

## **ENVIRONMENTAL IMPACT ON BIODIVERSITY AND HABITATS OF AQUATIC INSECTS FROM THE SHKUMBINI AND ISHEMI DELTA RIVERS (ALBANIA)**

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**Abstract.** Aquatic insects are very important due to their ability to serve like environmental bio-indicators. In this study, we evaluated the actual environmental situation of ecosystem in the Ishemi and Shkumbini river deltas, by analysing the biodiversity of dragonfly (pilivesa) Odonata (order Odonata, class Insects, type Arthropoda). The biological material was collected during the period 2007–2008. Data collected have figured out on both areas: 23 species, 15 genera and 8 families of Odonata. The most represented group is Anisoptera with 15 species and frequency 62.51%. The Libellulidae is the most represented family with 8 species and frequency 34.78%. The ecosystem surrounding the Shkumbini delta river shows a higher diversity, properly with 18 species and frequency 78.26%, while those of the ecosystem of Ishemi delta river present a lower diversity, of 10 species and frequency 43.47%. That is an indication that the Ishemi delta river is more polluted compared to that of the Shkumbini delta river, hence not offering optimum conditions for Odonata species, which look for highly conservation habitats. In both areas are encountered only 6 common species, and the ‘Jaccard index of similarity coefficient’ was 26.08%, which is an indication of different conditions of environmental quality for these bioindicator species.

*Keywords:* Odonata, environment, aquatic insect, habitat, ecosystem.

### **AIMS AND BACKGROUND**

The insects of order Odonata are among the most well-known aquatic insects. Commonly they are known as dragonfly and have a very impressive image. Dragonflies are classified in three main groups: Zygoptera which are more tiny and delicate creatures, Anisoptera with more fatty shape; and the last one, a relict group, Anisozygoptera. Their eggs and larvae are aquatic, while the adults are terrestrial<sup>1</sup>. Both the adults and nymph are classified as carnivorous, while some other species are predators. A special characteristic of these species is that they prefer

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to live in habitats with not contaminated and well oxygenated freshwaters. Based on that feature, dragonflies can be used like valuable bio-indicators regarding to evaluation of environmental contamination<sup>2-5</sup>.

The Odonata larvae play an important role in maintaining the demographical control of *Anopheles* larvae by consuming this species, hence indirectly controlling the epidemic illness like malaria<sup>6</sup>. In general, Odonata larva is capable to use the end point of substrates and aquatic vegetations, but some different species show preference only for some substrates<sup>7</sup>. The conduction of that study was important for both areas, because it gives an indication of anthropogenic factors on the environment, which tend to affect the aquatic entomofauna.

## EXPERIMENTAL

The collection of the Odonata species occurred during spring and summer times and the day time 10:00–13:00 of 2007–2008. The natural ecosystems were selected with dense vegetable fauna to the delta rivers of Ishemi, in Patoku, and Shkumbini in Kavaja. The collection of biological material was conducted by using the air and aquatic nets both for insects living in aquatic area as well as in aquatic plants. Identification of species was accomplished by signing the date, place and medium of catching. The plastic bags specially designated for Odonata order was used for the transportation of material to the Laboratory because they have a soft and delicate body. Regarding to the larvae material, prior to determination, those were kept in the bottles with 75% alcohol medium, while the adult individuals were isolated in ‘Odonata bags’<sup>8</sup>. Determination of the individuals was conducted with stereomicroscopy Zeiss; Stemi 2000-C, Serial 455044–9901, Optic: W-Pi 10×/23, by using the defining keys<sup>9-12</sup>.

## RESULTS AND DISCUSSION

After the collection and the determination of Odonata species in the studied areas, we analysed the data according to groups, families, areas of the study and species similarity among the areas. The study of bio-diversity of this group is concluded by determination of the biological material presented in the following table, the distribution of species according to areas of the study, Patoku (P) and Kavaja (K), and according to groups, families and genera, followed by common name in Albanian, which in many cases is invented by translation of their worldwide known name in Table 1.

**Table 1.** List of species for the Patoku and Kavaja areas

Scientific name	Albanian name	P	K
1	2	3	4
Order Odonata	Pilivesë		
Group Zygoptera	vajzë-fluturuset		
<b>Family</b> Calopterygidae S e l y s, 1850	Pilivesat krahëgjëra		
Genre Calopteryx L e a c h, 1815			
<i>Calopteryx virgo</i> L i n n é, 1758	vajzë-fluturuse e bukur	+	+
<i>Calopteryx splendens</i> H a r r i s, 1782	vajzë-fluturuse me shirita	+	+
<b>Family</b> Lestidae C a l v e r t, 1901	vajzë-fluturuset e holla		
Genre Lestes L e a c h, 1815			
<i>Lestes virens</i> C h a r p e n t i e r, 1825	vajzë fletë smeraldi vogël		+
Genre Chalcolestes K e n n e d y, 1920			
<i>Chalcolestes (lestes) viridis</i> V a n d e r L i n d e n, 1825	vajzë fletë smeraldi shelgjeve		+
<b>Family</b> Coenagrionidae K i r b y, 1890	vajzë fluturuse krahngusht		
Genre Ischnura C h a r p e n t i e r, 1840			
<i>Ischnura elegans</i> V a n d e r L i n d e n, 1820	vajzë fluturuese bishtblu		+
Genre Coenagrion K i r b y, 1890			
<i>Coenagrion ornatum</i> S e l y s, 1850	vajzë fluturuese e vogël		+
Genre Erythromma C h a r p e n t i e r, 1840			
<i>Erythromma najas</i> H a n s e m a n n, 1823	vajzë fluturuse sy kuqe		+
<i>Erythroma viridulum</i> C h a r p e n t i e r, 1840	vajzë fluturuse vogël sykuq		+
Group Anisoptera	Pilivesat e vërteta		
<b>Family</b> Gomphidae R a m b u r, 1842	pilivesat bisht kopçe		
Genre Onychogomphus S é l y s, 1854			
<i>Onychogomphus forcipatus</i> L i n n a e u s, 1758	pilivesa sy jeshil bisht gremç	+	+
Genre Gomphus L e a c h, 1815			
<i>Gomphus schneiderii</i> S e l y s, 1850	–		+
<i>Gomphus flavipes</i> C h a r p e n t i e r, 1825	pilivesa shpinë verdhë	+	+
<b>Family</b> Aeshnidae R a m b u r, 1842	pilivesa perandorake gjuetare		
Genre Caliaeschna S e l y s, 1838			
<i>Caliaeschna microstigma</i> S c h n e i d e r, 1845			+
<b>Family</b> Cordulegastridae C a l v e r t, 1893	pilivesat unazë arta		
Genre Cordulegaster L e a c h, 1815			
<i>Cordulegaster bidentatus</i> S é l y s, 1843	pilivesat dydhmbsh unazart		
<b>Family</b> Corduliidae S e l y s, 1850	pilivesat smeralde		
Genre Somatochlora S é l y s, 1871			
<i>Somatochlora flavomaculata</i> V a n d e r L i n d e n, 1825	pilivesat njolla verdha		+

to be continued

	1	2	3	4
<i>Somatochlor metallica</i> V a n d e r L i n d e n, 1825		pilivesat smeralde brilante	+	
<b>Family</b> Libellulidae R a m b u r, 1842		pilivesat gjahtare		
Genre <i>Ladona</i> N e e d h a m, 1897				
<i>Ladona fulva</i> M ü l l e r, 1764		pilivesa gjahtare e rrallë	+	+
Genre <i>Libellula</i> L i n n a e u s, 1758				
<i>Libellula depressa</i> L i n n a e u s, 1758		pilivesat gjahtare gjerrë		+
Genre <i>Orthetrum</i> N e ã m a n, 1833				
<i>Orthetrum brunneum</i> F o n s c o l o m b e, 1837		pilivesa shkumore jugut	+	+
<i>Orthetrum anceps</i> S c h n e i d e r, 1845		–		+
Genre <i>Sympetrum</i> N e w m a n, 1833				
<i>Sympetrum sanguineum</i> M ü l l e r, 1764		pilivesa shigjetare kuqe		+
<i>Sympetrum striolatum</i> C h a r p e n t i e r, 1840		pilivesa shigjetare zakonshme		+
<i>Sympetrum vulgatum</i> L i n n a e u s, 1758		pilivesa shigjetare e enda- cake		+
<i>Sympetrum flaveolum</i> L i n n a e u s, 1758		pilivesa shigjetë krahverdth		+

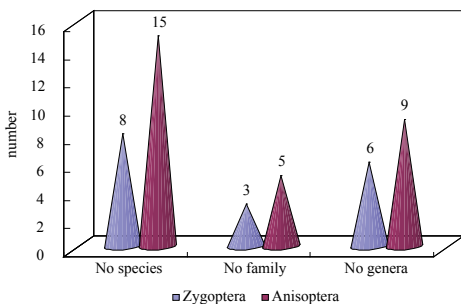
The data of the bio-diversity of Odonata for these areas show that this group is represented with 23 species, 15 genera and 8 families. Determination according to groups<sup>13</sup>, show that Zygoptera is represented with 8 species and frequency 34.78%, with 6 genera and frequency 40% and with 3 families and frequency 37.5%, while the Anisoptera one is represented with more species: 15 species and frequency 65.21%, with 9 genera with frequency 60% and 5 families with frequency 62.5% presented in Table 2 and Fig. 1). This shows that the species Anisoptera are more encountered, and emphasises that they have a higher tolerance toward the environmental factors than those areas offer.

**Table 2.** Distribution of species, families and genera according to the studied groups

Group	Number of species	Frequency of species (%)	Number of families	Frequency of families (%)	Number of genre	Frequency of genera (%)
Zygoptera	8	34.78	3	37.5	6	37.5
Anisoptera	15	65.21	5	62.5	9	62.5
Total	23	100	8	100	15	100

The results of the study on the species bio-diversity are presented in Table 3, Figs 2 and 3, where the distribution is analysed according to species and genera. The most represented family is Libellulidae with 8 species and frequency 34.78% of the overall species; with less species is Coenagrionidae with 4 species and frequency 17.39%; the Gomphidae with 3 species and frequency 13.04%, followed by Calopterygidae, Lestidae and Corduliidae with 2 species and frequency 8.69%

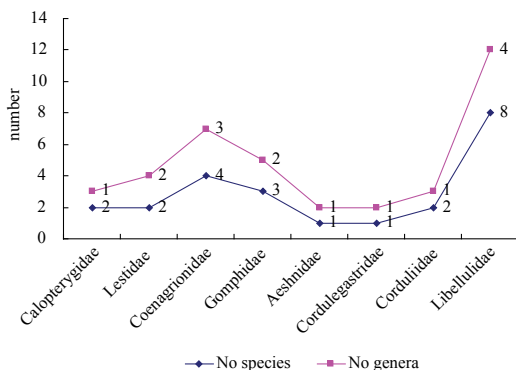
respectively; while Aeshnidae and Cordulegastridae is represented with only 1 species and frequency 4.37%.



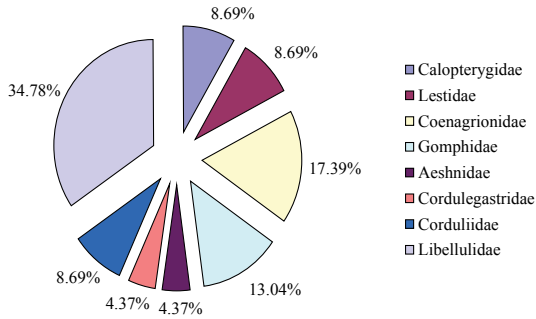
**Fig. 1.** Correlation of number of species, families and genera according to the studied groups

**Table 3.** Distribution of species and genera based on each studied family

Families	Number of species	Frequency of species (%)	Number of genera	Frequency of genera (%)
<b>Group Zygotera</b>				
Calopterygidae	2	8.69	1	6.66
Lestidae	2	8.69	2	13.33
Coenagrionidae	4	17.39	3	19.99
<b>Group Anisoptera</b>				
Gomphidae	3	13.04	2	13.33
Aeshnidae	1	4.37	1	6.66
Cordulegastridae	1	4.37	1	6.66
Corduliidae	2	8.69	1	6.66
Libellulidae	8	34.78	4	26.64
<b>Total</b>	<b>23</b>	<b>100</b>	<b>15</b>	<b>100</b>



**Fig. 2.** Relation of number of species and genera according to the studied families



**Fig. 3.** Relation of species percentages according to the studied families

The Libellulidae family has the greatest number of genera, 4 genera and frequency 26.64%, followed by Coenagrionidae with 3 genera and frequency 19.99%; Lestidae and Gomphidae with only 2 genera and frequency 13.33%; while Calopterygidae, Aeshnidae, Cordulegastridae and Corduliidae have only 1 genera and frequency 6.66%.

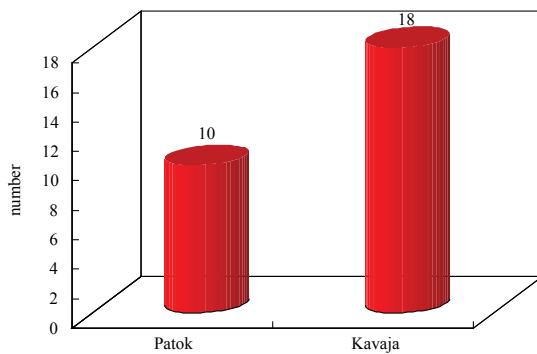
By analysing the diversity of Odonata order for Ishemi and Shkumbini delta rivers (Table 4 and Fig. 4), we concluded that Odonata species is presented with higher diversity habitats of aquatic environments surrounding the delta rivers with 18 species and frequency 78.26% of all encountered species, while in the environments across the Ishemi (Patoku) delta river with less encountered species, 10 species and frequency 43.47%. The lowest number of Odonata species in the environments close to the Ishemi delta river show that this area is more polluted compared to that of the Shkumbini delta river. It means that pollution has affected this area by decreasing the distributions of Odonata species.

**Table 4.** Distribution of number and percentages of encountered species according to the studied areas

Area	Number of species	Frequency of species (%)
Dl. Ishemi	10	43.47
Dl. Shkumbini	18	78.26
Total	23	100

**Table 5.** Common species and species coefficient

Area	Number of species	Number of common species
Patok	10	6
Kavaja	18	6



**Fig. 4.** Relation of number of species according to the studied areas

This pollution of aquatic environments decreases the distribution of Odonata species in the studied area to their necessity for not polluted area and well oxygenated waters<sup>2,4</sup>. Uncontrolled effluents of urban wastewaters of the Tirana and Durrwsi cities have considerable impact in contamination of this area.

Dumont<sup>14</sup> reported that *O. brunneum* and *O. anceps* were encountered on aquatic environments close to the Shkumbini delta river.

In order to give evidence of the environmental similarity for both habitats selected in this study, we evaluated the Jaccard index of similarity coefficient (measure similarity or coefficient de communauté)<sup>15</sup>.

By analysing the biological material of these two stations we concluded that only 6 species are founded on the both areas at the same time. The Jaccard index for these two areas is 26.08%. This means that these areas offer different environmental quality of habitats for the Odonata species.

## CONCLUSIONS

Our study shows that the order Odonata is represented with 23 species, 15 genera and 8 families, Anisoptera is represented by a bigger number of species, exactly 15 species with frequency of 62.51%, while Zygoptera is represented with only 8 species with a frequency of 34.78%. More represented is Libellulidae with 8 species, frequency 34.78% and 4 genera with frequency 26.64%. The Odonata represents a higher diversity across the habitats of the Shkumbini delta river with 18 species, or frequency 78.26%, while it was appeared to encounter only 10 species, or frequency 43.47% in the Ishemi delta river habitats. This indicates that the habitats of the Ishemi delta river are more polluted compared to those of the Shkumbini delta river. Uncontrolled discharges of urban wastewaters from the Durrresi and Tirana cities have a great impact on degradation of quality of the environment of this area. The number of the same species for both habitats is only

6, and the Jaccard coefficient of similarity was only 26.08%. This indicates that those habitats offer different conditions for Odonata species.

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