

## THE TREND OF THE COMPOSITION OF THE WILD-BEE POPULATION ON ANTHROPOGENIC EFFECTS IN THE BIOTOPES OF THE KISKÖRE STORAGE-TANK REGION AT THE TISZA-VALLEY

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### Abstract

Studies were performed along the middle-Tisza reach, at the region of the Kisköre storage-tank in the years 1976—77 and 1979—80. The area of the storage-tank was inundated in 1978 by means of damming up the water. Prior to and after damming up the water, apart from the trend of the composition and density relations of the wild-bee population, studies were conducted in respect to the consequences of certain human impacts. The anthropogenic effects were the damming up of the water and the inundation of the meadows of the storage-tank following the building of the dam-system; the partial re-sowing of the grasslands and newly established dam-system with high protein-containing lucerne, red clover and five-finger papilionaceae. The number of recordings was 102, the appreciated wild-bee material was composed of 3716 individuals.

1. On the effect of damming up the water, a modification was manifest with the disappearance of the flood-plain in the species composition of the wild-bee population of the dam sides. The similarity of the species according to locality was found to be moderate in the quantitative and qualitative appreciations. A slight change was manifest in the species diversity and quantitative relations of the wild-bee populations upon the effect of damming up the water.
2. The discontinuance of reapings has negative influence on the composition and density of the wild-bee population in the grassland communities of the fill slope.
3. The re-sowing of the dam sides with papilionaceae is beneficial to the enrichment of the economically valuable *Andrena*, *Halictus*, *Lasioglossum*, *Eucera*, *Bombus*, *Megabombus* and *Pyrobombus* species.

### Introduction

The development of the composition of the wild-bee population was studied in 10, regularly in 8 terrestrial biotopes of the Kisköre storage-tank in 1976—77 prior to, and in 1979—80 after the damming up of the water. The damming up of the water was in 1978. Following the inundation of the area of the storage-tank the level height of the water raised to 1,5 m. Approximately an area of 127 km<sup>2</sup> became covered with water in the storage-tank. Besides the recordings on composition and density, the aim was to determine the degree to which certain human impacts affect the wild-bee populations. The effects were the damming up of the water as well as the inundation of the meadows of the storage-tank following the building of the dam-system, the partial re-sowing of the grasslands and newly established dam-system with high protein-containing lucerne, red clover and five-finger papilionaceae. The studied areas are in general untreated with pesticides.

## Materials and Methods

A special method was required for determining the composition and density of the population of wild-bees in the grassland communities. From several methods and possibilities the zone method (BALOGH 1953, BANASZAK 1980) as well as its variant applied for agrocultures are already known (BENEDEK 1970, BENEDEK *et al.* 1975). In case of the grassland communities this had to be modified so as to have it acclimate to the different plant communities, the changing flower coverage per area unit, and to the phytomass manifest in certain aspects.

The recording method was the following: every flower-visiting Apoidea insect was collected singly with butterfly-net for 3 minutes progressing at an even pace at a 1 m wide, 50 m long zone of the dam side. In such manner the composition and density of the wild-bee population were determined within 50 m<sup>2</sup>/3 minutes on one occasion. The zone recording within 50 m<sup>2</sup>/3 minutes was repeated 10 times at the same site both at the water side and the saved side. The collections lasted 60 minutes at 20 × 50 m<sup>2</sup>, totally 1000 m<sup>2</sup>. The places of the 50 m<sup>2</sup> recording areas were at the dam basement, centre and top at both the water- and saved sides, adapting to the plant communities. The number of recordings at both sides of the fill slope was close to similar at the same sites at the different level heights of the dam. Owing to technical difficulties, the studies were massed according to flowering aspects along the middle-Tisza reach. Recordings for determining the density and composition of the Apoidea were performed at several localities on one day. This does not distort the composition and density data of the wild-bee population since — similarly to the conclusion of MÓCZÁR (1954) — the flower-visiting Apoidea populations of a grassland community are characterized by high species number and low individual number. Thus, notable differences are not observable in the daily population motion of the wild-bee species.

The studied sites were Tiszavalk, Poroszló, Sarud, Tiszanána, Kisköre, Tiszafüred-Tiszaörvény, Tiszaszőlös, Tiszaderzs, Abádszalók and Tiszacsege.

The collected Apoidea material was composed of 3716 individuals. Prior to the damming up of the water 1770 wild-bees were collected in the course of the 52 recordings, while following the damming up of the water 1946 individuals were collected during 50 recordings.

The species similarity of the population of wild-bees was appreciated by means of the Jaccard similarity index:

$$I_s = \frac{c}{a+b-c}$$

where a = number of every species occurring before damming up of the water

b = number of every species found after the damming up of the water

c = number of common species occurring before and after the damming up of the water

The quantitative development of the population of wild-bees was estimated with the Renkonnen index. HUHTA (1979) studied 16 such formulae. The formulae

$$PS = \sum_{i=1}^n \min(p_{1i}; p_{2i})$$

belongs to the similarity indices the best expressing the succession changes, where PS stands for the degree of similarity,  $p_{1i}$  is the % of the *i*th species prior to damming up of the water and  $p_{2i}$  is the % of the *i*th species following the damming up of the water.

Based on the Shannon—Weaver function, the species diversity of the flower-visiting wildbee-population (May, 1973) as well as the structural degree of the populations were also appreciated. The evenness (J), therefore, can be calculated from the quotient of the logarithm of two of the components; the species abundance as well as the diversity (H) and the species number (S) (PIELOU 1969)

The Shannon—Weaver function is

$$H = \sum_{i=1}^s \frac{n_i}{N} \ln \frac{n_i}{N}$$

where *n* is the occurrence (= individual number) of the *i*th species; *N* is the occurrence (= individual number) of the total number of species

$p_i = \frac{n_i}{N}$  is the probability of finding (selection), or a simple form is

$$H = \sum_{i=1}^s p_i \ln p_i$$

The evenness was appreciated with the following formula:

$$J = \frac{H}{\ln S}$$

where S stands for the number of species,

H for the diversity value.

The maximal diversity (PIELOU 1969) is given by the logarithm of the species number.

The diversity, maximal diversity and evenness were appreciated from the data of 1976, 1977, 1979 and 1980 with the help of computer, using different programmes.

The development of the Apoidea community on the effect of damming up the water was appreciated according to flight dynamic distribution and climatic tolerance. According to flight period the wild-bee species can be classed among 4 main groups (BENEDEK 1968), being one generation old species with short and medium flying period, two generations old species with long flying period and continuously reproducing species with long flying period.

Based on the works of PITTIONI and SCHMIDT (1942) and MÓCZÁR (1948) the wild-bee species can be classed among five groups according to climatic tolerance. These groups are: stenoecic eremophilous, euryoecic eremophilous, hypereuryoecic intermediary, euryoecic hylophilous and stenoecic-hylophilous. In the course of the appreciation, definitions on many wild-bee species were adopted from the works of afore-mentioned authors, while a number of species were reconsidered or classified according to climatic tolerance. This was done on the basis of author's own experiences pertaining to one and a half decades, according to his recordings on the character of habitat and climate.

## Results and Discussion

### 1. Effect of damming up the water on the composition and quantitative relations of the population of wild-bees

The number of species appreciated along the middle-Tisza reach at the study areas of the Kisköre storage-tank in 1976—77 prior to, and in 1979—80 following the damming up of the water was as follows:

Tiszavalk	37 species	(n = 3)
Poroszló	106 species	(n = 17)
Sarud	75 species	(n = 16)
Tiszanána	44 species	(n = 14)
Kisköre	100 species	(n = 16)
Tiszafüred-		
Tiszaörvény	112 species	(n = 12)
Tiszaderzs	46 species	(n = 7)
Abádszalók	109 species	(n = 16)
Tiszaszőlős	78 species	(n = 10)

On one occasion prior to damming up the water, recording was performed at Tisza-cege, too, however, the obtained data were not appreciated in lack of studies at this site after the damming up of the water.

#### a) Appreciation of the population of wild-bees according to species composition

Following the damming up of the water, the composition of the wild-bee population changed at the dam and flood-plain at the region of the Kisköre storage-tank along the middle-Tisza reach. The Apoidea disappeared from the flood-plain due to the water coverage. Based on the Jaccard similarity index, the species composition of the wild-bee population at the study sites concentrated on was appreciated:

I<sub>s</sub> values:

Poroszló	0,336	n <sub>d.e.</sub> = 9	n <sub>d.u.</sub> = 8
Kisköre	0,300	n <sub>d.e.</sub> = 9	n <sub>d.u.</sub> = 7
Sarud	0,395	n <sub>d.e.</sub> = 8	n <sub>d.u.</sub> = 8
Abádszalók	0,336	n <sub>d.e.</sub> = 8	n <sub>d.u.</sub> = 8
Tiszafüred-			
Tiszaörvény	0,257	n <sub>d.e.</sub> = 5	n <sub>d.u.</sub> = 7

Annotation: n<sub>d.e.</sub> = number of recordings prior to damming up the water  
n<sub>d.u.</sub> = number of recordings following the damming up of the water

The numbers of recordings at the listed sites were similar values both prior to and after the damming up of the water. The moderate similarity values based on the index values were resulted by the constant occurrence of the *Andrena*, *Halictus*, *Lasioglossum*, *Chalicodoma*, *Eucera*, *Bombus*, *Megabombus* and *Pyrobombus* species.

#### b) Quantitative appreciation of the wild-bee population according to species

Using the Renkonnen index, the similarity value was found to be 57.72% before and after the damming up of the water. The similarity was moderate regarding the quantitative appreciation of the wild-bee population according to species. This datum proves that in respect to the quantitative appreciation according to species, the population of wild-bees did not undergo any essential changes after the disappearance of the flood-plain. The species of the *Hylaeus*, *Hoplitis*, *Heriades*, *Chelostoma*, *Pseudoanthidium*, *Coelioxys*, *Epeolus*, *Triepeolus*, *Nomada* genera either disappeared after the damming up of the water, or their ratio within the population decreased. This can firstly be explained by the disappearance of their biotope, the flood-plain and their foster-plants. On the contrary, the number as well as quantitative ratio within wild-bee population of the economically significant wild-bee species showed an increase following the damming up of the water. On the effect of damming up the water an increase was manifest in the ratio within population of the important pollinating wild-bees, such as certain *Andrena*, *Halictus*, *Lasioglossum*, *Megabombus* and *Pyrobombus* species. After the damming up of the water there was a slight change in the climatic relations at the environs of the Kisköre storage-tank. Owing to the high specific heat value of the storage-tank's water mass the climate became more balanced. A more even water balance became characteristic to the soil of the dams following the damming up of the water. As a consequence, better drought-resistance was manifest for the re-sown papilionaceae at the dam section of the storage-tank and as the result of the insolation, the seared vegetation became less at the dam sections of Eastern, South-eastern exposure. The more favourable climatic conditions resulted more even meadow and weed communities, upon the effect of which the pollinating wild-bee species became more abundant. The vegetation period of the *Trifolium* and *Medicago* species became longer along the storage-tank as the consequence of damming up the water, on account of which it became possible to reap the papilionaceae on 3—4 occasions yearly. The appropriate moisture content of the soil quickened the formation of nectar in the foster-plants of the wild-bee populations.

The diversity (H), maximal diversity (H<sub>max</sub>) and evenness (J) values were as follows:

1976	S = 131	H = 3.9840	HM = 4.87520	J = 0.817
1977	S = 85	H = 3.8940	HM = 4.44265	J = 0.876
1976—1977	S = 161	H = 4.1630	HM = 5.08140	J = 0.819
1979	S = 95	H = 3.7490	HM = 4.55388	J = 0.823
1980	S = 118	H = 4.0210	HM = 4.77068	J = 0.843
1979—1980	S = 153	H = 4.1030	HM = 5.03044	J = 0.816

Analysing the diversity values in the course of the study years, as well as before and after damming up the water, it could be concluded that notable deviation was only manifest in the first year following the damming up of the water. In 1980, two years after damming up the water, the diversity value approximated the earlier findings. Besides such high species number, the diversity value can be judged as being acceptable. The diversity value prior to the damming up of the water was only 0.06 higher than after the damming up of the water. This fact can be appreciated in such a way that the species diversity and quantitative relations of the wild-bee population changed only slightly upon the effect of damming up the water.

The value of evenness only showed a minimal decrease (0.003) on the effect of damming up the water. Analysing the evenness values, it could be concluded that the population of wild-bees could be judged as being homogeneous during the study years, as well as before and after the damming up of the water.

The quantitative data according to species of the flower-visiting wild-bee population was appreciated upon the effect of damming up the water, according to flight dynamics and climatic tolerance (Tables 1., 2).

Table 1. *Results of the flight-dynamic appreciation*

Swarming groups	Prior to the damming up of the water		After the damming up of the water	
	ind.	%	ind.	%
Species with short flying period	220	12.43	153	7.86
Species with medium flying period	590	33.33	383	19.68
Continuously reproducing species with long flying period	306	17.29	559	28.73
Bivoltine species with long flying period	622	35.14	838	43.06
Unappreciated species	32	1.81	13	0.67
<b>TOTAL</b>	<b>1770</b>	<b>100.00</b>	<b>1946</b>	<b>100.00</b>

Table 2. *Appreciation according to climatic tolerance*

Groups according to climatic tolerance	Prior to the damming up of the water		After the damming up of the water	
	ind.	%	ind.	%
Stenoecic eremophilous	233	13.16	226	11.61
Euryoecic eremophilous	827	46.72	866	44.50
Hypereuryoecic intermediary	568	32.09	700	35.98
Euryoecic hylophilous	115	6.50	151	7.76
Stenoecic hylophilous	1	0.06	—	—
Unappreciated species	26	1.47	3	0.15
<b>TOTAL</b>	<b>1770</b>	<b>100.00</b>	<b>1946</b>	<b>100.00</b>

A lower ratio within population was manifest for the wild-bee species with short flying period (Table 1). One part of the species with short flying period belonging to the *Melitta*, *Megachile*, *Hoplitis*, *Osmia*, *Heriades*, *Chelostoma*, *Anthidiellum*, *Anthidium*, *Pseudoanthidium*, *Coelioxys*, *Stelis*, *Epeolus*, *Triepeolus*, *Pasites*, *Ammobates* genera disappeared from the population, or their quantitative ratio became lower on the effect of damming up the water. It also became apparent from the data that there was a marked decrease in the individual number of the species with medium flying period. At the flood-plains, a fifty percent decrease was evidenced in the ratio of the *Chalicodoma ericetorum* population, which species collects pollen and nectar on the flower of the *Lathyrus tuberosus*, and is characteristic to the Chalicodomae in its nest-building activities (GROZDANIC—MUCALICA 1968). The number of the species belonging to the *Anthidium*, *Tetralonia* genera became fewer on the effect of the damming up of the water. In case of the group of species with medium flying period, the ratio of the *Tetralonia ruficornis*, *T. salicariae* species decreased markedly. This can mainly be explained by the regression of the coverage of their foster-plants, the *Lythrum salicaria* and *L. virgatum*, owing to the damming up of the water. These species have no economical significance in the pollination of the agrocultures in our country. The quantitative development of the Eucera species was found to differ. There was a considerable decrease in the ratio of the *Eucera tigrifacies* and *E. tuberculata*, while an increase was manifest in the ratio of the *Eucera clypeata*, *E. interrupta* and *E. longicornis* having significance in the pollination of the *Medicago sativa*, *Trifolium pratense* and *Vicia* species. The nectar and pollen production — as energy source — of the flood-plain, flowering meadows and weeds, — fallen short after the inundation and unfavourable hydrological relations, — became compensated to a certain extent by the pollen- and nectar supplies of the species of the Papilionaceae, Labiatae and Cruciferae plant families found at the dam sides. The quantitative ratio of the wild-bee species with short and medium flying period showed a decrease after the damming up of the water, owing to the worsening of their essential conditions.

The continuously reproducing species with long flying period, with the exception of the *Hylaeus*, were taxa of great flight radius and energy turnover. It was firstly the individual number of the economically valuable bumble-bees that was found to increase.

There was an increase in the number of bivoltine species with long flying period, as the *Andrena*, *Halictus*, *Lasioglossum*. In case of the latter two groups the abundance following the damming up of the water was entirely unambiguous, developing as the result of continuous feeding, and good nesting possibilities for offspring care, provided by the dams. In the course of his studies, author often dug out the nests of *Andrena*, *Halictus*, *Lasioglossum*, *Bombus* and *Megabombus* species from the soil of the fill slopes.

The high specific heat of the water mass has compensating effect on the mesoclimatic relations. The quantitative ratio of the species showing extreme climatic tolerance was found to decrease. The same was experienced in case of the groups fond of heat. The ratio of the species of indifferent spread and greatly fond of humidity showed a slight increase after the damming up of the water (Table 2).

## 2. Effect of reaping on the development of the wild-bee populations

Reaping means partial intervention in the primary production of the plant communities of the dam-system and the flood-plain regions of higher relief. Under relatively settled weather conditions, the natural grassland communities can be

reaped on 2—3 occasions; the census re-sown with Papilionaceae 3—4 times annually. After 1—2 weeks, the temporal regularity of reapings ensures the variedness of the weeds and flowery meadows combined with Gramineae. The wide spectrum of foster-plants is beneficial to the species richness of the flower-visiting wild-bee population as well as to the great density of certain species.

The lack of the first, or later reapings resulted the narrowing down of the species composition of the flowery meadows and weeds at the fill slope. The coverage of the virulent weeds, like the *Carduus acanthoides*, *C. nutans*, later the *Pastinaca sativa* and the *Erigeron canadensis* became greater. By means of their continuous coverage, these plants exterminate the fosterplants for the wild-bee species at the fill slope. They provide food for many *Halictus*, *Lasioglossum*, *Bombus*, *Megabombus* and *Pyrobombus* species mainly at the time of the peak blooming of the *Carduus*, as the consequence of their attracting effect. After their withering they dry up and the bee pastureland character of the fill slope completely ceases. Accordingly, the Apoidea populations disappear in lack of food. Author experienced that there was no reaping at the region of Tiszaderzs at a section of 500—600 meters. By the second half of July, a continuous *Carduus* coverage developed at the water- and saved side of the fill slope. At the time of peak blooming there was an abundance of Papilionaceae-pollinating wild-bees, like the *Halictus simplex*, *H. maculatus*, *Lasioglossum malachurum*, *Bombus terrestris* and *Pyrobombus lapidarius* species.

At Tiszaderzs the populations of wild-bees collected during the studies on July 9 and August 10, 1976 were compared. The species similarity was appreciated with the Jaccard index, the quantitative ratios of the population's species composition with the Renkonnen index:

$$I_s = 0.12 \quad PS = 18.19$$

The lack of even the first, possibly the second reaping resulted slight similarity in species composition ( $I_s$ ). As the consequence of no reapings, such economically significant wild-bee species as the *Andrena labialis* and the *Megachile centuncularis* were not active in the grassland communities of the fill slopes. The quantitative similarity of the wild-bee population was also found to be slight ( $PS = 18.19$ ). In spite of no reapings, the *Andrena favipes*, *Halictus simplex*, *Pyrobombus lapidarius* and certain *Osmia* species were constant elements of the population even regarding the low similarity value.

The lack of reapings exerted negative influence on the composition and density of the wild-bee population in the grassland communities of the fill slope. At the time of peak blooming the virulent weeds distracted one part of the economically significant wild-bee species from the Papilionaceae cultures of the back areas.

### 3. The re-sowing with Papilionaceae of the grassland communities at the dam sides and their effect on the composition of the wild-bee population

For increasing the protein content of the hay, the grassland communities at several sections of the fill slope along the Kisköre storage-tank were re-sown with Papilionaceae. These were the *Medicago sativa*, *Trifolium pratense*, *T. repens*, and at places the *Lotus croniculatus* and *Vicia* species at sections of 200—300 meters.

The species composition of the wild-bees and their quantitative similarity were appreciated at the fill slope re-sown with the *Medicago sativa* and *Trifolium pratense* Papilionaceae, at the same sites, between the recording timepoints, in the course of the succession.

At Sarud the fill slope was re-sown with *Medicago sativa* Papilionaceae at a 1.5 km long section. The recordings were made prior to the reapings (June 10, July 9, August 22, 1980). The development of the similarity values for the composition and quantity of the wild-bee population between the study timepoints was as follows:

I. Comparison	II. Comparison	III. Comparison
June 10—July 9	July 9—July 22	August 22—September 22
$I_s=0.071$	$I_s=0.150$	$I_s=0.226$
PS=9.45	PS=32.770	PS=46.610

It is apparent from the data series that the composition and quantitative similarity of the wild-bee population increased during the flying period. The *Halictus simplex* and the *Megabombus sylvarum distinctus* were constant-dominant elements at the *Medicago sativa* flower-level during the vegetation period, prior to the reapings.

The *Hylaeus annularis*, *Halictus maculatus*, *Pyrobombus lapidarius*, *Bombus terrestris* were busy as additional species at the studied area, in varying numbers. By the middle of Summer, however, the *Halictus simplex*, *Pyrobombus lapidarius* and *Megabombus sylvarum distinctus* wild-bee species became the most significant flower-visitors of the fill slope.

In the region of Abádszalók, a 1.5 km long section of the dam was almost continuously re-sown with the *Trifolium pratense* Papilionaceae plant. The recording time-points before the reapings were May 26, July 8, August 9, September 26, 1976.

The similarity values for the species composition and quantity between the study time-points developed as follows:

I. Comparison	II. Comparison	III. Comparison
May 26—July 8	July 8—August 9	August 9—September 26
$I_s=0.093$	$I_s=0.140$	$I_s=0.074$
PS=22.22	PS=32.69	PS=10.87

In this case the recordings were performed before the damming up of the water. The population of wild-bees of the *Trifolium pratense* was the richest in species before the II. reaping. Following the III. reaping the values of similarity ( $I_s$ , PS) showed a decrease as the result of aridity and insolation.

In the course of the recordings performed in 1976, the quantitative similarity (PS) for the species composition pertaining to July 8 and August 9 can be regarded as an average with the value of 32.69. Every other similarity value was low, referring to the fact that the additional species showed considerable changes on the flower of the re-sown *Trifolium pratense* every 30—40 days.

The *Andrena flavipes*, *A. ovatula* species proved to be constant-dominant flower-visitors at the fill slope prior to the reapings, in the grassland communities and on the *Trifolium pratense* Papilionaceae plant. The *Melitta leporina*, *Andrena labialis*, *Halictus maculatus*, *H. subauratus*, *Anthidium oblongatum* and the *Bombus terrestris* species were significant flower-visitors both in the grassland communities and on the re-sown Papilionaceae at the time of peak blooming.

The re-sowing of the Papilionaceae is beneficial to the enrichment of the economically valuable wild-bee populations. The grassland communities of the dam side with the Papilionaceae re-sown in sections provide continuous supplies of pollen and nectar. The unperturbed soil of the dam side ensures undisturbed offspring care for the species of the *Eucera* and *Tetralonia* genera. The flowering meadows and the



weeds at the fill slope and flood-plain, as well as the blooming agrocultures of the back areas provide the possibility of competition for the wildbees. Even in our country autogamy is hindered because of the flower structure of several meadows, weeds and agricultural plants (KNUTH 1899, TROLL 1967, FREE 1970). Accordingly, the role of wild-bees in the entomogamic pollination of the plants is indispensable. This is especially important in case of the wild-bee populations swarming from the flood-plain and fill slope — as bee pasture-land — to the agrocultures of the back areas.

\* \* \*

1. On the effect of damming up the water, changes were manifest in the composition of the population of wild-bees along the middle-Tisza reach, at the region of the Kisköre storage-tank at the dam and the flood-plain.
  - a) The similarity of the species according to locality was found to be moderate based on the index values.
  - b) The similarity of the wild-bee population also showed an average regarding quantitative appreciation according to species.
 Slight changes were manifest in the species diversity and quantitative relations of the wild-bee population upon the effect of damming up the water. There was a decrease in the ratio within population of the wild-bee species with short and medium flying period.
2. The discontinuance of reapings has negative influence on the composition and density of the population of wild-bees in the grassland communities of the fill slope. At the time of peak blooming the virulent weeds distract one part of the economically important wild-bee species from the Papilionaceae cultures of the back areas. After their withering the dam side no longer has bee pasture-land character, since as the consequence of their great coverage till mid-Summer, the flowery meadow and other nectar- and pollen-producing weeds die out.
3. The re-sowing of the dam sides with Papilionaceae is beneficial to the enrichment in the economically valuable *Andrena*, *Halictus*, *Lasioglossum*, *Eucera*, *Bombus*, *Megabombus*, *Pyrobombus* species.

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## A vadméh közösségek összetételének alakulása antropogén hatásokra a Kiskörei tározó térségének biotopjaiban

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### Kivonat

A Kiskörei tározó térségében a védőtöltésen és a hullámtéren a vadméh közösség összetétele duzzasztás hatására megváltozott. A fajok lelőhelyenkénti hasonlósága, az index értékek alapján közepes volt. A vadméh közösség hasonlósága faj szerinti mennyiségi értékelésben közepes.

A vadméh közösség duzzasztás hatására történő faji sokrétűsége és mennyiségi viszonyai kismértékben változtak. A rövid és közepes rajzásidejű vadméh fajoknak a közösségen belüli aránya mérséklődött.

A kaszálások elmaradása negatívan befolyásolja a töltésrészsű gyeptársulásaiban a vadméh közösség összetételét és sűrűségét. A virulens gyomnövények csúcsvirágzás idején elvonják a mőgöttes területek pillangós kultúráiról a gazdaságilag jelentős vadméh fajok egy részét.

A töltésoldalak pillangósokkal való felülvetése elősegíti a gazdaságilag értékes *Andrena*, *Halictus*, *Lasioglossum*, *Eucera*, *Bombus*, *Megabombus*, *Pyrobombus* fajok feldúsulását.

## Promene sastava zajednica divljih pčela pod uticajem antropogenih faktora u biotopima akumulacije Kisköre

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### Abstrakt

Na području akumulacije Kisköre došlo je do promene sastava zajednica divljih pčela, kako na odbranbenim nasipima, tako i u plavnoj zoni. Sličnost vrsta divljih pčela po staništima na osnovu indeksa vrednovanja, kao i kvantitativni sastav njihovih zajednica je osrednji.

Pod uticajem akumulacije u neznatnoj meri je promenjen kvantitativni i kvalitativni sastav zajednica. Unutar zajednica odnosi vrsta sa kratkim i osrednjim rojenjem su postali ujednačeniji.

Izostanak košenja na padinama nasipa ima negativan efekat na sastav i gustinu populacija divljih pčela u travnatoj fitocenozi dolme. U periodu cvetanja virulentne korovske biljke, sa kultura leptirnjača okolnih područja, privlače deo privredno značajnih vrsta divljih pčela. Zasejavanje padina nasipa leptirnjačama doprinosi razvoju populacija privredno značajnih vrsta, kao sto su: *Andrena*, *Halictus*, *Lasioglossum*, *Eucera*, *Bombus*, *Megabombus*, *Pyrobombus*.

**Изменение состава сообществ диких пчел под влиянием  
деятельности человека в биотопах на территории  
Кушкерейско водохранилища**

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**Резюме**

На территории Кушкерейского водохранилища, созданного в бассейне среднего течения Тисы, на защитной дамбе и на затоп — ленной площади изменился состав сообщества диких пчел под влиянием поднятия уровня воды. Сходство видов по месту обнаружения, исходя из значений индекса, оценивалось средним. Сходство сообщества по видам, исходя из количественного анализа, было среднее. В связи с поднятием уровня воды условия видового разнообразия и количественные характеристики изменились незначительно. Снизился удельный вес в сообществе видов диких пчел, имеющих средние и короткие сроки роев.

Отсутствие сенокоса отрицательно влияет на состав и численность популяций в сообществах травяного покрова дамб. В период кульминации цветения сорняки отвлекают часть видов диких пчел от бобовых культур на ближайших участках. Посев трав *Rapiponaceae* на склонах дамб способствует распространению полезных для народного хозяйства видов *Andrena*, *Halictus*, *Lasioglossum*, *Eucera*, *Bombus*, *Megabombus*, *Pyrobombus*