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The vegetation of the cretaceous outcrops of Novhorod-Siverskyi Polesie loess "islands" (Ukraine) and the new locality of *Gentiana cruciata* L.

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Abstract. The vegetation of the cretaceous outcrops of Novhorod-Siverskyi Polesie loess "islands" is represented by the grasslands communities of the *Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow1951, *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947, *Trifolio-Geranietea sanguinei* T. Müller 1962 classes and shrubby phytocoenoses of the *Robinietea* Jurko ex Hadač et Sofron 1980 class. The structure and composition of the plant communities are influenced by the degree of anthropogenic influence (both in the past and present) on the ecosystems of cretaceous outcrops. The determining anthropogenic factors contributing to the formation of the ruderal communities were chalk mining and gardening. The influence of erosive processes is manifested in the spatial delimitation of plant communities of various syntaxonomic belongings. The anthropogenic successional communities: semiruderal grasslands and herblands of the immoral and subboreal zones of Europe (*Convolvulo-Agropyretum repentis* Felföldy (1942) 1943, *Poo compressae-Tussilaginetum farfarae* R. Tx. 1931) and scrub communities of temperate Europe, represented by the *Elytrigio repentis-Robinietum* Smetana 2002 phytocoenoses typical for Steppe zones, prevail. Semixerothermic communities were found on the steep slopes of the cretaceous outcrops (eastern and southwestern expositions) – early successional stages with a significant amount of the characteristic species of the *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947 class. On the cretaceous outcrops of Novhorod-Siverskyi Polesie loess "islands" the communities of *Trifolion medii* T. Müller 1962 (meso-subxerophytic fringe phytocoenoses on nutrient-poor but base-rich soils at lower altitudes of temperate Western and Central Europe) is localized on the slopes of the eastern and southeastern parts of the expositions which do not undergo anthropogenic influence and are separated by erosion forms. Such conditions were favorable for preserving the *Gentiana cruciata* L. relict species in this locality. The population of this species was found in the area of 50 m^2 in the *Trifolio medii-Agrimonietum* Th. Müller 1962 association community and represented by two compact groups of individuals (the area of 0.5 m^2 each) and individual plants. In order to preserve the habitat of this rare species, it is worth creating here a reserve.

Keywords: Polesie, cretaceous outcrops, loess "islands", plant communities, syntaxonomy, successional stages, rare plant species, anthropogenic impact.

1. Introduction

Among other Polesie districts, Novhorod-Siverskyi Polesie is characterized by the considerable dismemberment and outcrop of indigenous sediments. This imposes an imprint on the vegetation cover of the territory. The ecological and phytoindicative study of the plant communities of cretaceous outcrops of the Desna River right bank was carried out in the outskirts of the Kamin, Pushkari, Rohivka villages of the Novhorod-Siverskyi district, Chernihiv region (Savon & Lysenko, 2001). Our research covered the area located to the south of the earlier studies: in the

outskirts of the Putyvsk, Yukhnove and Horky villages. The goal of our study was to determine the composition of plant communities of cretaceous outcrops of Novhorod-Siverskyi Polesie, to find out their syntaxonomic affiliation and floristic features. The working hypotheses of the research: the cretaceous outcrops of Novhorod-Siverskyi Polesie are the potential places of formation of the xerothermic and semixerothermic grass communities and the habitats of rare plant species, characterizing these communities. One of such species is *Gentiana cruciata* L. – the object of the population modelling the spatial interactions between plants and insects (Clarke et al., 1998).

2. Study area

The investigated area (Fig. 1A) covers the zone with the largest dismemberment and and outcrop of root sediments along the right bank of the meridial part of the Desna River with the outcrops of indigenous sediments from the right bank of the lower part of the Sudost river to the turn of the Desna River to the southwest. The Desna River valley and its right bank tributaries, gullies, ravines cut the whole thickness of anthropogenic and paleogene sediments and penetrate deeply into the thickness of cretaceous sediments. In the thickness of cretaceous sediments in the right bank of the slopes of the Desna valley dark gray marls, limestone glauconitic sands and white chalk are outcropped. The surface of cretaceous sediments carries the marks of intense erosive dismemberment. The variation of absolute marks is from 125 to 165 m (Marynich, 1968).

In some parts paleogene sediments are partially blurred and anthropogenic sediments lie directly on chalky rocks. The lower layer of the anthropogenic strata is moraine. Moraine often lays the slopes of the right tributaries of the Desna River and its large gullies. The valleys of the right bank tributaries of the Desna River divide the explored area into several loess "islands": Rohovskyi, Novhorod-Siverskyi, Blystovitskyi, Ponornytskyi. The last ones are the continuation of the loess "islands" of Chernihiv Polesie, which are characterized by a greater degree of synanthropy of the vegetation cover (Lukash et al., 2018).

In the hypsometric plane, the territory is an elevated plain, absolute markings of which exceed 200 m. The ex-

Figure 1. Location of the cretaceous outcrops of Novhorod-Siverskyi Polesie loess "islands" (the square marked as "A")

cess of the Desna is 100-105 m. The proximity of the deep local base of erosion and the fact that the loess cover is easily eroded is the main cause of the exclusive development of the ravine and gully network, the density of which exceeds 1 km / km^2. The meadow-steppe and synanthropic vegetation is well represented on the slopes of the ravines and gullies.

3. Material and methods

The materials for the article were collected during the field research of the loess "islands" of Novhorod-Siverskyi Polesie during 2006-2018. The field study of the vegetation was carried out by geobotanical methods (Korchahin, 2012). The vegetation descriptions were carried out during theoptimum of vegetation period in the areas of 30-50 m^2. The exposition and steepness of the slopes, the general projective coverage of the vegetation community and the coverage of each species were noted Cover abundance scale is the following: + – up to 1%, 1 – 1-5%, 2 – 6-15, 3 – 16-25%, 4 – 26-50%, 5>50%. 25 phytosociological relevés were taken. Syntaxa were identified according to Mucina et al. (2016), Matuszkiewicz (2001) (for natural vegetation), Solomakha et al. (1992) (for synanthropic vegetation), Brzeg (2005) (for *Trifolio-Geranietea sanguinei* communities). Syntaxa names are ordered according to Mucina et al. (2016). The successional stages of vegetation are named by the dominant species.

4. Results and discussion

A generalized scheme of the vegetation of the cretaceous outcrops of Novhorod-Siverskyi Polesie loess "islands" is the following:

Class: *Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow1951

Order: *Agropyretalia intermedio-repentis* T. Müller et Görs 1969

The group of semiruderal alliances

Alliance:*Convolvulo arvensis-Agropyrion repentis* Göors 1967

Association: *Convolvulo-Agropyretum repentis* Felföldy (1942) 1943

Association: *Falcario vulgaris-Agropyretum repentis* Müller et Görs 1969

Association: *Poo compressae-Tussilaginetum farfarae* R. Tx. 1931

Class: *Festuco-Brometea* Br.-Bl. et Tx. ex Soó 1947

The group of orders of sub-xeric steppic grasslands

Order: *Brachypodietalia pinnati* Korneck 1974

Iinitial community: *Chamaecytisus ruthenicus-Aster amellus* [*Cirsio-Brachypodion pinnati* Hadač et Klika in Klika et Hadač 1944 + *Molinio-Arrhenatheretea* Tx. 1937+*Trifolio-Geranietea sanguinei* T. Müller 1962]

Iinitial community *Elytrigia intermedia-Salvia pratensis* [*Cirsio-Brachypodion pinnati* Hadač et Klika in Klika et Hadač 1944 + *Molinio-Arrhenatheretea* Tx. 1937 + *Trifolio-Geranietea sanguinei* T. Müller 1962]

Initial community *Origanum vulgare purum* [*Cirsio-Brachypodion pinnati* Hadač et Klika in Klika et Hadač 1944 + *Molinio-Arrhenatheretea* Tx. 1937 + *Trifolio-Geranietea sanguinei* T. Müller 1962]

Class: *Trifolio-Geranietea sanguinei* T. Müller 1962

Order: *Origanetalia* T. Müller 1962

Alliance: *Trifolion medii* T. Müller 1962

Association: *Trifolio medii-Agrimonietum* Th. Müller 1962

Class: *Robinietea* Jurko ex Hadač et Sofron 1980

Order: *Chelidonio-Robinietalia* Hadač et Sofron 1980

Alliance: *Balloto nigrae-Robinion pseudoacaciae* Hadač et Sofron 1980

Association: *Elytrigio repentis-Robinietum* Smetana 2002.

Relevés 1-14 (Table 1) belong to the *Convolvulo arvensis-Agropyrion repentis* association from the *Agropyretalia intermedio-repentis* order of the *Artemisietea vulgaris* class. The cenoses of the *Convolvulo-Agropyretum repentis* association occupy the largest areas on the cretaceous sediments (Fig. 2B).

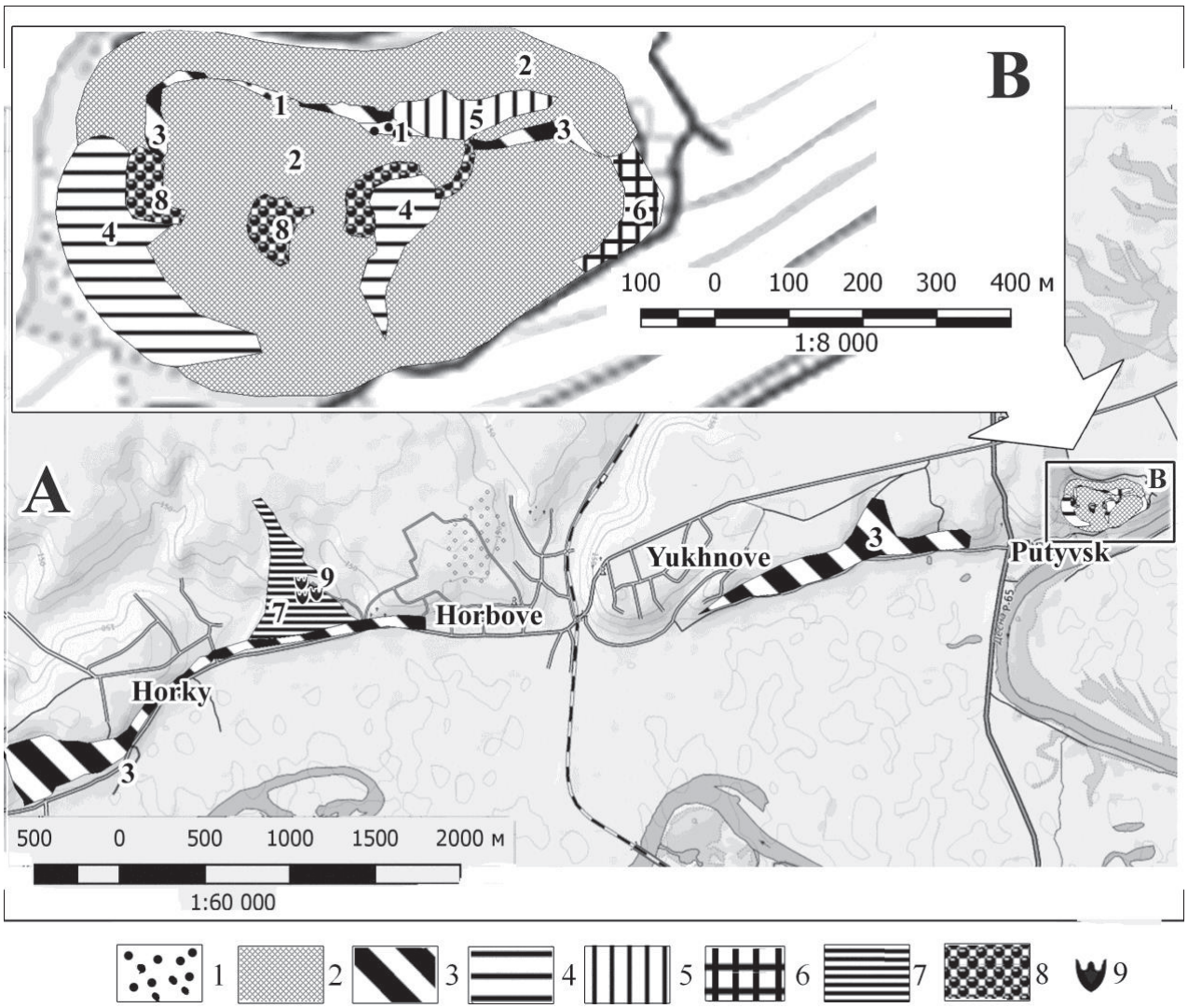

Figure 2. Mapping of the vegetation of the cretaceous outcrops of Novhorod-Siverskyi Polesie loess "islands". Syntaxon (1-8): 1 – *Falcario vulgaris – Agropyretum repentis*, 2 – *Convolvulo arvensis – Agropyretum repentis*, 3 – *Poo compressae-Tussilaginetum farfarae*, 4 – *Chamaecytisus ruthenicus – Aster amellus,* 5 – *Elytrigia intermedia–Salvia pratensis*, 6 – *Origanum vulgare purum,* 7 – *Trifolio medii-Agrimonietum*, 8 – *Elytrigio repentis-Robinietum*; 9 – the habitat of *Gentiana cruciata* L.

Table 1. Floristic structure of plant communities of the cretaceous outcrops of Novhorod-Siverskyi Polesie loess "islands"

Relevé number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Area [m^2]	40	45	40	40	36	42	48	45	40	35	40	30	25	30	30	36	42	36	25	50	42	50	40	45	35
Shrub layer cover [%]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	5	0	0	0	20	10	40	35	45	50
Herb layer cover [%]	90	95	95	90	95	100	50	70	65	85	70	80	75	85	45	50	25	25	20	90	90	25	20	35	20
Mosses cover [%]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
Exposition of the slope	N	N	SE	SE	NE	E	W	S	W	S	NE	S	SE	E	E	SW	SW	E	SW	E	SE	SE	S	NE	W
Slope steepness [^{0}]	35	20	2	1	2	30	10	30	5	10	0	0	0	0	35	30	40	35	40	10	5	20	15	10	5
Syntaxon	**1**		**2**									**3**			**4**		**5**	**6**		**7**		**8**			
Ch., *D. Ass. Falcario vulgaris-Agropyretum repentis																									
Falcaria vulgaris	4	1	+	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
**Bunias orientalis*	+	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Ch. Ass. Convolvulo-Agropyretum repentis																									
Convolvulus arvensis	+	.	1	2	1	1	2	1	4	2	2	+	+	.	.	.	.	.	.	.	.	.	+	.	.
Elytrigia repens	.	+	5	3	5	4	3	4	3	5	4	.	.	+	.	.	.	+	.	.	.	3	3	4	3
Ch., *D. Ass. Poo compressae –Tussilaginetum farfarae																									
Tussilago farfara	.	.	.	.	.	.	.	.	.	.	.	5	5	5	.	.	.	.	.	.	.	.	.	.	.
**Agrostis stolonifera*	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.	.	.	.
**Poa compressa*	.	.	.	.	.	.	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	.	.	.	.
**Ranunculus repens*	.	.	.	.	.	.	.	.	.	.	.	+	1	1	.	.	.	.	.	.	.	.	.	.	.
Ch. All. Convolvulo arvensis-Agropyrion repentis Ch. O. Agropyretalia intermedio-repentis, Ch. Cl. Artemisietea vulgaris																									
Bromopsis inermis	.	+	+	+	.	.	3	4	+	+	+	.	+	+	+	+	+	+	+	.	.	.	.	.	.
Calamagrostis epigeios	+	+	1	3	2	.	+	1	3	4	2	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Cerastium arvense	+	.	+	.	+	+	.	.	+	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Poa angustifolia	+	+	.	.	.	+	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	.	+	+	.
Ch., *D. All. Cirsio-Brachypodion pinnati																									
Aster amellus	.	.	.	.	.	+	.	.	.	.	.	.	.	.	3	2	.	.	.	.	.	.	.	.	.
Campanula bononiensis	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.
**Elytrigia intermedia*	.	+	+	+	+	.	.	.	.	+	.	.	.	.	+	.	2	+	1	.	.	.	.	.	.
Iris aphilla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Carex praecox	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	+	+	.	.	.	.	.	.
Linum flavum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
Thalictrum simplex	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	+	+	+	.	.	.	.	.	.
Ch. O. Brachypodietalia pinnati																									
Anthemis tinctoria subsp. *subtinctoria*	.	+	.	.	.	.	.	.	.	+	.	.	.	.	+	+	+	+	+	+	+	.	.	.	.
Asparagus officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	.
Campanula sibirica	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+	+	+	+	.	+	.	+	.	.	.
Echium russicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Salvia verticillata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	.	.	.	.	.	.
Scabiosa ochroleuca	+	.	+	.	.	.	.	.	.	.	+	.	.	.	+	+	.	+	+	+	.	.	.	.	.
Thymus marschallianus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.
Thymus tschernjajevii	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.
Viola rupestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.
Ch. Cl. Festuco-Brometea	.	.	.	.	.	.	.	.	.	.	.	.	.	.						.	.	.	.	.	.
Anthyllis macrocephala	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	+	.	.	.	.
Brachypodium pinnatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	.
Campanula glomerata	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	.	+	.	.	.	.	.	.
Carex humilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.
Euphorbia cyparissias	+	.	+	+	+	.	.	.	+	+	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.
Filipendula vulgaris	.	+	.	+	.	.	.	.	.	+	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.
Gentiana cruciata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Plantago media	.	.	.	.	+	.	.	.	+	.	+	.	.	.	+	+	+	.	.	.	+	.	.	.	.
Poa bulbosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.
Stachys recta	+	.	+	.	.	.	.	+	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	.
Veronica spicata	.	+	.	.	.	.	.	.	+	.	.	.	.	.	+	.	+	+	+	.	.	.	.	.	.
Ch. Cl. Molinio-Arrhenatheretea																									
Arrhenatherum elatius	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Campanula patula	.	.	.	+	+	.	.	.	.	+	.	.	.	.	+	.	+	+	.	.	.	.	.	.	.
Leucanthemum vulgare	.	+	.	.	.	.	.	.	.	+	.	.	.	.	+	.	+	.	.	.	+	.	.	.	.
Phleum pratense	.	.	+	1	+	.	.	.	.	.	.	+	.	+	.	+	+	+	.	.	+	.	.	.	.
Plantago lanceolata	.	.	.	1	+	.	.	.	+	.	+	.	+	+	.	+	.	.	+	.	.	.	.	.	.
Ranunculus acris	.	.	+	.	.	.	.	.	+	.	.	.	+	.	.	+	+	+	.	+	.	.	.	.	.
Rumex acetosa	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Tragopogon orientalis	.	.	+	+	+	.	.	+	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.
Trifolium prantense	.	.	.	+	+	.	.	.	+	+	+	.	+	+	+	.	+	.	.	.	+	.	.	.	.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Ch., *D. Ass. Trifolio medii-Agrimonietum																									
Agrimonia eupatoria	.	+	.	.	.	.	.	.	.	+	+	.	.	.	+	+	+	1	+	3	2	+	+	.	+
**Centaurea jacea*	.	.	+	+	+	.	.	.	+		.	.	.	.	.	+	+	.	.	+	1	.	.	.	.
**Daucus carota*	+	+	+	+	+	.	+	.	+	+	+	.	.	.	.	.	1	.	.	+	+.	.	.	.	.
**Festuca pratensis*	.	+	1	.	.	2	.	.	.	.	+	.	.	+	+	.	.	.	.	+	+	.	.	.	
Trifolium medium	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
Ch., *D. All. Trifolion medii																									
**Achillea submillefolium*	.	.	+	.	.	+	.	+	+	.	.	.	+	.	+	.	+	+	.	+	+	.	.	+	.
**Campanula rotundifolia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	.	.	.	.
Dactylis glomerata	.	.	.	+	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	.	.	.	.
Galium mollugo	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	1	+	.	.	.	.
Knautia arvensis	.	+	.	+	.	.	.	+	.	+		.	.	.	+	.	.	+	.	+	1	.	.	.	.
**Lathyrus pratensis*	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	+	.	+	+	.	.	.	.
Vicia cracca	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	+	+	.	.	.	.
Vicia sepium	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	+	+	+	.	.	.	.
Veronica chamaedrys	.	.	+	.	.	.	.	.	+	+	+	+	+	.	.	+	.	.	+	+	+	.	+	.	.
Ch., *D. O. Origanetalia																									
Ch., *D. Cl. Trifolio-Geranietea sanguinei																									
Astragalus cicer	+	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.		1	.	.	.	.
																				1					
Clinopodium vulgare	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	+	+	+	+	+	.	.	.	.
Securigera varia	.	+	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.
**Frangula alnus* (b)	.	.	.	.	.	.	.	.		.	.	.	+	+	+	.	.	.	.	.	+	.	.	.	.
Fragaria viridis	+	.	3	+	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Galium verum	+	.	+	2	2	.	.	+	.	.	+	.	.	.	+	+	+	.	.	3	1	.	.	.	.
**Medicago falcata*	2	.	3	+	4	.	.	+	.	.	.	+	+	+	+	.	.	.	.	+	+	.	.	.	.
Origanum vulgare	+	.	1	.	.	.	.	+	.	.	.	.	.	.	+	+	+	2	2	1	1	.	.	.	.
**Pimpinella saxifraga*	.	.	.	+	+	.	.	.	.	.	.	.	+	.	.	+	.	.	.	+	.	.	.	.	.
**Solidago virgaurea*	.	.	.	+	+	.	.	.	+	+	.	.	.	+	+	.	.	+	.	.	+	.	.	.	.
Verbascum lychnitis	+	.	+	.	.	.	.	.	+	+	+	.	.	.	+	.	.	+	.	+	+	.	.	.	.
D. Ass. Elytrigio repentis-Robinietum																									
Artemisia vulgaris	.	+	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	+	.	+	+	+	+	+
Carex hirta	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	+	.
Galeopsis bifida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Humulus lupulus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+
D. All. Balloto nigrae-Robinion pseudoacaciae																									
Chenopodium album	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	2	1
Lactuca serriola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+
Robinia pseudoacacia (b)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	3	3	4
Robinia pseudoacacia (c)	.	.	.	+	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	+	+
Taraxacum officinale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+
D. O. Chelidonio-Robinietalia																									
D. Cl. Robinietea																									
Acer negundo (b)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	1	1
Acer negundo (c)	.	.	+	.	.	+	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+
Acer tataricum (b)	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1
Anthriscus sylvestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+
Artemisia absinthium	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	+	.	.
Ballota nigra	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+
Caragana arborescens (b)	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	+	.	.	+	.	1	+	+	1
Centaurea diffusa	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Chelidonium majus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+
Fallopia dumetorum	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.
Geum urbanum	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+
Geranium robertianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+
Lapsana communis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+
Sisymbrium loeselii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
Swida sanquinea (b)	.		.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	1	+	.	+
Other species																									
Agrimonia pilosa	+	+	.	1	+	+	.	.	+	.	.	+	+	+	+	.	.	+	.	.	.	.	+	.	.
Allium paczoskianum	+	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
Artemisia marschalliana	.	+	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Artemisia scoparia	+	+	2	.	.	.	.	.	+	.	.	+	.	.	+	.	.	+	+	.	.	.	.	.	.
Berteroa incana	+	.	+	.	.	+	.	+	.	+	.	.	+	+	.	.	.	+	+	.	.	.	.	.	.
Chamaecytisus ruthenicus (c)	.	.	+	+	.	5	.	.	.	.	.	.	.	.	2	3	+	.	.	3	2	.	.	.	.
Centaurea phrygia	.	+	.	.	.	.	.	.	+	.	.	.	+	.	.	+	.	.	+	1	+	.	.	.	.
Cichorium intybus	+		+	.	.	.	.	.	+	+	.	+	.	+	.	+	.	+	.	.	.	.	.	.	.
Dianthus fischeri	+	.	1	1	2	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Echium vulgare	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	+	.	.	.	.	.
Equisetum pratense	.	.	.	4	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.
Eryngium planum	+	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Euphorbia stricta	.	.	.	.	.	+	.	+	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.
Euphrasia stricta	+	.	.	+	+	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Helichrysum arenarium	+	.	+	.	.	.	.	.	+	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.
Hieracium umbellatum	.	+	.	1	+	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.
Hypericum perforatum	.	+	.	+	+	.	.	.	+	.	+	.	+	+	.	+	.	.	.	.	.	.	.	.	.
Lavatera thuringiaca	+	.	+	+	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Leontodon hispidus	.	+	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	+	1	.	.	.	.	.
Libanotis intermedia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
Melilotus albus	.	.	.	.	.	.	+	.	+	.	+	.	.	+	+	.	+	.	.	1	.	.	.	.	.
Melilotus officinalis	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Nonea rossica	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Odontites vulgaris	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pastinaca sylvestris	.	.	.	+	1	.	.	.	+	.	+	+	.	+	.	+	1	.	+	.	.	.	.	.	.
Phlomis tuberosa	+	.	2	+	4	.	.	2	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
Polytrichum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Potentilla impolita	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	+	.	.	.	.	.	.
Psammophiliella muralis	.	+	.	.	.	.	+	.	+	.	+	.	.	.	.	+	1	.	+	.	.	.	.	.	.
Pyrus communis (b)	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	+	.	+	.	.	.	.
Rubus caesius	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.
Salvia pratensis	1	.	+	.	.	.	.	+	+	.	.	.	.	.	+	.	2	.	.	.	+	.	.	.	.
Sedum ruprechtii	.	+	.	.	+	.	.	.	+	+	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.
Senecio jacobaea	+	.	+	1	+	+	.	+	.	.	.	.	.	+	+	.	+	.	.	1	+	.	.	.	.
Thalictrum aquilegifolium	.	+	.	.	.	+	.	.	+	.	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.
Trifolium campestre	.	+	.	+	+	.	.	.	.	.	+	.	.	+	.	+	.	+	.	.	+	.	.	.	.

Note:

Syntaxon: 1 – *Falcario vulgaris-Agropyretum repentis*, 2 – *Convolvulo arvensis-Agropyretum repentis*, 3 – Poo *compressae-Tussilaginetum farfarae*, 4- *Chamaecytisus ruthenicus–Aster amellus,* 5- *Elytrigia intermedia–Salvia pratensis*, 6 – *Origanum vulgare purum,* 7 – *Trifolio medii-Agrimonietum*, 8 – *Elytrigio repentis-Robinietum*.

– dominant species of the initial community.

Locality of relevés: 1-11, 15-19, 22-25 – the Chernihiv region, Novhorod-Siverskyi district, Putyvsk village; 12 – the Chernihiv region, Novhorod-Siverskyi district, between the Yukhnove and Putyvsk villages; 13 – the Chernihiv region, Novhorod-Siverskyi district, between the Horky and Horbove villages; 14 – the Chernihiv region, Novhorod-Siverskyi district, Putyvsk village; 20-21 – the Chernihiv region, Novhorod-Siverskyi district, between the Horky and Horbove villages.

Date: 1-9 – 16.08.2006, 10-17.09.2012, 11-24.07.2016, 12, 16, 17-25.07.2017, 13-15 – 16.06.2018, 22, 23 – 24.07.2016, 24 – 25.07.2017, 25 – 16.06.2018

Authors of relevés: 1-11, 18-23 – O. Lukash, 12, 16, 17, 24 – O. Yakovenko, O. Lukash, 13-15, 25 – O. Lukash, I. Miroshnyk, S. Strilets.

The *Convolvulo-Agropyretum repentis* phytocoenoses were formed in the areas covered with a 0.5-1.0-meter layer of loess sediments. These areas were used by the locals 20-25 years ago as kitchen gardens, and now they are experienced such types of anthropogenic influence as cattle grazing and recreational load. The communities are formed by such species as *Elytrigia repens* (L.) Nevski and *Convolvulus arvensis* L., sometimes *Calamagrostis epigeios* (L.) Roth. co-predominates, *Cerastium arvense* L., *Elytrigia intermedia*, *Poa angustifolia* L., *P. compressa* L. *Bromopsis inermis* (Leyss.) Holub are singly found. The species of the *Molinio-Arrhenatheretea* and *Festuco--Brometea* classes take part in this association communities formation.

Consequently, the *Convolvulo-Agropyretum repentis* ruderal communities described by us, which are characterized by a high participation of biennial or perennial plants, are mostly a succession stage, which is replaced by the community of *Sisymbrion officinalis* (Class *Papaveretea rhoeadis*).

The communities, belonging to the *Falcario vulgaris--Agropyretum repentis* association, occur on the northern slopes near the Putyvsk village (Fig. 2B). These phytocoenoses occupy small "islets" between erosive dams. They are diagnosed by the dominant species of *Falcaria vulgaris* Bernh. and *Bunias orientalis* L.

The foot of cretaceous outcrops is occupied by the phytocoenoses belonging to the *Poo compressae-Tussilaginetum* association (Fig. 2A, B; Table 1, relevés 12-14). As a rule they were formed in the places of industrial and spontaneous mining of chalk. It should be noted that industrial mining of chalk was carried out near the Putyvsk village in the 70's-90's years of the twentieth century. Unauthorized local chalk mining is continued to the present time. *Tussilago farfara* L. (the characteristic species of the association) dominates in all of the described areas. These communities are also differentiated by *Agrostis stolonifera* L., *Poa compressa* L. and *Ranunculus repens* L. Depending on the time of phytocoenoses formation the areas of the *Poo compressae-Tussilaginetum* association vary by the number of species. In the areas, where industrial mining of chalk stopped 30 years ago (Table 1, relevé 14), 34 species were recorded, among which rhizome perennials predominate, as well as tree and shrub species (on the level of the grassy tier).

In the absence of anthropogenic pressure, grass communities with traits of steppe phytocoenoses were formed on the steep slopes of the cretaceous outcrops of the eastern and southwest expositions (Fig. 2B; Table 1, relevés 15-19). This is evidenced by the presence of the characteristic species of the *Festuco-Brometea* class in the described areas, *Anthyllis macrocephala* Wender, *Brachypodium pinnatum* (Huds.) P.Beauv., *Campanula glomerata* L., *Carex humilis* Leyss., *Euphorbia cyparissias* L., *Filipendula vulgaris* Moench, *Plantago media* L., *Poa bulbosa* L., *Poa compressa* L., *Stachys recta* L., *Veronica spicata* L. in particular. There are the characteristic species of the *Brachypodietalia pinnati* order and the *Cirsio-Brachypodion pinnati* alliance in all the five relevés. However, the structure and (or) composition of the described communities does not allow to clearly refer them to one or another association of the alliance mentioned above. Note that there is a number of species according to which the *Molinio-Arrhenatheretea* and *Trifolio-Geranietea sanguinei* classes are diagnosed in relevés 15-19. Probably the phytocoenoses described by us are the communities at early stages of successions with domination of *Chamaecytisus ruthenicus* (Fisch. Ex Woł.) Klásková and *Aster amellus* L. (relevés 15-16), *Elytrigia intermedia* (Host) Nevski and *Salvia pratensis* L. (relevé 17), as well as *Origanum vulgare* L. (relevés 18-19). A projective coverage of the dominants is 15-25% with a total projective cover of 20-50%. As part of these communities, there is a number of rare for Polesie species that are situated in this region on the northern border of distribution. For example: *Aster amellus* L., *Carex praecox* Schreb, *Echium russicum* J.F. Gmel, *Iris aphilla* L. and *Linum flavum* L., *Salvia verticillata* L., *Phlomis tuberosa* L. and others. Thus, the recorded xerothermophilic communities have an environmental significance and are the objects of monitoring researches.

Xerothermic and semixerothermic steppe communities in Polesie are rare. For the Western Polesie within the borders of Belarus, Poland and Ukraine (Fijałkowski et al., 2002), as well as the "Prybuzhskoe Polesie" Biosphere Reserve (Demyanchik, 2006), the presence of xerothermic grass communities of the *Festuco-Brometea* class on the cretaceous sediments is indicated. Such communities are not mentioned for the Polesie National Park (Baryla et al., 2002; Święs, 2002) and Polesie Natural Reserve (Vorobyov et al., 1997). Within Ukrainian (Southern) Polesie *the Festuco-Brometea* steppe communities are known in Zhytomyr Polesie near the rivers, where crystalline sediments are lying off (Onishchenko, 2006). But they have not been studied in detail. The communities of the *Festuco-Brometea* class in the Briansk region (Russia) within the boundaries of the loess plateau landscapes in the western spurs of the Middle Russian Highlands, where they are on the northern border of their habitat (Bulokhov, 2001, 2009) have been investigated to the greatest extent. Within Eastern Polesie these are the closest xerothermic phytocoenoses in the cretaceous sediments to the communities described by us. On the territory of the Briansk region, in the composition of the *Festuco-Brometea* class one *Festucetalia valesiacae* Soó 1947 order, *Cirsio-Brachypodion pinnati* Hadač et Klika in Klika et Hadač 1944 alliance with one *Poo compressae-Onobrychidoetum arenariae Bulokhov* 1990 association (Bulokhov, 2001) was established. The diagnostic species of this

association are *Onobrychis arenaria* (Kit.) DC. and *Poa compressa* L. The communities of this association can be found in small sections on the steep eroded slopes of river valleys and gullies on the complex of ravine-gully gray forest soils spread by chalk. The comparison of phytocoenotic data makes it possible to note that the communities described by A. Bulokhov (2001, 2009) differ from the xerothermic phytocoenoses on the cretaceous sediments of Novhorod-Siverskyi Polesie with a greater representation of steppe species.

In relevés 20 and 21 (Table 1), taked out at the chalk outcrops near the Horky village, the characteristic species (*Astragalus cicer* L., *Clinopodium vulgare* L., *Securigera varia* (L.) Lassen, *Origanum vulgare*, *Verbascum lychnitis* L.) and diagnostic species (*Frangula alnus* Mill., *Medicago falcata* L., *Pimpinella saxifraga* L.., *Solidago virgaurea* L.) of the *Trifolio-Geranietea* class and the *Origanetalia* order were identified. The described community is referred to the *Trifolion medii* alliance due to the presence of a number of diagnostic species, among which are the species of the specified alliance: *Agrimonia eupatoria* L., *Galium mollugo* L., *Trifolium medium* L., *Vicia sepium* L., and the typical species of the *Molinio-Arrhenatheretea* class (*Achillea submillefolium* Klokov et Krytzka, *Campanula rotundifolia* L., *Dactylis glomerata* L., *Knautia arvensis* (L.) Coult., *Lathyrus pratensis* L., *Veronica chamaedrys* L., *Vicia cracca* L. et al.). Its belonging to the group of the neutrophilic associations shows the presence of *Geranium sylvaticum, Medicago falcata* L., *Securigera varia.* A. Brzeg (2005) points out the characteristic (*Agrimonia eupatoria*, *Trifolium medium* L.) and differential (*Centaurea jacea* L., *Daucus carota* L., *Festuca pratensis* Huds. & *Potentilla reptans* L.) species for *the Trifolio medii-Agrimonietum* association. All these species, except the last one, were recorded in the phytocoenoses described by us. That is why we referred these communities from relevés 20 and 21 to the specified association.

In the outskirts of the Putyvsk village on the slopes of the cretaceous outcrops scrub communities of temperate Europe, represented by non-typical for Polesie synanthropic *Elytrigio repentis-Robinietum* phytocenoses, which are characteristic of the Steppe zone of Ukraine, were formed (Fig. 2B; Table 1, relevés 22-25). These communities are formed by *Robinia pseudoacacia* L. (3-4 m high) with an admixture of *Acer negundo* L. The reason for referring the identified communities to the corresponding association is the presence of the diagnostic species (*Chenopodium album* L., *Lactuca serriola* L., *Taraxacum officinale* Wigg. Aggr.) of the *Balloto nigrae-Robinion pseudoacaciae* Hadač et Sofron 1980 association and the diagnostic species (*Elytrigia repens* (L.) Nevski with a 20-40% projective covering, as well as *Artemisia vulgaris* L., *Carex hirta* L., *Galeopsis bifida* Boenn. *Humulus lupulus* L.) of the *Elytrigio repentis-Robinietum* association.

We believe that the *Elytrigio repentis-Robinietum* phytocoenoses are the last stage of the overgrowth of the cretaceous outcrops slopes in the succession series: ruderal phytocenoses of nutrient-demanding short-lived winter annual grasses on sandy anthropogenic soils (*Sisymbrion officinalis* Tx. et al. ex von Rochow 1951) → semiruderal grasslands and herblands (*Convolvulo-Agropyretum repentis* Felföldy (1942) 1943) → ruderal shrub communities *Elytrigio repentis-Robinietum* Smetana 2002).

In chalk outcrops in the community of the *Trifolio medii-Agrimonietum* association in the area of 50 m^2 (Fig. 2A; Table1, relevé 20) the *Gentiana cruciata* population was determined. The middle density of the population was 0.34 individuals/m^2. It is represented by two compact groups of 3 and 4 generative individuals, the area of 0.5 m^2 each, and 10 juvenile individual plants. The plants of other ontogenetic states have not been found. Thus, the population of *G. cruciata* in a new locality can be characterized as incompletely limbed with a left-sided spectrum: juvenile plants predominate. In Fig. 3 the spatial structure of the *G. cruciata* population is represented.

G. cruciata – a European-Southwest Asian forest-steppe relict species, included in the Red Books of the Republic of Belarus (Skuratovich, 2015) and the Briansk region (Evstigneev, 2004). This species is very rare for the Eastern Polesie. The nearest to the identified place is the "Markovsk mountains" (the Briansk region) – the richest in the Eastern Polesie center of the calcephalous flora. For today, our discovery of *G. cruciata* is the first and only one for Novhorod-Siverskyi Polesie. It should be noted, that *G. cruciata* is a diagnostic species of the *Festuco-Brometea* Br.-Bl et Tx. ex Soó 1947 class. However, the conditions of the determined location (open slope of the eastern exposition, close occurrence of carbonate rocks) are typical for the location of this species. For comparison, in Western Europe (in particular, in Poland), the locations of *G. cruciata* were found in xerothermic grassland on the southern and south-western slopes of the river valleys in the communities that are characterized by high proportions of species of the *Festuco-Brometea*, *Molinio-Arrhenatheretea*, *Trifolio-Geranietea sanguinei* and *Rhamno-Prunetea* classes (Wójcik & Piątek, 2015, Wójcik, 2018). In Western Pomerania the population of this species was found in *Adonido-Brachypodietum* pinnati communities for which *G. cruciata* is a characteristic species (Piotrowska, 2010). It is worth noting that the populations of *G. cruciata* in western localities, in comparison with the populations in Novhorod-Siverskyi Polesie, are larger in size, more numerous and denser. For example, in Brwice population 183 individuals of *G. cruciata* were found in the area 1200 m^2 (Piotrowska, 2010). 1107 individuals of *G. cruciata* were found in Unisław locality, the highest frequency and density was 0.339 individuals/m^2 (Krasicka-Korczyńska et al., 2011)

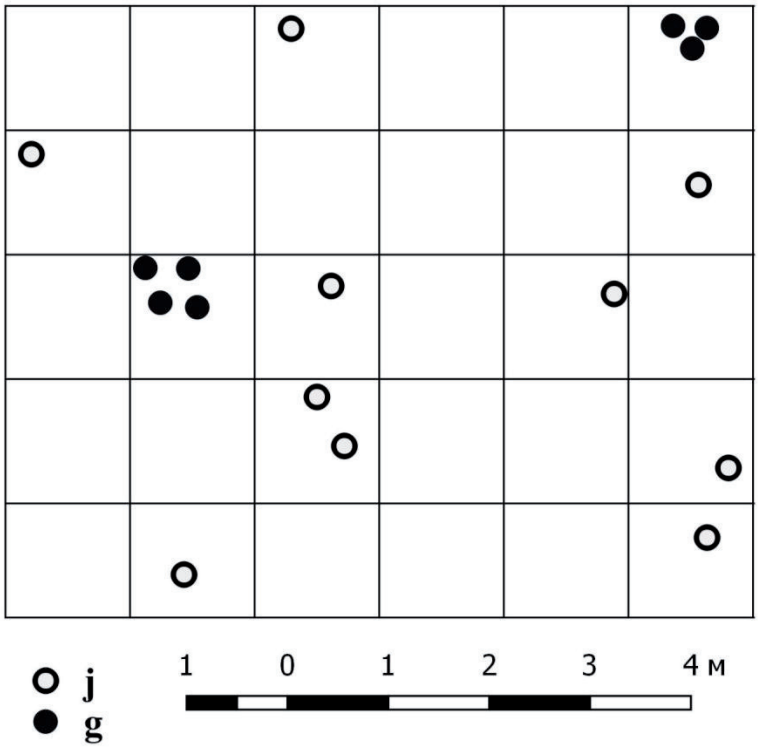

Figure 3. Spatial structure of the *G. cruciata* population in the Novhorod-Siverskyi locality. Denotations: j – juvenile individuals, g – generative individuals

The *G. cruciata* locality in Novgorod-Siverskyi Polesie loess "islands" is not under conservation. Therefore, in order to preserve the habitat of this rare species, it is worth creating here a reserve.

5. Conclusions

The structure and composition of the vegetation communities of the cretaceous outcrops of Novhorod-Siverskyi Polesie loess "islands" is influenced by the degree of anthropogenic influence (both in the past and present) on the ecosystems. The determining anthropogenic factors contributing to the formation of the ruderal communities were chalk mining and gardening. The influence of erosive processes is manifested in the spatial delimitation of plant communities of various syntaxonomic belongings.

In the vegetation cover of the cretaceous outcrops of Novhorod-Siverskyi Polesie loess "islands" semiruderal grasslands and herblands phytocoenoses of the nemoral and subboreal zones of Europe belonging to the *Convolvulo arvensis-Agropyrion* repentis Göors 1967 association predominate. The *Elytrigio repentis-Robinietum* Smetana 2002 phytocenoses is the last stage of the overgrowth of the cretaceous outcrops slopes during the succession from the ruderal vegetation of nutrient-demanding short-lived winter annual grasses on sandy anthropogenic soils to *Robinia* groves with weedy understorey on loamy dry soils.

The initial semixerothermic communities (*Chamaecytisus ruthenicus-Aster amellus, Elytrigia intermedia-Salvia pratensis, Origanum vulgare purum*) are close to the phytocoenoses of the *Festuco-Brometea* class by the species composition. Natural meso-subxerophytic fringe vegetation on nutrient-poor but base-rich soils (*Trifolion medii* T. Müller 1962) are represented fragmentarily. They do not suffer from the anthropogenic pressure and are separated by erosive forms. Such conditions were favorable for preserving the relict *Gentiana cruciata* L. species in this locality. The population of this species was found in the area of 50 m^2 in the community of the *Trifolio medii-Agrimonietum* Th. Müller 1962 association and represented by two compact groups of individuals (the area of 0.5 m^2 each) and individual plants. In order to preserve the habitat of this rare species, it is worth creating here a reserve.

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