STUDIES OF DROSOPHILIDAE (DIPTERA) IN YUGOSLAVIA.
XIII. COLLECTIONS FROM APATIN AT DANUBE COAST

V. KEKIĆ1, M. ANDJELKOVIC1,2 AND G. BÄCHLI3

1 Institute of Zoology, Faculty of Biology, University of Beograd,
   Studentski trg 16, YU-11000 Beograd
2 Institute for Biological Researches "Siniša Stanković",
   29. novembra 142, YU-11000 Beograd
3 Zoological Museum, Winterthurerstrasse 190,
   CH-8057 Zürich, Switzerland

A total of 26 Drosophilidae species has been recorded in two ecologically different habitats near Apatin: at the Danube coast - 26 species, and 17 species in a nearby settlement with vegetable gardens and orchards. Also, a list of Drosophilidae species of former Yugoslavia has been increased to 58 species by Drosophila acuminata and Stegana similis, collected at the Danube coast.

KEY WORDS: Diptera, Drosophilidae, Apatin, the river Danube.

INTRODUCTION

This is the fourth paper in a series on Drosophilidae fauna researches along the Danube river in Yugoslavia (KEKIĆ et al., 1995, 1996a, b). The main presumption of those researches was that rivers have always been natural migratory paths for various organisms, and that the Danube, the largest European river (2857 km long), has had an exceptional role in that.

Today, through Maine - Rhine system, the Danube connects the North and the Black Sea, and through its tributaries, Tisa and Morava, it connects the Pannonian plane and the southern parts of Balkan Peninsula, various biogeographic areas and different habitats - some of them remaining "wild", while others being dramatically altered by human activities.
We believe that Drosophilidae fauna researches along the Danube river and its tributaries will contribute to a better knowledge of migratory paths and ecology of these organisms, and of the ecological condition of habitats (localities) observed, as well.

MATERIAL AND METHODS

Following the methodology applied in previous researches (KEKIĆ et al., 1995, 1996a, b), flies were collected in two ecologically different habitats: close to the Danube river, in a green belt along the river, and a little further in a nearby settlement.

Apatin is a small town, 1404 km far from the mouth of the Danube to the Black Sea. A habitat near the river is a flat bank overgrown with herbaceous vegetation, willows and poplars, in places interrupted by sand. At this habitat flies have been collected on June 16 and 17, September 6 - 8, 1989, and July 12 - 14, 1994. Baits have been placed 10 to 50 m far from the river.

Flies have also been collected in a nearby settlement in July 12 - 14, 1994. The habitat is about 200 m far from the first one described, separated by the levee, with orchards and vegetable gardens.

Flies have been collected by baits (fermenting fruits), distributed all over the habitats studied. At the time of maximum flies' activity (in the morning and evening) those ones attracted by bait have been captured by an entomological net; for more detailed description of collecting methodology see KEKIĆ et al. (1996c).

RESULTS AND DISCUSSION

The location of Apatin and other localities of the Drosophilidae fauna research along the Danube are presented on a sketch map (Fig. 1).

Flies are rather vagile organisms and they can, if they want to, travel few hundred meters per day in search for food, shelter, mate, site for oviposition, etc. (see e. g., TAYLOR et al., 1984). Considering that, flies have always been collected immediately near Danube and in a nearby, but ecologically different habitat.

Table I presents results of determination of flies collected at the locality Apatin. A total of 26 species has been recorded, 24 at the Danube bank and 17 in a nearby settlement.

According to our categorization of Drosophilidae habitats (KEKIĆ et al., 1996c), both habitats studied are semidomestic, with the presence of peoples' frequent activities, i. e. humans' constant immediate or indirect influence. Nevertheless, there exists a considerable difference in Drosophilidae species com-
position between habitat near the river, and the other one, 200 m away, assigned as settlement.

The difference is clearly illustrated by the proportion of synanthropic or domestic *Drosophila* species (Paterson & Stone, 1952; Dobzhansky, 1965; Parsons & Stanley, 1981) in each habitat. The proportion of those flies at the Danube bank has been 14%, and in a settlement over 44%. It is not surprising, for it is logically to expect a larger proportion of domestic species in a habitat with a larger influence of men.

On the other hand, it is well known that flies can differentiate habitats and microhabitats with the most suitable combination of ecological conditions at the time. In the field, in every real habitat, in the frame of potential area of daily
Table 1

Drosophilidae flies collected at the locality Apatin.

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>Danube coast</th>
<th>Settlement</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June/July</td>
<td>September</td>
<td></td>
</tr>
<tr>
<td>Amiota</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. seminivirgo</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chymomyza</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. amoena</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Drosophila</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. acuminata</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>D. ambiguca</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>D. bifasciata</td>
<td>10</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>D. busckii</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>D. confusa</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>D. fenestrarum</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>D. helvetica</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>D. hydei</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>D. immigrans</td>
<td>236</td>
<td>3</td>
<td>239</td>
</tr>
<tr>
<td>D. kundzei</td>
<td>2</td>
<td>365</td>
<td>367</td>
</tr>
<tr>
<td>D. limbata</td>
<td>17</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>D. littoralis</td>
<td>2</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>D. melanogaster</td>
<td>17</td>
<td>184</td>
<td>370</td>
</tr>
<tr>
<td>D. obscura</td>
<td>135</td>
<td>52</td>
<td>187</td>
</tr>
<tr>
<td>D. phalerata</td>
<td>29</td>
<td>221</td>
<td>250</td>
</tr>
<tr>
<td>D. ruffrons</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>D. simulans</td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>D. subobscura</td>
<td>995</td>
<td>853</td>
<td>1848</td>
</tr>
<tr>
<td>D. testacea</td>
<td></td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>D. transversa</td>
<td></td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>D. trisitis</td>
<td>2</td>
<td>10</td>
<td>42</td>
</tr>
<tr>
<td>Leucophaena</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. maculata</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Scaptomyza</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. pallida</td>
<td>5</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Stegana</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. similis</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1207</td>
<td>1971</td>
<td>4023</td>
</tr>
</tbody>
</table>

The names of the domestic *Drosophila* species are emphasized by bold letters.

Activity and motion of *Drosophila*, ecologically different microhabitats can be found, sometimes only at a few meters' distance. Different *Drosophila* species composition presents an indirect evidence that flies can recognize between them (Kečić & Marinković, 1979), while direct confirmation would be that even genetically different individuals of the same species prefer different microhabitats with different probability (for bibliography on the subject see Taylor & Powell, 1983; Taylor, 1987).
Table II

Drosophilidae species collected at five localities along the Danube coast.

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>Apatin</th>
<th>Sremska Kamenica</th>
<th>Stari Slankamen</th>
<th>Belgrade</th>
<th>Vinci</th>
<th>No. of local.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Amiota</em></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>1. <em>A. semivirgo</em></td>
<td>+</td>
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<td>3</td>
</tr>
<tr>
<td>2. <em>A. variegata</em></td>
<td></td>
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<td>1</td>
</tr>
<tr>
<td><em>Chymomyza</em></td>
<td></td>
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<td></td>
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<tr>
<td>3. <em>C. amoena</em></td>
<td></td>
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<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><em>Drosophila</em></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4. <em>D. acuminata</em></td>
<td>+</td>
<td></td>
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<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>5. <em>D. ambigua</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>6. <em>D. andalusiaca</em></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>7. <em>D. bifasciata</em></td>
<td>+</td>
<td></td>
<td></td>
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<td>5</td>
</tr>
<tr>
<td>8. <em>D. busckii</em></td>
<td></td>
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<td></td>
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<td>2</td>
</tr>
<tr>
<td>9. <em>D. cameraria</em></td>
<td>+</td>
<td></td>
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<td>1</td>
</tr>
<tr>
<td>10. <em>D. confusa</em></td>
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<td></td>
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<td>3</td>
</tr>
<tr>
<td>11. <em>D. deflexa</em></td>
<td>+</td>
<td></td>
<td></td>
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<td>1</td>
</tr>
<tr>
<td>12. <em>D. fenestrarum</em></td>
<td></td>
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<tr>
<td>13. <em>D. funebris</em></td>
<td></td>
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<td></td>
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<td>4</td>
</tr>
<tr>
<td>14. <em>D. helvetica</em></td>
<td>+</td>
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<td>4</td>
</tr>
<tr>
<td>15. <em>D. hydei</em></td>
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<td>4</td>
</tr>
<tr>
<td>16. <em>D. immigrans</em></td>
<td>+</td>
<td></td>
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<td>5</td>
</tr>
<tr>
<td>17. <em>D. kuntzei</em></td>
<td></td>
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<td>5</td>
</tr>
<tr>
<td>18. <em>D. limbata</em></td>
<td>+</td>
<td></td>
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<td>3</td>
</tr>
<tr>
<td>19. <em>D. littoralis</em></td>
<td></td>
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<td>2</td>
</tr>
<tr>
<td>20. <em>D. melanogaster</em></td>
<td>+</td>
<td></td>
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<td>5</td>
</tr>
<tr>
<td>21. <em>D. obscura</em></td>
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</tr>
<tr>
<td>22. <em>D. phalerata</em></td>
<td>+</td>
<td></td>
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<td>5</td>
</tr>
<tr>
<td>23. <em>D. repleta</em></td>
<td></td>
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</tr>
<tr>
<td>24. <em>D. rufifrons</em></td>
<td>+</td>
<td></td>
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<td>2</td>
</tr>
<tr>
<td>25. <em>D. simulans</em></td>
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<td></td>
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</tr>
<tr>
<td>26. <em>D. subobscura</em></td>
<td>+</td>
<td></td>
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<td>5</td>
</tr>
<tr>
<td>27. <em>D. testacea</em></td>
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<td></td>
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<td></td>
<td>5</td>
</tr>
<tr>
<td>28. <em>D. transversa</em></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>29. <em>D. tristis</em></td>
<td></td>
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<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td><em>Leucophenga</em></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>30. <em>L. maculata</em></td>
<td>+</td>
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<td></td>
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<td>1</td>
</tr>
<tr>
<td><em>Scaptomyza</em></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>31. <em>S. graminum</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>32. <em>S. pallida</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td><em>Steganha</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. <em>S. similis</em></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

No. of SPECIES 24  18  19  20  18

The names of the domestic *Drosophila* species are emphasized by bold letters.

Considering the facts mentioned above and the ecology of different Drosophilidae, it is possible to adequately characterize ecological condition of a
given habitat in a certain time, based on a proportion of synanthropic species in a collection, and to determine a degree of a habitat "contamination" by humans.

Two species new for the fauna of Yugoslavia have been captured at the locality Apatin: *Drosophila acuminata* Collin, 1952, and *Stegana similis* Lastovka et Maca, 1982 (a specimen of the latter one has been captured in August, 1980, at the Jastrebac Mt., Ravnište locality, determined as *D. similis* by Dr. J. Maca - unpublished record).

The list of Drosophilidae species recorded at the territory of former Yugoslavia, with those two species, counts 58 at the moment (KEKIĆ et al., 1996c).

Table II presents the main faunistic results of all our previous researches of Drosophilidae along the Danube.

A total of 33 species has been detected in semidomestic habitats, making 57% of all species recorded on the territory of former Yugoslavia. The number of species found differs in different localities. Some of the species are obviously rare and can be found only locally or occasionally, while others are very common, and can be found everywhere: *D. ambigua, D. bifasciata, D. immigrans, D. kunizei, D. melanogaster, D. phalerata, D. subobscura, D. testacea, D. transversa* and *Scapomyza pallida*. Regarding the presence of a large number of wild habitats along the Danube river (let us mention the exceptionally various landscapes in Iron Gate gorge in the National Park "Djerdap", or Kovilje Marsh or famous oak trees along the Danube) we believe that the number of species exceeds 33 to a large extent.

REFERENCES


ИСТРАЖИВАЊА DROSOPHILIDAE (DIPTERA) ЈУГОСЛАВИЈЕ.

XIII. КОЛЕКЦИЈЕ ИЗ АПАТИНА НА ОБАЛИ ДУНАВА

В. КЕКИЋ, М. АНЂЕЛКОВИЋ И Г. БАХЛИ

ИЗВОД

Почињући истраживања фауне Drosophilidae у стаништима на обали Дунава, пошли смо од чињенице да су ресне одувек биле природни путеви миграције различитих врста организама и да је Дунав (дугачак 2857 км) у европским миграцијама имао и има велику важну улогу.

Данас, преко система Рајна - Мајна - Дунав, повезано је Северно и Црно Море, а преко притока Дунава у Југославију, Тисе и Мораве, повезана је Пондска лизија на северу са јужним делом Балканско у полуострва - повезане су веома различите биогеографске области и еколошки различита станишта, од којих су нека велико драматично измењена и деградирана, а нека још увек релативно дивља и очувана.

Верујемо да истраживања фауне Drosophilidae мушци дуж тока Дунава могу да помогну бољим разумевању, како путева миграције ових организама и њихове екологије, тако и процене еколошког стања различитих станишта.

У овом, као и у свим нашим досадашњим радовима, мушки су ловљене уз помоћ супстрата за примамљивање (воћа у процесу врења) и ентомолошке мрежице (види Kekić et al., 1996c).
На Табели I су приказане резултати ловљења мушица у близини Апатина у два блиска, али еколошки различита станишта: непосредно уз Дунав, у зеленом појасу који прати реку и у повртарско-вођарском делу оближњег викенда насеља. Према нашој грбови класификацији станишта Drosophilidae, оба припадају групи полудоместичних (Кекић et al., 1996c). Укупно је уловљено 26 врста: на обали Дунава 24, а у насељу 17.


У досадашњим истраживањима фауне Drosophilidae на обали Дунава (Fig. 1 и Tab. II) откривено је укупно 33 врсте, а с обзиром да мноштво "дивља" и веома специфична еколошка станишта још нису истраживана (на пример, велики комплекси храстових шума у горњем току Дунава, ритови и мочваре код Петроварадина и Ковиља, или делови Дунава у оквиру Националног парка "Ђердан"), верујемо да ће број врста бити изненађујуће велики.

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