

The effects of fire on insect assemblages have been investigated in a few insect orders, including Hymenoptera, Lepidoptera, Collembola, Hemiptera, and Coleoptera (New, 2014). Nonetheless, different groups have been shown to become variously poorer and less abundant or richer and more abundant in burned than unburned ‘control’ patches. Such trends are difficult to predict because insect responses are affected by the geographic region, climatic conditions, fire regime, and intensity. Clearly, more research is needed to predict population and community dynamics, as well as ecosystem and global changes (Showalter, 2012). Drosophilids are good models for investigating the effects of disturbance on natural populations, because they are diverse, easily sampled, and sensitive to environmental variations. Here, we showed differences in assemblages between burned and unburned habitats based on abundance and richness of drosophilids. Future research should refine these results by increasing the geographical scale and including community analyses that consider not only abundance and richness but also species composition.

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Drosophilids of the Lake Urmia National Park, Iran (Dip.: Drosophilidae).

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Abstract

Drosophilid fauna of the Lake Urmia National Park was studied for the first time in the framework of an ongoing survey on the economically and veterinarily important flies of the Iranian national parks. A total of 10 species have been identified, of which the genus *Lordiphosa* Basden and the three species *Drosophila hydei* Sturtevant, *Lordiphosa andalusiaca* (Strobl), and *Scaptodrosophila lebanonensis* (Wheeler) are found to be new records for the Iranian fauna. The species *D. melanogaster* Meigen, *D. phalerata* Meigen, *D. simulans* Sturtevant, *D. subobscura* Collin, *Scaptomyza flava* (Fallén), *Scaptomyza pallida* (Zetterstedt), and *Zaprionus indianus* Gupta are first recorded from the park. A key to the drosophilids of the Lake Urmia National Park and images of the genitalia of each species are presented.

Introduction

The drosophilid fauna of Iran is poorly studied, being represented by only 25 species, none of which is recorded from the western provinces (Bächli, 2016). The northwestern province of West Azarbaijan borders

Turkey and Iraq to the west and Nakhchivan to the northeast and covers the west coast of the Lake Urmia. Except for a handful of recorded species (Asem *et al.*, 2016), the insect fauna of the Lake Urmia National Park and its islands have remained largely unknown. Due to mismanagement and habitat loss, Lake Urmia has been devastatingly shrunk over the past decades risking the lives of the local people and endangering the lake's fauna and flora. The insect fauna of the Lake Urmia National Park deserves a thorough investigation through which the fragility of the park's ecosystem and the need for sound and effective remedial measures can be underlined.



Figures 1–2. General views of the two collecting sites at the Lake Urmia National Park. 1, Rashakan and the dry bed of the Lake Urmia; 2, Kaboudan Island.

Material and Methods

Using Malaise traps and pan traps, we have assembled a sizable collection of flies including drosophilids at two locations in the province of West Azarbaijan. The traps were set up in the vicinity of Rashakan village (Figure 1) and Kaboudan Island (Figure 2). The fly specimens are preserved at the Hayk Mirzayans Insect Museum (HMIM), Tehran, Iran.

Localities

Rashakan: Rashakan is a village located 35 km south of the provincial capital city of Urmia. Malaise traps were run from 8 July to 6 September 2016 through the grounds of the Research Station for the Lake Urmia National Park, seated at an elevation of 1315 meters above sea level, on the fringe of the village, in a mixed-fruit orchard close to the coast of the lake (37°20'38.8"N 045°17'37.4"E).

Kaboudan Island: Kaboudan is the largest island of the Lake Urmia National Park. The area of the island is about 3175 hectares (7846 acres) and tightly protected for being home to a number of vulnerable wild bird and animal species. Malaise traps were used from 19–24 June 2016 at an altitude of 1322 meters (37°29'42.7"N 045°38'13.9"E).

Results

We here record 10 drosophilid species, which, except *D. melanogaster*, are all new to the west of Iran including the province of West Azarbaijan and the Lake Urmia National Park. The genus *Lordiphosa* Basden is newly recorded from Iran. The species *Drosophila hydei* Sturtevant, *Lordiphosa andalusiaca* (Strobl), and *Scaptodrosophila lebanonensis* (Wheeler) are recorded from Iran for the first time. The remaining species are as follows: *Drosophila phalerata* Meigen, *Drosophila simulans* Sturtevant, *Drosophila subobscura* Collin, *Scaptomyza flava* (Fallén), *Scaptomyza pallida* (Zetterstedt), and *Zaprionus indianus* Gupta.

Key to the drosophilids of the Lake Urmia National Park

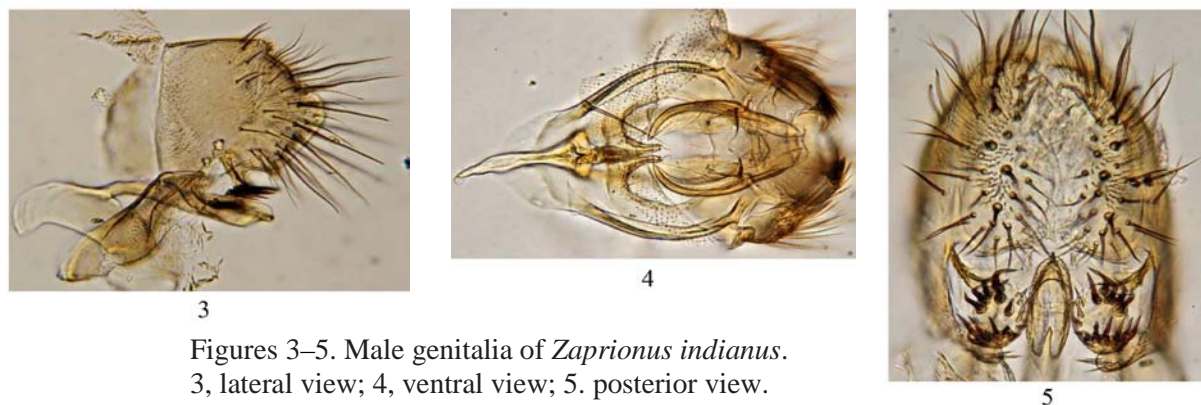
The following key is primarily based on the key in Bächli *et al.* (2004) and includes all recorded drosophilid species of the park. Images of genitalic characters have been provided to enhance the accuracy of the identifications.

- 1 Mesonotum, scutellum and orbital plates with longitudinal stripes surrounded by black lines; fore femur with a row of setae combined with basal spines (4♂♂, 5♀♀ Rashakan) (Figures 3–5)

.....*Zaprionus indianus* Gupta
 [a polyphagous fruit pest attacking almost 80 plant species that has been spreading rapidly throughout the country since its arrival in 2008 (Parchami-Araghi & Mohammadi-Khorramabadi, 2009)]

- 1' Mesonotum, scutellum and orbital plates without longitudinal stripes; fore femur without composite spines

.....2



Figures 3–5. Male genitalia of *Zaprionus indianus*. 3, lateral view; 4, ventral view; 5, posterior view.

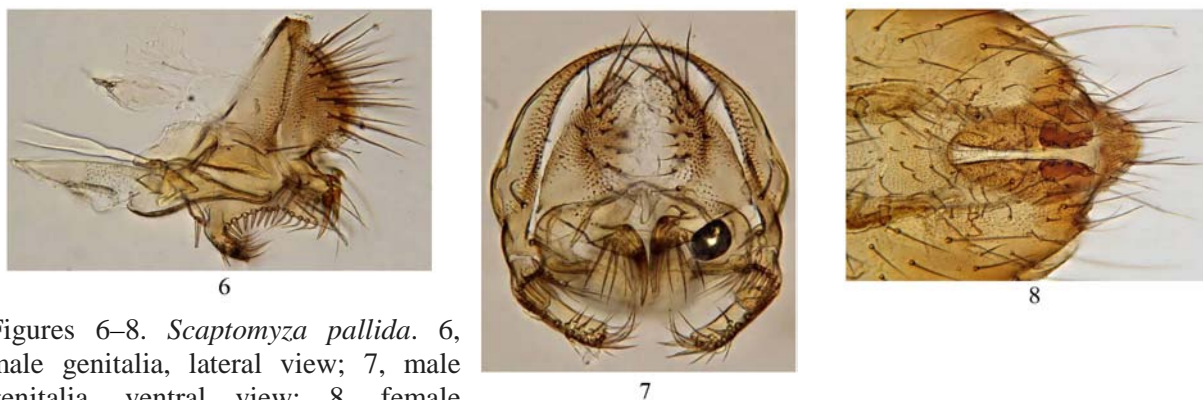
- 2 2–4 rows of acrostichal setae; 2 katepisternal setae.....3

.....*Scaptomyza* Hardy

- 2' 4–8 rows of acrostichal setae; 3 katepisternal setae.....4

- 3 2 rows of acrostichal setae (1♂, 1♀ Rashakan; 1♀ Kaboudan Island) (Figures 6–8)

.....*Scaptomyza pallida* (Zetterstedt)
 [a saprophagous fly that serves as a secondary pest in canola fields in the Caspian Sea provinces of Iran (Parchami-Araghi *et al.*, 2015, *in press*)]



Figures 6–8. *Scaptomyza pallida*. 6, male genitalia, lateral view; 7, male genitalia, ventral view; 8, female postabdomen including sclerotized oviscaps, ventral view.



9



10



11

Figures 9–11. Male genitalia of *Scaptomyza flava*. 9, lateral view; 10, ventral view; 11. posterior view.

- 3' 4 rows of acrostichal setae (1♂, Rashakan) (Figures 9–11)
*Scaptomyza flava* (Fallén)
 [a leaf-miner of gypsophila and brassicas (Martin, 2004)]
- 4 Median katapisternal seta at most half as long as anterior one; carina developed; prescutellar acrostichal setae absent.....5
*Drosophila* Fallén
- 4' Median katapisternal seta at least as long as anterior one; carina absent or present; prescutellar acrostichal setae absent or present.....9
- 5 Marginal bands on abdominal tergites uniform and complete.....6
- 5' Marginal bands on abdominal tergites medially narrowed or interrupted.....8



12



13



14



15

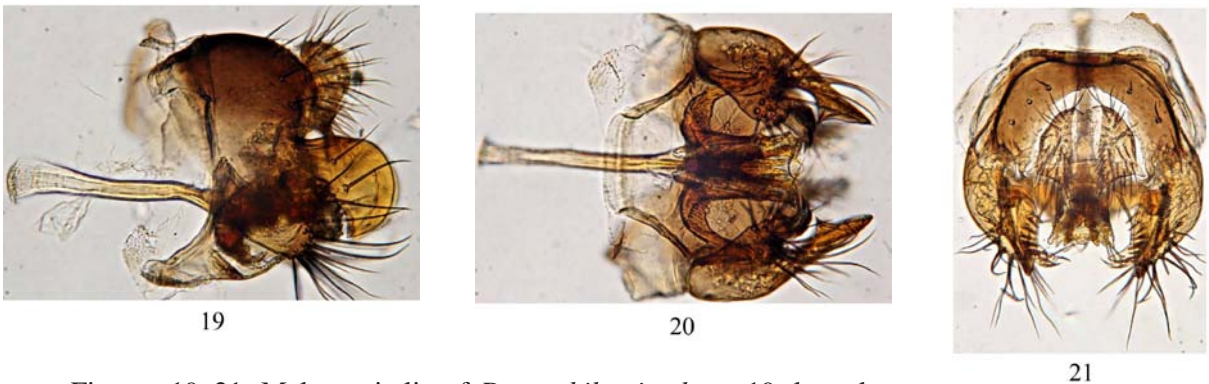
Figures 12–15. *Drosophila subobscura*. 12, male genitalia, lateral view; 13, male genitalia, ventral view; 14, male genitalia, posterior view; 15, sex combs on protarsomeres 1-2 of male.

- 6 Both protarsomeres 1 and 2 in male with distinct sex combs; wing slightly darkened along vein Costa in apical half (2♂♂, Rashakan) (Figures 12–15)
*Drosophila subobscura* Collin
 [Its larvae cause problems in wineries, breweries, and distilleries by feeding on grapes, but at the same time transfer wild yeasts that give rich bouquet (Bächli, 2004).]
- 6' Only protarsomere 1 in male with a distinct sex comb; wing hyaline.....7



Figures 16–18. Male genitalia of *Drosophila melanogaster*. 16, lateral view; 17, ventral view; 18, posterior view.

- 7 Gena about 1/10 of large eye diameter; male dorsal branch of epandrial ventral lobe triangular and pale in lateral view (12♂♂, 18♀♀ Rashakan) (Figures 16–18)
*Drosophila melanogaster* Meigen
 [a saprophagous, cosmopolitan species]
- 7' Gena about 1/20 of large eye diameter; male dorsal branch of epandrial ventral lobe quite roundish and amber in lateral view (3♂♂ Rashakan) (Figures 19–21)
*Drosophila simulans* Sturtevant
 [closely related to *D. melanogaster* in both external morphology and habitat]



Figures 19–21. Male genitalia of *Drosophila simulans*. 19, lateral view; 20, ventral view; 21, posterior view.

- 8 Wing crossveins R-M and dM-Cu brown and narrowly shadowed; abdominal tergites 2–4 each with 4 partially isolated or narrowly connected brown, more or less triangular spots (3♂♂ Rashakan) (Figures 22–24)
*Drosophila phalerata* Meigen
 [Its larvae breed in fungus (Bächli 2004).]
- 8' Wing crossveins hyaline, abdominal tergite bands medially interrupted, laterally broadened; male with elongated setae on inner side of protarsus (12♂♂, 11♀♀ Rashakan) (Figures 25–27)*Drosophila hydei* Sturtevant
 [a new species record for Iran. Its larvae breed in spoiled fruit and decaying potatoes and adults invade houses, farmhouses, and grocery stores to become nuisances to the inhabitants (Bächli, 2004)]



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Figures 22–24. Male genitalia of *Drosophila phalerata*. 22, lateral view; 23, ventral view; 24, posterior view.



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Figures 25–27. Male genitalia of *Drosophila hydei*. 25, lateral view; 26, ventral view; 27, posterior view.

- 9 Median katapisternal seta longer than anterior one; face flat, carina almost absent; prescutellar acrostichal setae absent; abdominal tergites 2–4 each with a pair of posterolateral dark bands (1♀ Kaboudan Island) (Figures 28–29)

.....*Lordiphosa andalusiaca* (Strobl)

[new genus and species records for Iran]

- 9' Median katapisternal seta almost as long as anterior one; face with a bulbous carina; prescutellar acrostichal setae short; abdomen dark brown (2♂♂ Rashakan) (Figures 30–32)

.....*Scaptodrosophila lebanonensis* (Wheeler)

[a new species record for Iran]



28



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Figures 28–29. Female of *Lordiphosa andalusiaca*. 28, habitus, lateral view; 29, postabdomen, including oviscap, lateral view.



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31



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Figures 30–32. Male genitalia of *Scaptodrosophila lebanonensis*. 30, lateral view; 31, ventral view; 32, posterior view.

Conclusion

The existing work is considered a preliminary report on the family Drosophilidae of the Lake Urmia National Park as our current findings suggest the high diversity of the flies in the park that requires further faunistic studies in the future. We are planning to set up traps in other areas of the park including Ashk, Espir, and Arezoo islands in addition to Rashakan and Kaboudan Island.

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