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Short Communication

Dragonflies (*Odonata*) of Botanical Garden's Pond of SUA in Nitra

Mária Babošová*, Jana Ivanič Porhajašová, Dávid Ernst
Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Slovakia

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The faunistic research of dragonflies was realized during 2016 and 2017. The research was carried out under the conditions of Botanical garden's pond of Slovak University of Agriculture (SUA) in Nitra. 229 dragonfly individuals (105♂, 124♀) were trapped during the monitored period. Trapped individuals represented 10 species and 3 families of dragonflies. The aim of the research was to determine the species composition of dragonflies of the selected locality. Based on the representation of individual species for the monitored locality, its dominance was also calculated.

Keywords: dragonflies, *Odonata*, bioindicator, habitat, pond, dominance, climate change

1 Introduction

The dragonflies (*Odonata*) are definitely one of the most obvious and various group of the insects. The biology of nature protection calls the dragonflies as an umbrella species. So, the protection of dragonfly habitats helps to protect the wide spectrum of other aquatic animals with similar requirements on the environment (Noss, 1990; Lambeck, 1997; Hreško et al., 2006). Adult dragonflies are excellent predators and flyers, but larval stages live in the aquatic environment (Holuša, 2013). Dragonfly larvae represent an important intermediate stage of trophic relationships. Larvae are hunted by larger invertebrates and vertebrates and are themselves predators of many aquatic animals (Corbet, 1999). The occurrence of dragonflies can give us a lot of information about the environment and its current state. Some species occur only in an undisturbed environment with original ecosystems (Šácha et al., 2007; Šácha, 2010). The knowledge of dragonfly occurrence can be used to assess the changes in its species spectrum, or to assess the importance and regime of environment where it lives (Holuša, 2013). Hreška et al. (2006) states that results of dragonfly research can be used for revitalization, conservation and legislative measures. The presence of dragonflies helps to indicate the overall status of both aquatic and terrestrial habitats. Various environmental changes reflect changes in the structure of dragonfly communities. Dragonflies are currently also being used to assess the impact of climate change. For example, the so-called Loosers include *Calopteryx splendens*, whose population density will decrease due to global warming because it is sensitive to oxygen deficiency in water (Beracko et al., 2017). Due to the increasing use of dragonflies for the indication of global climate changes, the aim of the research was to determine the impact of environment on species composition of dragonflies.

2 Material and methods

Faunistic research of dragonflies was carried out under the conditions of the park pond situated in the Botanical Garden of the Slovak University of Agriculture (SUA) in Nitra during 2016 and 2017 from May to August. The Botanical Garden of SUA is a scientific and pedagogical workplace founded on 1st January 1982. Botanical Garden covers an area of 21.2 ha. The collection of the Botanical Garden contains 3,765 taxa and about 1,000 cultivars. In addition to tropical and subtropical species, plants of temperate zone, domestic flora, ornamental plants and crops are represented. The area of the Botanical Garden is of irregular shape. The pond is situated in the middle of Botanical Garden. Shores of pond are slightly inclined and reinforced by concrete blocks. The pond is

***Corresponding Author:** Mária Babošová, Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Department of Environment and Biology, Tr. Andreja Hlinku 2, 949 76 Nitra, Slovakia; e-mail: maria.babosova@vuniag.sk. ORCID: https://orcid.org/0000-0003-0952-8728

filled by groundwater and rainwater. *Iris pseudacorus*, *Sparganium erectum*, *Phragmites australis*, *Nuphar lutea*, representatives of Typhaceae and Nymphaeaceae plant species there are extended around the pond. The aquatic ecosystem of pond is inhabited by fish, frogs and ducks.

The method of trapping of dragonfly adult individuals by entomological net (∅ 0.40 m, handle length of 1.5 m) was used for the research. The trapping was carried out above the water surface and close to vegetation under the ideal meteorological conditions (clear to cloudy, warm, complete windless or just a light breeze). The biological material was preserved with 96% alcohol. The following keys were used to determine the dragonflies: Askew 1988, Hanel and Zelený (2000), Dijkstra and Lewington (2006), Heidemann and Seidenbusch (1993), Kohl (1998) and Šácha et al. (2008). The classification and nomenclature of dragonflies by Wasscher and Bos (2000) were performed. Based on the representation of individual species of the monitored locality, dominance by Losos (1992) was calculated:

$$D = n_i / N \times 100 \quad (1)$$

where:
n_i – number of individuals of species *i*
N – total number of individuals

According to Tischler (1949) the individual species were included into the dominance classes: 1 – subrecedent (<1%), 2 – recedent (1–2%), 3 – subdominant (2–5%), 4 – dominant (5–10%) and 5 – eudominant (>10%) (Holuša and Vaněk, 2008).

3 Results and discussion

229 (105♂, 124♀) individuals of dragonflies (10 species and 3 families) were trapped and classified during 2016 and 2017. 5 species of dragonflies were classified as Zygoptera suborder and 5 as Anisoptera. The number of identified species represents 14.49% of the total number of species of Slovakia (David, 2013). Eudominant (*D* >10%) species were: *Ischnura elegans*, *Coenagrion puella*, *Nallagma cyathigerum* and *Sympetrum sanguineum*. Dominant (*D* >5<10%) were: *Orthetrum cancellatum*, *Sympetrum vulgatum*, *Lestes barbarus* and *Lestes sponsa*. Subdominant (*D* >2<5%) species were: *Libellula depressa* and *Sympetrum striolatum*. Recedent and subrecedent (*D* <2) dragonfly species were not recorded in this experimental locality during the research (Table 1).

Suborder: Zygoptera

Family: Coenagrionidae

Coenagrion puella (Linnaeus, 1758)

Year 2016: 16th May: 2♂, 1♀; 21st June: 5♂, 2♀; 12th July: 3♂, 1♀; 16th August: 3♂, 2♀.

Year 2017: 24th June: 5♂, 2♀; 30th June: 4♂, 1♀; 17th July: 7♂, 5♀; 4th August: 4♂, 3♀; 26th August: 2♂.

Enallagma cyathigerum (Charpentier, 1840)

Year 2016: 16th May: 2♂; 21st June: 3♂, 2♀; 12th July: 2♂, 2♀; 16th August: 2♂.

Year 2017: 24th June: 3♂, 2♀; 30th June: 2♂, 3♀; 17th July: 2♂, 2♀; 4th August: 2♂; 26th August: 1♂, 1♀.

Ischnura elegans (Vander Linden, 1820)

Year 2016: 16th May: 3♂, 1♀; 21st June: 5♂, 3♀; 12th July: 4♂, 2♀; 16th August: 3♂, 3♀.

Year 2017: 24th June: 4♂, 3♀; 30th June: 5♂, 3♀; 17th July: 3♂, 2♀; 4th August: 2♂, 1♀; 26th August: 1♂, 1♀.

Table 1 Representation of dragonfly species and its dominance in 2016 and 2017

Species	2016	D (%)	2017	D (%)	Σ
Coenagrion puella (Linnaeus, 1758)	19	17.75	33	27.05	52
Enallagma cyathigerum (Charpentier, 1840)	13	12.15	18	14.75	31
Ischnura elegans (Vander Linden, 1820)	24	22.43	25	20.49	49
Lestes barbarus (Fabricius, 1798)	7	6.54	5	4.09	12
Lestes sponsa (Hansemann, 1823)	6	5.61	8	6.56	14
Libellula depressa (Linnaeus, 1758)	5	4.67	3	2.46	8
Orthetrum cancellatum (Linnaeus, 1758)	8	7.47	7	5.74	15
Sympetrum sanguineum (Müller, 1764)	13	12.16	10	8.19	23
Sympetrum striolatum (Charpentier, 1840)	4	3.73	7	5.74	11
Sympetrum vulgatum (Linnaeus, 1758)	87.49	6	4.93	14	
Total	107	100.00	122	100.00	229

Family: Lestidae

Lestes barbarus (Fabricius, 1798)

Year 2016: 16th May: 1♂; 21st June: 2♂, 1♀; 12th July: 2♂; 16th August: 1♂.

Year 2017: 24th June: 1♂, 1♀; 30th June: 1♂; 4th August 1♂; 26th August: 1♂.

Lestes sponsa (Hansemann, 1823)

Year 2016: 21st June: 1♂; 12th July: 2♂, 1♀; 16th August: 1♂, 1♀.

Year 2017: 24th June: 2♂; 30th June: 2♂, 1♀; 17th July: 2♂; 26th August: 1♂.

Suborder: Anisoptera

Family: Libellulidae

Libellula depressa (Linnaeus, 1758)

Year 2016: 21st June: 1♀; 12th July: 2♂, 1♀; 16th August: 1♂.

Year 2017: 17th July: 3♂.

Orthetrum cancellatum (Linnaeus, 1758)

Year 2016: 21st June: 2♂, 1♀; 12th July: 2♂; 16th August: 2♂, 1♀.

Year 2017: 30th June: 2♂; 17th July: 1♂, 1♀; 4th August: 2♂; 26th August: 1♀.

Sympetrum sanguineum (Müller, 1764)

Year 2016: 16th May: 2♂; 21st June: 3♂, 1♀; 12th July: 2♂, 2♀; 16th August: 2♂, 1♀.

Year 2017: 24th June: 2♂, 1♀; 30th June: 2♂; 17th July: 1♂; 4th August: 2♂, 1♀; 26th August: 1♂.

Sympetrum striolatum (Charpentier, 1840)

Year 2016: 12th July: 2♂; 16th August: 1♂, 1♀.

Year 2017: 30th June: 1♂, 1♀; 17th July: 2♂; 4th August: 2♂, 1♀.

Sympetrum vulgatum (Linnaeus, 1758)

Year 2016: 21st June: 3♂, 1♀; 12th July: 2♂, 1♀; 16th August: 1♂.

Year 2017: 24th June: 1♂, 1♀; 17th July: 2♂, 1♀; 4th August: 1♂.

Most of the classified dragonfly species of the monitored locality were typically stagnicolous. Stagnicolous species inhabit various types of aquatic habitats of calm waters (David and Ábelová, 2015). *Ischnura elegans*, *Libellula depressa* and *Orthetrum cancellatum* were classified as eurytopic dragonfly species. Eurytopic species inhabit different habitats and can survive under the different environmental conditions. Monitored locality is not a habitat with running water, species typical for such localities were not identified.

The vegetation species composition and vegetation cover of aquatic habitats is an important environmental factor influencing dragonflies (Hreško et al., 2006). Submerse and natant water vegetation presence is important for dragonfly egg laying and its development. The dragonfly species (also called as thermophilic species) of calm eutrophic water habitats of lowlands to uplands prefer overheated water, such as small water reservoirs, flooded sand pits, gravel pits, etc.

The presence of dragonflies can be considered as an expression of the favourable state and stability of the natural ecosystem. The largest number of dragonfly species live in habitats that consist of a wide range of micro habitats with different environmental characteristics. Olberg et al. (2000) states that Anisoptera responds much more strongly to ecosystem pollution than Zygoptera. It was found that environmental interventions and changes of environmental quality caused changes in the species spectrum of odonatocenoses in practice (Sahlén and Ekestubbe, 2001; Wildermuth, 2001; Foote and Hornung, 2005; Butler and Demaynadier, 2008; Simaika and Samways, 2008; Harabiš and Dolný, 2010). On the basis of the above it can be stated that common species of dragonflies typical for calm waters were recorded in the monitored locality.

The Palearctic species (*Coenagrion puella*, *Lestes sponsa*, *Libellula depressa*, *Orthetrum cancellatum*, *Sympetrum striolatum*, *Sympetrum vulgatum*), Circumboreal species (*Enallagma cyathigerum*) and Eurosiberian species (*Ischnura elegans*, *Lestes barbarus*, *Sympetrum sanguineum*) there are widely spread on the Earth (Šácha et al., 2008).

4 Conclusions

During the years 2016 and 2017 was carried faunistic research of dragonflies. Were trapped 229 individuals of dragonflies and 10 species were classified. Most of the classified dragonfly species were typically stagnicolous. Common dragonfly species of calm waters were recorded in the monitored locality. Eudominant species were: *Ischnura elegans*, *Coenagrion puella*, *Enallagma cyathigerum* and *Sympetrum sanguineum*. Typical species of running water habitats were not identified during the monitored period. Research of dragonflies is important in terms of its species diversity, which confirms the favourable status of habitats. The results showed that none of the identified dragonfly species indicates climate change.

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