

## Ecological and coenotic characteristic of *Cyclachaena xanthiifolia* (Nutt.) Fresen. In the flora of Ukraine

O.N. Kurdyukova

*Pushkin Leningrad State University*  
10, St. Petersburg sh., Pushkin, St. Petersburg, 196605, Russia  
E-mail: [herbology8@gmail.com](mailto:herbology8@gmail.com)

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The flora of Ukraine includes *Cyclachaena xanthiifolia* adventitious species, which is dangerous for humans and animals. It got out of human control and spread widely throughout the whole territory, but its environmental features have not been studied enough. We found that *Cyclachaena xanthiifolia* is the eurytopic species in Ukraine, that is, it has wide ecological amplitude. It grows well and develops in wide weather and climatic divides: from semi-ombrophytic climate (1000 mm, Pre-Carpathian, Transcarpathia) to arid one (less than 350 mm, Prysylvashshia) in terms of climate humidity; from hemioceanic climate (Western Ukraine and the Black Sea coast) to subcontinental one (Dry-steppe and South-steppe zones) in terms of climate continentality. Its habitats are confined to flat, lowered, but well-drained and low areas. We did not find it at the altitudes of more than 500 m. This is heliophyte, a short-day plant. According to temperature requirements, it occupies an intermediate position between submesothermal and macrothermal plants that grow well when the amount of heat in April-October is from 1780 to 2620 kcal/cm<sup>2</sup> and the sum of effective temperatures is from 2850 to 3750°C. When it comes to demand on soil moisture, it is predominantly mesophytic plant; with regard to soil solution reaction, it is neutrophilic or subacidophilic plant; with respect to soil fertility, it is eutrophic humifilous eunitrophilic plant on ruderal habitats, and oligotrophic agumyl or sub-agumyl heminitrophilic plant on technogenic ones. The highest frequency of occurrence, abundance and the best morphological plants' parameters were found on black earth, chestnut, and meadow soils, and the worst plants' parameters were found on sod-podzol, brown forest, sand, saline and bog soils. In relation to landscapes cultivation, this plant is euhemerobe or polyhemerobe. It grows in the *Ambrosio artemisiifolia-Chenopodietum albi*, *Ambrosio artemisiifolia-Cirsietum setosi*, *Amaranto retroflexi-Setarietum glaucae*, *Amaranthesetum blitoidi-Echinochloetum grusgalli*, *Poligono-Chenopodietea* communities and others in segetal biotopes. It grows in the *Ivaetum xanthiifoliae*, *Atriplicetum tataricae*, *Chenopodietum glauco-rubri*, *Chenopodio-Atriplicetum hastatae*, *Ambrosio artemisiifoliae-Xanthietum strumariae* communities and others in ruderal biotopes.

**Keywords:** Ukraine; *Cyclachaena xanthiifolia*; environmental features; coenotic characteristics; biomorphological indicators

### Introduction

The flora of Ukraine includes many adventitious plants. They appeared on the territory of the country as a result of international trade relations or the wildness of cultivated species.

These plants include *Cyclachaena xanthiifolia* (Nutt.) Fresen. North American species from the *Asteraceae*. It perfectly adapted to the new conditions of existence, got out of human control and by its uncontrolled spreading turned into a dangerous species for humans and animals. Until the 50-60s of the 20<sup>th</sup> century, it was relatively rare ruderal species, and in the last 50-60s, it has become a common ruderal and segetal species (Kurdyukova, Zherdeva, 2014; Kurdyukova, Konoplia, 2012, 2018; Kurdyukova, 2019).

According to our and other surveys as of 1/1/2019, *Cyclachaena xanthiifolia* was found in all regions of Ukraine with the exception of alpine regions (over 500 m above sea level).

*Cyclachaena xanthiifolia* grows in any and all biotopes: from heavily disturbed ruderal to undisturbed waterlogged and dry (Manzhos, 2001; Kurdyukova, Zherdeva, 2014; Kurdyukova, 2018) is characterized by rapid growth and high seed production (Hodi & Torma 2002; Kurdyukova, Konoplia, 2018).

Its wide spreading causes negative changes in natural plant communities and threatens with very dangerous environmental, economic and social consequences (Manzhos, 2001; Kurdyukova, 2019).

Critical part in the intensive species spreading and biomorphological features formation is played by ecological and coenotic conditions of growth and development, including climatic conditions (sums of effective temperatures (T<sub>m</sub>), climate

continentality (Kn); edaphic conditions (water regime (Hd), aeration (Ae), acidity (Rc), salt regime (Tr) of soils, the content of nitrogen (Nt) and humus (Gm); anthropogenic ecosystems (anthropotolerance (Atl), synantropization (Cnt); phytocenotic (strategy (Str) and its activity (Act), illumination (IIm), coenotic amplitude (Ptc), etc. However, there is very little data on *Cyclachaena xanthiifolia* ecological features, often contradictory and incomplete. For example, it is only known that *Cyclachaena xanthiifolia* primarily occupies loose soils rich in nutrients and moisture, especially well aerated soils provided with nitrogen (Veselovskii, Man'ko, Kozubskii, 1993; Manzhos, 2001).

At the same time, *Cyclachaena xanthiifolia* can grow on mechanically and chemically disturbed substrates (Shcherbina, 1949; Manzhos, 2001).

According to most researchers, *Cyclachaena xanthiifolia* is a xerophyte (Fisyunov, 1984; Veselovskii, Man'ko, Kozubskii, 1993; Kurdyukova, Konoplia, 2012). For seed germination and growth, minimum amount of moisture is enough (for example, 8,0–9,5%), at that, the amount of stable wilting was 7,8% (Polenov, 1958).

Minimum temperature for *Cyclachaena xanthiifolia* growth and development is considered to be 2–3 °C, optimum temperature is 12–20°C, and maximum temperature is 38 °C. According to other sources, optimal conditions for seed germination and further growth were formed at a temperature of 12 to 22 °C (Polenov, 1958; Fisyunov, 1984).

The purpose of our work is to give an ecological and coenotic assessment of *Cyclachaena xanthiifolia* in Ukraine.

## Materials and methods

The studies were carried out during 2014–2018 in Ukraine. Ecological assessment of *Cyclachaena xanthiifolia* was carried out according to the scales adopted in the «Ecoflora of Ukraine» (Diduch, 2000). Coenotic confinedness was carried out on the basis of the processing of geobotanical and herbal descriptions, performed by us in the Northern and Southern steppe zones as well as Dry steppe and Forest steppe zones of Ukraine. Classification by confinedness to cenosis type was carried out according to A.D. Belgard (Belgard, 1950).

## Results

In Ukraine, *Cyclachaena xanthiifolia* is a typical eurytopic species, that is, it has a wide ecological amplitude. It grows well and develops in wide weather and climatic divides: from semi-ombrophytic climate (1,000 mm, Pre-Carpathian, Transcarpathia) to arid one (less than 350 mm, Prysyvashshia) in terms of climate humidity; from hemioceanic climate (Western Ukraine and the Black Sea coast) to subcontinental one (Dry-steppe and South-steppe zones) in terms of climate continentality, as well as on a wide variety of substrates (from high-fertile well-provided with humus to very poor undeveloped soils without humus layer). Its habitats are confined to flat, lowered, but well-drained and low areas (up to 500 m above sea level). We did not find it at the altitudes of more than 500 m. This is a short-day plant, some kind of heliophyte, that is, it grows mainly in open places. *Cyclachaena xanthiifolia* often formed homotypical thickets there, and withstood shading of up to 40% of full light in crops, gardens, parks as well as along fences.

According to temperature requirements, *Cyclachaena xanthiifolia* occupies an intermediate position between submesothermal and macrothermal plants that grow well when the amount of heat for April–October is from 1780 to 2620 kcal/cm<sup>2</sup> and the sum of effective temperatures is from 2850 to 3750 °C.

The relationship between biomorphological parameters of *Cyclachaena xanthiifolia* plants and physicochemical properties of various soil types was fairly clear. According to generalized data, the highest frequency of occurrence, abundance and best morphological plants' parameters were found on black earth, chestnut, and meadow soils, and the worst plants' parameters were found on sod-podzol, brown forest, sand, saline and bog soils.

In general, it showed signs of eutrophic humifilous eunitrophilic species in the crops of cultivated plants and typical ruderal habitats, and oligotrophic agumyl or sub-agumyl heminitrophilic species on technogenic ones.

According to soil solution reaction, *Cyclachaena xanthiifolia* is neutrophil or subacidophilic plant, as it prefers neutral or slightly acidic soils with pH interval from 6,5 to 7,1.

When it comes to demand on soil moisture, *Cyclachaena xanthiifolia* is predominantly mesophytic plant. The optimal conditions for its growth and development took shape at a moisture content of soil meter layer at the level of 70–80% of HB. At the same time, it tolerated its temporary decrease to 40–60% of HB, which indicates a flexible mechanism of adaptation to dry conditions and explains a high frequency of occurrence and abundance in areas of unstable and insufficient moisture.

According to soil moisture variability over the course of a year, *Cyclachaena xanthiifolia* belongs to hemihydro-contrast-phyllous plants of the eurytopic type confined to ecotopes with moderately uneven wetting of the root layer with moderate or slight wetting by its sediments and melt water.

The high anthropotolerance of *Cyclachaena xanthiifolia* and the ability to survive in modern conditions are indicated by the anthropogenic ecosystems wherein it is common. Being a kenophyte (introduced to Ukraine in 1840), *Cyclachaena xanthiifolia* has long been naturalized and is now persistently distributed in all anthropogenic ecosystems (epicophyte), including urbanized ones, where it forms euhemerobic and polyhememerobic communities.

The maximum abundance, projective cover, biomass and seed productivity of *Cyclachaena xanthiifolia* were formed in the territories of manure storages, landfills, livestock farms, as well as along summer livestock camps and alluvial soils along river banks. These indicators were somewhat worse for plants growing in orchards, vegetable gardens, crops of melons and gourds, as well as vegetables and row crops; and minimal indicators were shown at construction and industrial sites, quarries, railway and automobile embankments, pastures, etc. (Table 1).

**Table 1.** Morphobiological indicators of *Cyclachaena xanthiifolia* in various environmental conditions of growth and development, 2014–2018

Zone	Soil type	Biotope	Abundance, pcs/m <sup>2</sup>	Plant height, cm	Projective coverage, %	Biomass, g/m <sup>2</sup>	The average seed productivity of one plant, pcs.	
Forest steppe	typical black earth soil	ruderal	41	217	100	5,1	6148±537	
		cultural	6,3	176	46	1,3	11148±1550	
		technogenic	33	69	88	1,6	1016±78	
	grey forest soil	ruderal	17	163	96	1,2	1744±105	
		cultural	0,3	161	27	0,4	3015±334	
		technogenic	5,8	52	19	0,6	841±91	
Northern steppe	bog soil	-	1,1	63	9,1	0,2	148±36	
		ordinary black earth soil	ruderal	56	208	100	6,3	5563±484
		cultural	5,1	186	51	1,8	14272±1793	
	meadow soil	technogenic	27	79	90	1,1	1324±222	
		-	16	191	73	3,8	7156±386	
		-	4,3	80	16	0,3	245±40	
Southern steppe	sandy soil	ruderal	49	201	100	5,3	8533±709	
		cultural	3,8	175	34	1,0	9778±151	
		technogenic	31	72	65	1,2	1169±205	
Dry steppe	chestnut soil	ruderal	44	169	100	3,4	1104±92	
		cultural	4,2	170	48	1,3	10317±1077	
		technogenic	26	67	62	0,9	876±91	
	salted chestnut soil	ruderal	11	84	91	1,1	560±63	
		cultural	0,9	76	11	0,3	974±78	
		technogenic	7,3	58	18	0,5	331±44	

In coenotic terms, *Cyclachaena xanthiifolia* also has wide amplitude. It grows in the *Ambrosio artemisiifolia-Chenopodietum albi*, *Ambrosio artemisiifolia-Cirsietum setosi*, *Adonido aestivalis-Consolidetum orientalis* communities in the segetal biotopes of cereal crops; it grows in the *Setario-Galinsogotum*, *Amaranto retroflexi-Setarietum glaucae*, *Amaranthesetum blitoidi-Echinochloetum grusgalli*, *Amaranthesetum blitoidi-retroflexi* communities in the biotopes of row crops; and it grows in the *Poligono-Chenopodietea*, *Convolvulo-Agropyretum repentis* communities in orchards, vineyards, and gourds, etc.

It grows everywhere in both zonal and azonal plant communities in ruderal biotopes: in the *Ivaetum xanthiifoliae*, *Daturo-Valvetum neglectae*, *Tanaceto-Artemisietum vulgaris* communities in landfills, trash cans, fallows, territories of livestock farms, roadside localities; in the *Artemisietum annuae*, *Atriplicetum tataricae*, *Chenopodietum glauco-rubri* communities along railway and road embankments and on dry pastures; in the *Atriplicetum nitentis*, *Chenopodio-Atriplicetum hastatae* communities in urban areas; and in the *Ambrosio artemisiifoliae-Xanthietum strumariae*, *Balloto-Chenopodietum* communities in floodplains of rivers, gullies, edges, along field roads and forest belts, as well as along the edges of fields, etc.

## Conclusions

*Cyclachaena xanthiifolia* plants are characterized by wide ecological amplitude. It grows in different conditions: from semi-ombrophytic climate to arid one, and from hemioceanic climate to subcontinental one. In terms of altitude distribution, it is predominantly flat species. When it comes to demand on heat, it is submesotherm or macrotherm plant.

When it comes to demand on soil moisture, it is predominantly mesophytic plant; with regard to soil solution reaction, it is neutrophilic or subacidophilic plant; with respect to soil fertility, it is eutrophic humifilous eunitrophilic plant on ruderal habitats, and oligotrophic agumyl or sub-agumyl heminitrophilic plant on technogenic ones.

*Cyclachaena xanthiifolia* is spreading in all anthropogenic ecosystems. In relation to landscapes cultivation, this plant is euhemerobe or polyhemerobe.

It grows in the *Ambrosio artemisiifolia-Chenopodietum albi*, *Ambrosio artemisiifolia-Cirsietum setosi*, *Amaranto retroflexi-Setarietum glaucae*, *Amaranthesetum blitoidi-Echinochloetum grusgalli*, *Poligono-Chenopodietea* communities and others in segetal biotopes.

It grows in the *Ivaetum xanthiifoliae*, *Atriplicetum tataricae*, *Chenopodietum glauco-rubri*, *Chenopodio-Atriplicetum hastatae*, *Ambrosio artemisiifoliae-Xanthietum strumariae* communities and others in ruderal biotopes.

## References

- Belgard, A. (1950). Forest vegetation of the southeast of the Ukrainian SSR. Kiev: KGU. (in Russian).
- Diduch, Ya. (2000). Ecoflora of Ukraine. T.1. Kiev: Fitosotsiotsentr. (in Ukrainian).
- Hodi L. & Torma M. (2002). Germination biology of *Iva xanthiifolia* Nutt. Z. Pfl. Krankh. Pfl. Schutz, Sonderh. 18: 219–224.
- Kurdyukova, O., Zherdeva, K. (2014). Distribution and control of *Cyclachaena xanthiifolia* (Nutt.) Fresen in anthropogenically disturbed ecotops. Agroecological journal, 3, 91–95. (in Ukrainian).
- Kurdyukova, O., Konoplia M. (2012). The weeds of Ukrainian steppes. Lugansk: Elton-2. (in Ukrainian).
- Kurdyukova, O., Konoplia N. (2018). Seed productivity and weed seeds: Monograph. St. Petersburg: Svoe izdatel'stvo. (in Russian).
- Kurdyukova, O. (2018). Seed production capability of monocotyledonous and dicotyledonous weeds in segetal and ruderal habitats. Ukrainian Journal of Ecology, 8(1), 153–157. DOI: 10.15421/2018\_200.
- Kurdyukova, O. (2019). *Cyclachaena xanthiifolia* (Nutt.) Fresen. spreading, abundance and occurrence in Ukraine. Ukrainian Journal of Ecology, 9(1), 63–67.
- Manzhos, S. (2001). Substantiation of control measures against *Cyclachaena xanthiifolia* and other weeds on the uncultivated land of farms of the Left-bank forest-steppe of Ukraine. Ph.D. dissertation. Poltava. (in Ukrainian).
- Polenov, L. (1958). On seed germination and the development of seedlings of some weeds at different temperatures and low humidity. Ukrainian Botanical Journal, 2, 44–56. (in Ukrainian).
- Tkach, E., Sherstoboeva, E. (2013). Ecological aspects of the invasion of *Iva xanthiifolia* Nutt. in agrophytocenoses. Agroecological journal, 3, 75–80. (in Russian).
- Fisyunov, A. (1984). Weed Control Guide. Moscow: Kolos. (in Russian).
- Veselovskii, I., Man'ko, Yu., Kozubskii O. (1993). Weed reference. Kiev: Urozhai. (in Ukrainian).
- Shcherbina, A. (1949). To the ecology of *Iva xanthiifolia* (Nutt.) from observations in the vicinity Voronezh. Botanical magazine, 1, 76–84. (in Russian).

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