensity and extent of entry of alien species has recently increased so that it is recognized as one of the biggest environmental problems. Strategy of preventive measures for biological invasions and measures for minimize the consequences of their impact on natural systems was adopted in 1992 in Rio de Janeiro Convention on Biological Diversity [20]. For this purpose it is necessary to establish the prevalence, species composition, the main migration routes and the degree of naturalization of these species in natural plant communities.

Methods. Approaches by V. Protopopova to achieve the goal for investigate of synanthropic component of fallow-lands were used [12]. Geobotanical researches of natural and anthropogenically disturbed vegetation of meadows and fallow-lands, especially into dynamics were used by applying direct and indirect methods of developing by famous scientists: Ye. Lavrenko [6]; A. Tolmachev [14], I. Yurkevych, O. Kruchanovoyi [4], V. Aleksandrov [2], B Myrkin, L. Naumov, A. Solomesch [8] B. Yurtsev [16], herbarium materials of Department of Botany of NUBiP of Ukraine and Institute of Botany of M. Holodnoho were used. Identification of species composition were determined by Key to species of Flora of Ukraine [11] and agreed with the current nomenclature list of vascular plants of Ukraine [18]. The results of geobotanical studies obtained using conventional direct and indirect methods phytocoenotic: reconnoitring route, laying plots geobotanic profiling, vegetation dynamics.

Results and their discussion. Synanthropic different component groups into fallow-lands by different years of demutation process include 181 species from 44 families and 137 genera of higher vascular plants (52% from total number). It's representing 12,2% of synanthropic flora of Ukraine [12].

The *Magnoliophyta*, which include 99,4% of species, are basis of synanthropic floral structure (*Magnoliopsida* – 89% and *Liliopsida* – 11%), vascular spore are only 0,6%, which correlates with the corresponding figure for synanthropic component of Ukraine [12].

The main part of species of the flora include 14 families and 142 species (78,5%), while the remaining 30 families – only 39 species (21,5%) (Fig. 1). The predominant ten families include 128 species (70,7%), the first three family – 79 (43,6%). The dominance of a few families have feature for synanthropic and natural flora Ukraine and other regional flora [12].

Primary position in the spectrum belongs to the leading families *Asteraceae* (26,0%), in the corresponding spectrum steppes of Ukraine. This item belongs *Brassicaceae*, while *Asteraceae* occupies the second position [12, 17]. High position of this famili indicates a significant part of boreal elements in synanthropisation component, due to apophytes and adventive North American species (*Ambrosia artemisiifolia* L., *Bidens frondosa* L., *Conyza canadensis* (L.) Cronqist, *Cyclachaena xanthiifolia* (Nutt.) Fresen., *Galinsoga parviflora* Cav., *Helianthus tuberosus* L., *Phalacroloma annuum* (L.) Dumort., *Silphium perfoliatum* L., *Solidago canadensis* L.) and from Mediterranean and Mediterranean-Iran-Turanian origin (*Centaurea cyanus* L., *Centaurea diffusa* Lam., *Cichorium intybus* L., *Lactuca serriola* L., *Onopordum acanthium* L., *Sonchus arvensis* L., *Sonchus oleraceus* L.). The second position is Fabaceae (8,8%), which indicating a significant impact of Mediterranean elements in the formation of synanthropic flora of the Forest-steppe of Kiev region.

The third position belongs to the Brassicaceae (8,8%). In our opinion, the position of Brassicaceae into the spectrum of leading families reflects the level of synantropisation of flora of the region under study and according to V. Protopopova [12] is evidence of invasion into fallow-lands species of typical for Mediterranean and Iran-Turanian regions. Poaceae, in the range synanthropic species, as among the leading families of synanthropic flora into Forest-steppes of Ukraine, ranked fourth (6.6%). Fifth position belongs *Lamiaceae* (4,4%), sixth *Caryophyllaceae* (3,9%), seventh and eighth with the same number of species occupy by Rosaceae Scrophulariaceae (3,3%). An interesting fact is that the family Rosaceae didn't include into the spectrum of synanthropic Ukraine [12]. But high position within the study area is explained in less frequent spontaneous fallow alien elements – *Armeniaca vulgaris* Lam., *Cerasus vulgaris* Mill., *Malus domestica* Borkh. and apofitiv – *Agrimonia eupatoria* L., *Potentilla anserine* L., *Potentilla argentea*

Table 1. The predominant family of synanthropic flora into fallow-lands of Forest-steppe of Kyiv region

Rank		Family name	Number of species, un.	Percentage *, %
1.	1	*Asteraceae*	47	26,0
2.	2–3	*Fabaceae*	16	8,8
3.	2–3	*Brassicaceae*	16	8,8
4.	4	*Poaceae*	12	6,6
5.	5	*Lamiaceae*	8	4,4
6.	6	*Caryophyllaceae*	7	3,9
7.	7–8	*Rosaceae*	6	3,3
8.	7–8	*Scrophulariaceae*	6	3,3
9.	9–10	*Polygonaceae*	5	2,8
10.	9–10	*Apiaceae*	5	2,8
Total number:			128	70,7

* – from the total number of synanthropic component into fallow-lands

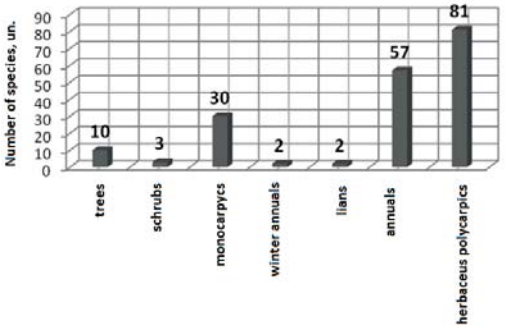

Fig. 1. Biomorphes of synanthropic species for the duration of the life cycle

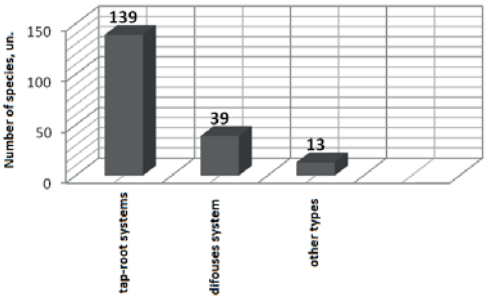

Fig. 2. Distribution of synanthropic species by type of underground systems

L., listed on the surrounding area. Ninth and tenth positions are *Polygonaceae* and *Apiaceae* (2,8%), respectively.

By dominant genera include the next: genera with 5 species – *Artemisia*; genera wich include 3 species – *Achillea*, *Senecio*, *Medicago*, *Vicia*, *Plantago*, *Veronica*.

Important characteristics that explain the spread of synanthropic species into fallow-lands are information about their origin and biological and ecological features.

Prevailing biomorphes for the duration of the life cycle (Fig. 1) of synanthropic species are herbal policarpycks (44,8%), the second position ranked with annuals (31,5%), high participation which is characteristic of synanthropic flora [12]. The third position include monocarpic species (16,6%), much less participate trees (5,5%), other biomorf cover only 3,9%.

For type of underground systems predominate species with tap-root system (76,8%) (Fig. 2), much less participate types of diffusion type of underground structure (21,5%). The remaining 13 species (7.2%) refer to these types of underground stolons – *Xanthoxalis fontana* (Bunge) Holub, rhizomatous type with *Acorus calamus* L., *Elytrigia repens* (L.) Nevski, E*pilobium collinum* C.C. Gmel., Six species have rhizomal-generative and tap-root systems – *Achillea nobilis* L., *Inula britannica* L., *Picris hieracioides* L., *Convolvulus arvensis* L., *Robinia pseudoacacia* L., *Melandrium album* (Mill.) Garcke.

In results of analysis, the prevalence are xero-mesophytes species (48.6%) ranked second are mesophytes (34.8%), much less mesoxerophytes (6.6%), the rest of the species, which belong to four hidromorphes falls 8,3% (Figure . 3).

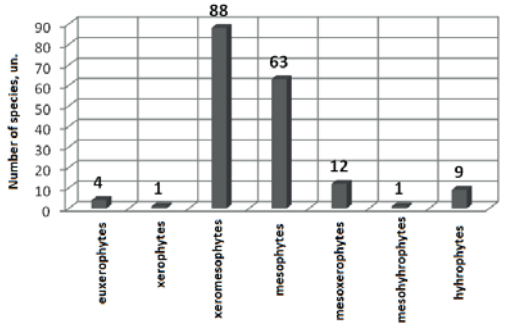

Fig. 3. Distribution of synanthropic species by hydromorphes

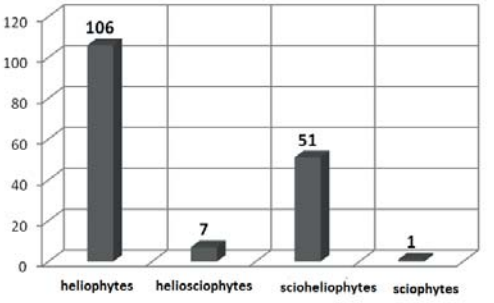

Fig. 4. Distribution of synanthropic species in relation to the degree of illumination

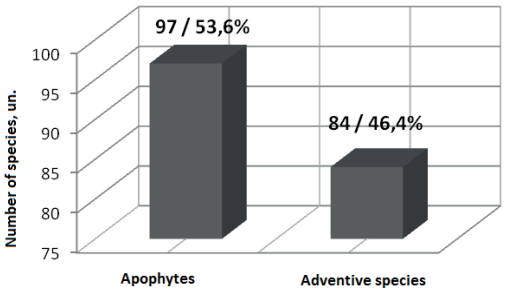

Fig. 5. Relationship between factions synanthropic component groups fallow-lands into forest-steppe of Kyiv region

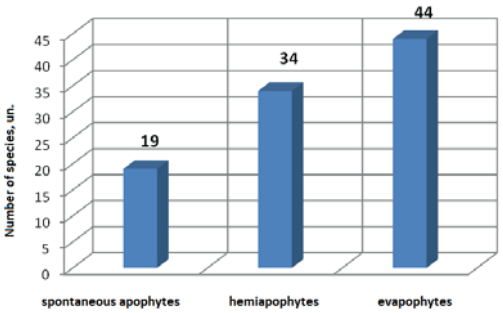

Fig. 6. Groups of apophytes in the distribution of anthropogenically transformed ecotypes

These data make it possible to conclude eurytopes amplitude adjustment main part of the terms of habitat types. The shift towards range of xerophytes reflects the characteristics of the location of the study area within the steppes of Ukraine.

Analysis of plants in relation to lighting conditions (Fig. 4) confirmed the dominant position heliophytes (58,6%), due to environmental conditions increase in open spaces fallow-lands. The second position occur by scio-heliophytes (28,2%), third – heliostsyophytes (3.9%), this eco-plastic types with a wide amplitude adaptations to stage lighting.

Apophytes fraction contains 53,6% alien – 46,4% (Fig. 5). The value of the ratio apofity / Advent is 1.15.

Prevalence processes of apophytisation under adventisation process indicates that the studied region situated far from the main adventysation centers.

Among apofitiv (Fig. 6) the distribution of fallow anthropogenically transformed ecotypes dominated evapophytes (24,3%), somewhat less hemiapophytes (18,8%) apophytes random (10,5%).

As part of alien species dominated the time of entry arheophytes (47 species or 56%) kenophytes are somewhat smaller part (44%) (Fig. 7). Value arheophytes / kenophytes is 1,27 / 1. Prevalence arheophytes indicates slower percolation process adventysation into studied region, compared with the flora of Ukraine [12].

The degree of naturalization (Fig. 8) of the alien faction dominated epekophytes of synanthropic species (30.9%), significantly inferior group erhaziophytes (4,4%) – *Helianthus annuus* L., *Helianthus tuberosus* L., *Vinca minor* L., *Trifolium hybridum* L ., *Armoracia rusticana* PG Gaertn., B. Mey. et Scherb., *Brassica campestris* L., ahriofitiv

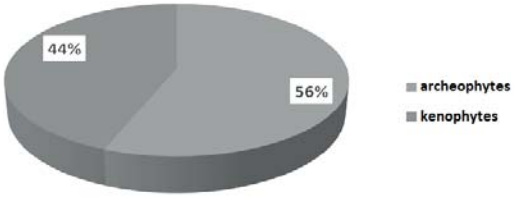

Fig. 7. Group of alien species for future entry

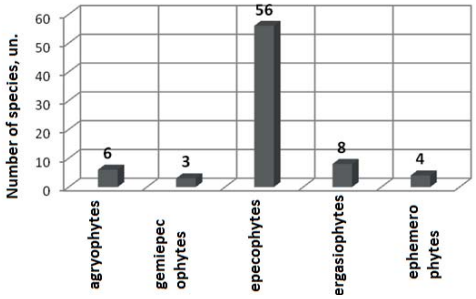

Fig. 8. Groups of alien species in the degree of naturalization

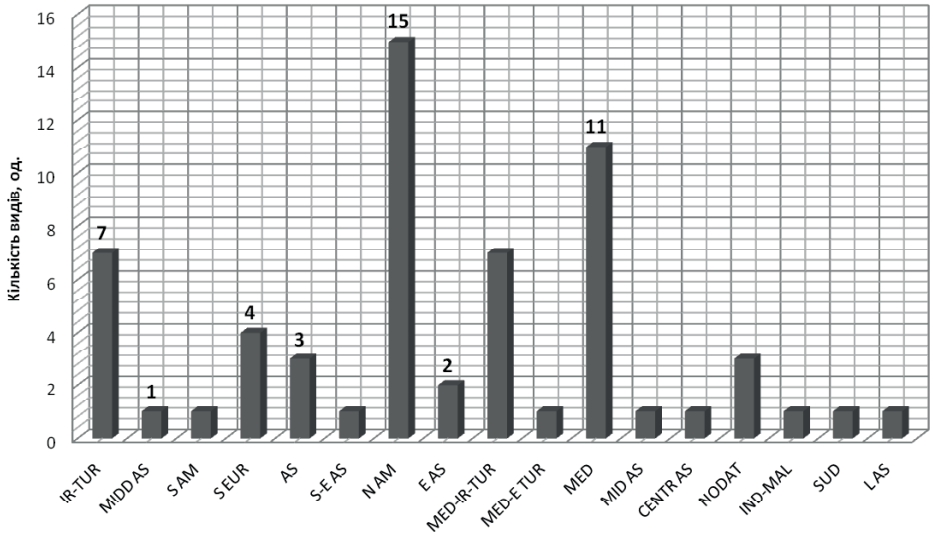

Fig. 9. Distribution of alien species of origin

Abbreviations: IR-TUR - Iran-Turan, MIDD AS - Near, S AM - South, S EUR - southern European, AS - Asian, SE AS - South-East Asia, N AM - North, E AS - East Asia, MED-IR- TUR - Mediterranean-Iran-Turan, MED - Mediterranean, MID AS - Asian, CENTR AS - Central Asia, NODAT - data available, IND-MAL - Indo-Malayan, SUD - Sudan, LAS - Asia Minor

group formed six types: *Phalacroloma annuum*, *Acorus calamus* L., *Impatiens parviflora* DC., *Acer negundo* L., *Salix fragilis* L., *Oenothera biennis* L., (3,3%), hemiepekophytes include three species: *Cichorium intybus* L., *Anisantha tectorum* (L.) Nevski, *Lathyrus tuberosus* L. (1,7%).

Predominant species of the Mediterranean (11%) and North America (10.5%) and Asian (7.9%) origin, lower part of the Iran-Turanian species (5.3%), southern European (5.3%), Mediterranean-irano- Turanian (4.4%), centers of origin of alien species. The rest is allocated to the amplitude of 1 to 4 types among the 12 centers (Fig. 9).

Conclusions. Established that synanthropic flora fallow forest-steppe part of Kyiv region contains 181 species that form 44 families and 137 genera.

To top ten families (128 species, 70.7%) belongs *Asteraceae* (47 species, 26,0%) *Fabaceae* and *Brassicaceae* (16 species, 8,8%), *Poaceae* (12 species, 6,6%), *Lamiaceae* (8 species, 4,4%), *Caryophyllaceae* (7 species or 3,9%), *Rosaceae* and *Scrophulariaceae* (6 species or 3,3%), *Polygonaceae*, *Apiaceae* (5 species or 2,8%).

First place in the spectrum belongs to the leading families *Asteraceae* (26,0%). High position aster indicates a significant part boreal element in the process synantropisation. Primery position among the families belonging *Artemisia* (5 species or 2,8%), and the families of three types (1,7%) — *Achillea*, *Senecio*, *Medicago*, *Vicia*, *Plantago*, *Veronica*. Between synanthropic species dominated herbal polykarpics (81 species, 44,8%), the type of underground systems — tap-root species (139 species, 76,8%), among hidromophes — xeromesophytes (88 species, 48,6%) by reference plant lighting conditions — heliophytes (106 species or 58,6%). Fraction of apophytes contains 53,6% (97 species), alien — 46,4% (84 species). Geographycal analysis of adventive species revealed the predominance of Mediterranean (20 species, 11%) and North American (19 species, 10,5%) origin of species.

Література

1. Акатов В.В., Акатова Т.В. Видовой пул, видовоебогатство, эффект компенсации плотностью и инвазиабельность растительных сообществ // Журн. биол. инв. – 2012. – № 3. – С. 2–19.
2. Александрова В.Д. Изучение смен растительного покрова // Полевая геоботаника. М. – Л.: Наука, 1964. – С. 300–447.
3. Арепьева Л. А. Экологический анализ ценофлор рудеральной растительности урбанизированных территорий Курской области // Вестник ВГУ. Сер. геогр. – 2008. – № 1. – С. 60–65.
4. Геоботаническое изучение лугов: Сб. бот. раб. / Под ред. И.Д. Юркевича и Е.А. Кручановой. – Минск: Изд-во АН БССР, 1962. – Вып. IV. – 146 с.
5. Бурда Р.І., Ігнатюк О.А. Методика дослідження адаптивної стратегії чужорідних видів рослин в урбанізованому середовищі: Монографія. – К.: НЦЕБМ НАН України, ЗАТ "Віпол", 2011. – 112 с.
6. Лавренко Е.М. Основные закономерности растительности сообществ и пути их изучения. Полевая геоботаника. – М.: Изд-во АН СССР, 1959. – Т.1. – С. 13–75.
7. Лукаш О. В. Адвентизація флори судинних рослин Східного Полісся // Укр. ботан. журн. – 2009. – **66**, № 4. – С. 507–517.
8. Миркин Б.М., Наумова. Л.Г., Соломещ А.И. Современная наука о растительности. – М.: Логос, 2001. – 264 с.
9. Мосякін С.Л. Флористичні нотатки про адвентивні рослини м. Києва // Укр. ботан. журн. – 1992. – **49**, № 6. – С. 36–39.
10. Мосякін С.Л., Яворська О.Г. Нові знахідки адвентивних рослин у флорі Київської міської агломерації // Укр. ботан. журн. – 2001. – **58**, № 4. – С. 493–498.
11. Определитель высших растений Украины / Под ред. Ю.Н. Прокудина. – К.: Наук. думка, 1987. – 548 с.
12. Протопопова В.В. Синантропная флора Украины и пути ее развития. – К.: Наук. думка, 1991. – 192 с.
13. Стародубцева Е. А. Чужеродные виды растений на особо охраняемых территориях (на примере Воронежского биосферного заповедника) // Журн. биол. инвазий. – 2011. – № 3. – С. 36–40.
14. Толмачев А.И. Богатство флоры как объект сравнительного изучения // Вест. Ленингр. ун-та. Сер. биол. – 1970. – № 9. – С. 71–83.
15. Характеристика фітоценотипів заплавних лук р. Дніпра / Шеляг-Сосонко Ю.Р., Афанасьев Д.Я., Соломаха В. А. та ін. // Укр. ботан. журн. – 1981. – **38**, №2. – С. 16–31.
16. Юрцев Б.А. Жизненные формы: один из узловых объектов ботаники // Проблемы морфологической экологии растений. – М.: Наука, 1976. – С. 9–41.
17. Якубенко Б.Є. Систематична структура флори природних фітоценозів Лісостепу України // Науковий вісник НАУ. – 2005. – Вип. 83. – С. 169–177.
18. Mosyakin S.L., Fedoronchuk M.M. Vaskular Plants of Ukraine a Nomenclatural Checklist. – Kiev: National Academy of Sciences of Ukraine M.G.Kholodny Institute of Botany, 1999. – I– XXIII, 1–346 p.
19. Raunkiaer C. Life formes of plants and statical plant geography. – New York- London, 1934. – 352 p.
20. Shine C., Williams N., Gundling L. A Guide to Designing Legal and InstitutionalFrameworks on Alien Invasive Species. – IUCN, Gland: Switzerland Cambridge and Bonn, 2000. – 138 p.

АННОТАЦИЯ

Якубенко Б.Є, Чурилов А.М., Тертишный А.П., Ярмоленко А.К. *Синантропизационный анализ флоры залежей Лесостепи Киевской области // Биоресурсы и природопользование. – 2014. – **6**, № 3–4. – С. 5–10.*

Проведено синантропизационный анализ флоры залежей Лесостепи Киевской области. Выяснено, что синантропная составляющая группировок залежей разных лет демутации насчитывает 181 вид из 44 семейств и 137 родов высших сосудистых растений (52% от общего количества видов). Проанализированы происхождение, ареалы, биологические и экологические особенности синантропных видов региона.

АНОТАЦІЯ

Якубенко Б.Є., Чурілов А.М., Тертишний А.П., Ярмоленко А.К. *Синантропізаційний аналіз флори перелогів Лісостепу Київської області// Біоресурси і природокористування. – 2014. – **6**, № 3–4. – С. 5–10.*

Проведено синантропізаційний аналіз флори перелогів Лісостепу Київської області. З'ясовано, що синантропна складова угруповань перелогів різних років демутації налічує 181 вид з 44 родин та 137 родів вищих судинних рослин (52% від загальної кількості видів). Проаналізовано походження, ареали, біологічні та екологічні особливості синантропних видів регіону.