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### **CENCHRUS LONGISPINUS (HACK.) FERNALD ON ANTHROPOGENICLY TRANSFORMED AREAS OF THE DNIESTER DISTRICT**

During the study of flora of ecotopes of the railway tracks of the Dniester embankment, 14 localities of the North American species *Cenchrus longispinus* were identified. On the sand the plants are better developed, have more lateral shoots. On crushed stone substrate, especially in the interrail space of the railway, plants are low – 7 (10) cm high. In addition, *Cenchrus longispinus* on the Dniester embankment was found in areas where no radical transformation of the ecotope (beach) is detected.

**Key words:** *Cenchrus longispinus*; railway tracks; Dniester embankment

*Cenchrus longispinus* (Hack.) Fernald (family Poaceae), also known as spiny burr grass, is one of the 29 adventive plant species in Ukraine that pose the greatest potential threat to the environment. These species are at the expansion stage and possess a number of common features: stress tolerance, high degree of naturalization, significant coenotic activity, wide ecological amplitude, as well as the ability to spread efficiently and quickly to new territories. The distribution of such species in new ecotopes requires special attention of scientists [13; 18; 24; 27].

The study of localization, features of naturalization, biological and ecological properties of adventive plants in Ukraine is reflected in a wide range of regional [2; 3; 6; 8; 11; 20; 23; 26] and national floristic works [4; 5; 14; 17; 18; 27].

Since the plants of the genus *Cenchrus* emerged in Ukraine, scientists have clarified the species names of specimens stored in various herbarium collections. Presently, it is determined that all *Cenchrus* exemplars that were previously found in Ukraine belong to *C. longispinus*, so studying of these and new specimens using of molecular- genetic methods is considered as relevant [1; 12; 22; 28]. Also, the molecular-genetic approach using ISSR markers is considered as appropriate for defining the genus of specimens, because, according to morphological features, individuals of the genus *Cenchrus* are visually similar to plants of a number of other genera of the family Poaceae [21].

Specimens of *Cenchrus longispinus* outside Ukraine have been observed in South America, USA, Africa, Asia (India, Israel, etc.), Europe (Spain, Italy, Greece,

France), as well as in Moldova, Russia (Belgorod, Rostov, Volgograd and other regions), etc. [15; 22; 28]. In Ukraine, *Cenchrus longispinus* has been known since the 1950s, from Kherson, Mykolaiv, Odesa, Donetsk regions, and so on. The species is also known from the ecotopes of the Dnieper sands (Kyiv region) [27]. As of 2013, the area of plant contamination of this species in Ukraine was 25074 ha [19].

In the Odesa region, according to the Border State Inspectorate for Quarantine Plants, their seeds, including cenchrus, were mostly found in grain bulks, especially in those which arrived from the United States [7; 10].

*Cenchrus longispinus* is a plant 20–60 cm high, with flat leaves (2.5–5 mm wide). Stems are also flat, creeping, can take root in nodes. The panicles are apical, up to 10 cm long, well-developed or partially located in the vagina of the upper leaf. Spikelets are 4–7 cm long, two-flowered. There are 2 lemmata, they are intensely pubescent, woodified, sticky. The number of chromosomes is  $2n = 34$  or  $36$  [15; 24]. Each plant can produce from 1,000 to 3,000 seeds per season. Seed viability lasts up to five years [19; 21]. Plants and inflorescences of *C. longispinus* are presented in the pictures (photos 1, 2).

At the time of introduction to the territory of Ukraine, the species is a kenophyte of North American origin; by the degree of naturalization in the transformed areas the species is characterized as agrio-epicophyte [10; 18]. It belongs to quarantine organisms that are partially distributed in Ukraine (A-2) [16].

The weed is very drought-resistant, so in arid conditions it may be dominant [19]. In relation to insolation, *C. longispinus* is a heliophyte with a cosmopolitan range. The species has overcome the E-barrier, and a major part of its populations is concentrated on anthropogenic ecotopes [10].



Fig. 1. *Cenchrus longispinus*. A part of an inflorescence. Photo by Bondarenko O., 29.08.2020, Karolina-Bugas

*Cenchrus longispinus* is an element of psammophyton [18; 24]. It is a characteristic species of “C1.1.1 Habitats of annual grasses xerophytic communities road verges and abandoned land”, which is a part of “C1 Ruderal biotopes”, namely “C1.1 Ruderal biotopes of annuals and biennial plants”. As a rule, this is a group of demutations at initial stages for ruderalized, anthropogenically transformed ecotopes that are represented, for the most part, by mechanically disturbed, somewhat nitrified soils [14].

Such biotopes in Ukraine are widespread throughout the territory, and in Europe they are parts of a number of biogeographical regions (Continental, Mediterranean, Pannonian, Steppe) [14].

*Cenchrus longispinus* is extremely harmful to crops, especially of sunflowers, vegetables and other cultivated plants. In some places, plant contamination can reach 300 individuals / m<sup>2</sup>. Prickly seeds significantly reduce the

quality of sheep's wool, and are the cause of some diseases of this category of farm animals [19; 22; 24; 27].

One of the methods of modern detection of quarantine species is an annual one-two-time survey of areas that can probably be centers of their vegetation. Such areas include coastal ecotopes, transport hubs, etc [15]. In the United States, it is proposed to use some herbicides in order to control *Cenchrus* vegetation [25]. However, it is still difficult to monitor the distribution of *Cenchrus longispinus* [27].

In the summer of 2021, we surveyed anthropogenically transformed areas of the Dniester embankment by the route method. The flora of the railway tracks between the Karolino-Bugas and Soniachna railway stations was studied. A number of *Cenchrus longispinus* localities were identified.

Previously, on August 29, 2020, two plants of the species were noted by Bondarenko O. Yu. on the beach and five more – near the country houses opposite the railway station Karolino-Bugas. Ph. D., Assoc. Vasileva T. V. and Ph. D., Assoc. Kovalenko S. G. also, in different years, noted the findings of plants of the genus *Cenchrus* on the Dniester embankment.

The Dniester embankment is a part of the Odesa Geobotanical District of cereal and wormwood-cereal steppe, saline meadows, salt marshes and vegetation of carbonate outcrops, Black Sea-Azov steppe subprovince, Pontic steppe province and Eurasian steppe region [9].

The recorded localities of *Cenchrus longispinus* (from 23.08.2021, 29.08.2021) have the following coordinates:

46 ° 07'49.4 "N, 30 ° 30'49.7" E – near the platform of the railway station Lymanska, in the place of the organized pedestrian crossing over the tracks, a level crossing is situated near. More than 30 exemplars were noted. They are low-grown, up to 15–20 cm high, but well-branching. The plants are normally developed; almost all shoots of the first and second orders have inflorescences with fruits.

46 ° 07'47.4 "N, 30 ° 30'47.8" E – opposite the platform of the railway station Lymanskaya, along the tracks. There were single specimens on crushed stone man-made substrate at a distance of 20 meters. The plants are low-grown, poorly developed. However, each individual has at least two side shoots; the main shoot is always with inflorescences with seeds.

46 ° 07'46.5 "N, 30 ° 30'47.1" E – a locality of 27 specimens. Most plants have several shoots, almost all of which possess fruit.

46 ° 07'16.1 "N, 30 ° 30'27.8" E 24 specimens, up to 30 cm high, were found. By sight, more than 80% of shoots developed fruits. Some plants are damaged. The



Fig. 2. *Cenchrus longispinus*. Vj g'j cdkwu  
"on the crushed stone" iwdnt cvg qhl cky c f  
"tracks near yj g'j cky c f" inq' O qt iwc' O  
"Photo by Dqpf ct gnu" OI wO'33Q: Q243

area on the side of the boulevard “The Golden Coast” – a place of unauthorized crossing over the railway tracks from the beach zone. The plants were found both on the crushed stone substrate of the tracks and on the adjacent sandy soil.

46 ° 07'12.4 “N, 30 ° 30'26.2” E – 12 specimens were noted, they are well developed, with a significant number of lateral shoots. The plants are not damaged, are more than 40 cm high; almost all lateral shoots of the first order are fruitful.

46 ° 07'07.2 “N, 30 ° 30'23.7” E – 11 specimens were found. The plants are normally developed, almost all shoots of second order are fruitful. The individuals were observed both on the crushed stone substrate of the tracks and between the concrete slabs of the parking lots near the guest houses.

46 ° 07'05.5 “N, 30 ° 30'23.5” E – several specimens were defined. The individuals are normally developed, with almost all branches of the stem being fruitful. The plants grow both on the crushed stone substrate of the tracks and between the concrete slabs of the parking lot near the guest houses. A place of unauthorized crossing over the railway tracks to the beach is situated nearby.

46 ° 07'03.3 “N, 30 ° 30'22.3” E – a locality near the steps from the platform of the railway station Morska. There are more than 30 plants, but they grow individually. The specimens were found on the southern side of the crushed stone substrate of the tracks. Some plants grew in the inter-rail space. They are in bad condition, up to 13 cm high. However, by sight, almost all the shoots of the second order are fruitful. Some plants were only 7 (10) cm high, but also developed seeds.

46 ° 06'47.1 “N, 30 ° 30'14.7” E – eight plants of *C. longispinus* grew on the northern side of the crushed stone substrate of the railway tracks, and five more were situated nearby. They are low-grown, but all their second-order shoots possess fruits.

46 ° 05'58.6 “N, 30 ° 29'30.2” E – a place of an authorized crossing from Lazurna Street, near the platform of railway station Druzhba. Five specimens were found on the south side, at the base of the crushed stone embankment and nearby, on sandy soil. They are low (up to 25 cm), but have side shoots, almost all of which have fruit.

46 ° 05'40 “N, 30 ° 29'11.5” E – one plant was found on sandy soil, at the base of the crushed stone embankment of the railway tracks, near the unauthorized crossing over the railway tracks; it is 10 cm high. All four of its side shoots are fruitful.

46 ° 05'39 “N, 30 ° 29'10.5” E – 12 plants, 25 (30) cm high, were found near the crossing over the railway tracks. The plants are damaged, trampled, low-grown, the shoots were laid on the crushed stone of railway. Shoots that stood straight and were undamaged were marked only in places inaccessible to pedestrians, under the rails of the crossing. On the northern side of the embankment, plants were observed both on the crushed stone substrate of the tracks and on the sandy soil, also near the crossing. About 30 plants were found there with up to 35 cm long laying stems. By sight, more than 50% of the shoots were damaged by pedestrians, however, almost all of them are fruitful. Damaged stems, as a rule, possess grown enough lateral shoots. Additional shoots, at the time of the study, were represented by spikelets with fruit. In an inflorescence there were about from three to seven (mostly five) two-flowered

spikelets. Between the stems of *C. longispinus*, on sandy soil, there were defined exemplars of *Tribulus terrestris* L. (*Zygophyllaceae*), in the immediate vicinity – several specimens of *Amaranthus retroflexus* L. (*Amaranthaceae*).

46° 05' 02.6 "N, 30° 28' 36.7" E – 26 plants vegetated near the authorized crossing over the railway tracks, from the southern part of the crushed stone embankment and on sandy soil near its base. The plants were up to 40 cm high, almost all shoots were fruitful. Some of them, however, were damaged by pedestrians.

46° 04' 54.7 "N, 30° 28' 37.6" E – 23 plants, more than 30 cm high. A part of the shoots was lying. Plants were observed sporadically on the sand on Lazurna Street (perpendicularly to the P70 highway) in the open area where Luna Park is located and under the lattice fence there. The area is almost equidistant from the railway tracks and from the coast, is often crossed by pedestrians and is spreaded using the sticky thorns on the spikelet scales on the cenchrus seeds.

### Conclusions

1. In August 2021, 14 localities of the quarantine species *Cenchrus longispinus* were recorded by the route method during the study of the flora of the railway tracks of the Dniester embankment. The plants are mostly localized in areas of unauthorized or organized pedestrian crossings over railway tracks. The substrate is crushed stone of railway tracks or adjacent sandy soil.

2. The plants growing on sandy soil, by sight, are better developed, have more lateral shoots, are higher (up to 40 cm); on crushed stone substrate, especially in the inter-rail space, the plants reach height of 7 (10) cm. However, specimens on both types of substrate, even those that undergo moderate and severe mechanical damage by pedestrians, possess a significant number of grown additional shoots. Almost all shoots of the first and second orders, at the time of the study, had inflorescences with seeds.

3. Plants of *Cenchrus longispinus* on the Dniester embankment are present not only in areas with strong anthropogenic impact, but also where human influence is moderate (locality 46° 04' 54.7 "N, 30° 28' 37.6" E) or apparently non-existent (opposite the railway station Karolino-Bugas, August 29, 2020). In fact, all surveyed areas are visited by pedestrians (vacationers).

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### ***CENCHRUS LONGISPINUS* (HACK.) FERNALD НА АНТРОПОГЕННО ПЕРЕТВОРЕНИХ ДІЛЯНКАХ ДНІСТРОВСЬКОГО ПЕРЕСИПУ**

#### **Резюме**

**Мета.** Адвентивний вид *Cenchrus longispinus* (Hack.) Fernald на території України знаходиться у стадії експансії. Суттєву потенційну небезпеку для довкілля становить завдяки стрес-толерантності, широкій екологічній амплітуді, високому ступеню натуралізації, значній ценотичній активності тощо. Вивченню умов появи та натуралізації нових адвентивних видів, особливо карантинних – нині приділяється значна увага.

*Cenchrus longispinus*, походить в Північній Америці та поширюється із зерновими вантажами. Вид розповсюдився на території багатьох країн – його виявлено у Південній Африці, Індії, Молдові, Росії, низці європейських держав. В Україні вид вперше зафіксовано у південних регіонах. Він є кенофітом, агріоепеофітом та відноситься до карантинних організмів, що обмежено поширені в Україні (А-2). В екологічному відношенні вид тяжіє до посушливих ґрунтових умов. Є геліофітом, в еколого-ценотичному відношенні – псамофітом. Більшість його популяцій зосереджена на антропогенних ектопах.

**Методи.** Влітку 2021 року, маршрутним методом обстежено антропогенно перетворені ділянки Дністровського пересипу. Вивчали флору залізничних колій між залізничними станціями Кароліна-Бугаз та Сонячна.

**Результати.** Виявлено 14 локалітетів *Cenchrus longispinus*. В публікації наведено їх координати. Рослини, здебільшого, локалізовані на ділянках самовільних або обладнаних пішохідних переходів через залізничні колії. Субстратом є щебінь колій або прилеглий піщанистий ґрунт.

**Висновки** На піску рослини, візуально, – краще розвинені, мають більшу кількість бічних пагонів, більш високі. На щебенистому субстраті залізничних колій, особливо у міжколіїному просторі, рослини низькі – 7(10) см. Екземпляри на обох типах субстрату, навіть при наявності помірного та сильного механічного пошкодження пішоходами – мають значну кількість відрослих додаткових пагонів. Практично всі пагони – з плодами.

*Cenchrus longispinus* на Дністровському пересипі представлений не лише на ділянках із сильним антропогенним навантаженням, але й там, де плив людини помірний, або практично відсутній. Проте, практично всі обстежені ділянки відвідують пішоходи або відпочиваючі.

**Ключові слова:** *Cenchrus longispinus*; залізничні колії; Дністровський пересип

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**CENCHRUS LONGISPINUS (HACK.) FERNALD  
ON ANTHROPOGENICLY TRANSFORMED AREAS  
OF THE DNIESTER DISTRICT**

**Abstract**

**Problem.** The adventive species *Cenchrus longispinus* (Hack.) Fernald in Ukraine is at the expansion stage. It poses significant potential threat to the environment due to stress tolerance, wide ecological amplitude, high degree of naturalization, significant coenotic activity and so on. Much attention is now being paid to the study of the conditions for the emergence and naturalization of new adventitious species, especially quarantine ones.

*Cenchrus longispinus* originates from North America and is distributed with grain bulks. The species has spread to many countries – it has been found in South Africa, India, Moldova, Russia, in a number of European countries. Навести яких.

In Ukraine, the species was first detected in the southern regions. It is a kenophyte, agrio-epicophyte and belongs to the quarantine organisms that are partially distributed in Ukraine (A-2). In the ecological sense, the species prefers arid soil conditions. It is a heliophyte, in ecological and coenotic terms – a psammophyte. Most of its populations are concentrated in anthropogenic ecotopes.

**Methods.** In the summer of 2021, anthropogenically transformed areas of the Dniester embankment were surveyed by a route method. The flora of the railway tracks between the railway stations Karolina-Bugas and Sonyachna was studied.

**Results.** 14 localities of *Cenchrus longispinus* were identified. Their coordinates are given in the publication. Plants are mostly localized in areas of unauthorized or organised pedestrian crossings over railway tracks. The substrate is crushed stone of railway tracks or adjacent sandy soil.

**Conclusions.** On sand plants, by sight, are better developed, have more lateral shoots, are higher. On the crushed stone substrate of railway tracks, especially in the interrail space, the plants are low – 7 (10) cm high. Specimens on both types of substrate, even those that undergo moderate and severe mechanical damage by pedestrians, possess a significant number of grown additional shoots. Almost all shoots have developed fruit.

*Cenchrus longispinus* on the Dniester embankment is represented not only in areas with strong anthropogenic impact, but also where human influence is moderate or apparently nonexistent. However, all surveyed areas are visited by pedestrians or vacationers.

**Key words:** *Cenchrus longispinus*; railway tracks; Dniester embankment



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