BIS HEALTH AND ENVIRONMENTAL SCIENCE

Volume 2 2025 | DOI: 10.31603/bishes.242
6th Borobudur International Symposium on Science and Technology (BIS-STE) 2024

UNIMMA PRESS
Universitas Muhammadiyah Magelang

Hover flies (diptera, syrphidae) are pollinators of species of the genus *ferula* l. 1753 in Uzbekistan

U.U. Usanov[1*], M.R. Rakhimov[1], A.R. Jabborov[1], Sh.S. Anorboyeva[2]

[1] Samarkand State University, Samarkand, Uzbekistan
[2] University of Economics and Pedagogy, Karshi, Uzbekistan
[*]Corresponding author email: usanov0892@gmail.com

Abstract

Perennial grasses of the genus *Ferula* L. 1753 plays an important role in the ecosystems of Central Asia. They are among the most common and prominent plants in various ecosystems in this region. Since their main route of distribution is seeds, the production of seeds that depend on pollinators is crucial to maintaining biodiversity in the region. Our research focuses on studying the pollinators that help these plants reproduce. In this article, we aim to explore the relationship between *Ferula* plants and the species of hoverflies that act as their pollinators [1]. We conducted our research in Central and Southern Uzbekistan. We have captured 93 species of hoverflies belonging to 33 different genera that visit the flowers of six *Ferula* species using a standard entomological net. Our research shows that the species and abundance of these flies vary among different *Ferula* species. These differences are influenced by factors such as plant diversity, inflorescence shape, and height.

Keywords

Ferula, Pollinators, Syrphidae, Diptera

Introduction

The genus *Ferula* L. includes perennial grasses widespread in Central Asia [2]. One of the features of this genus is that a significant part of the species in it are monocarpic (flowering and seed formation occur only once during its ontogenesis) [3]. The main importance of representatives of the genus in the national economy is associated with the resin obtained from it [4]. Nurseries where *Ferula* is grown have been established in Uzbekistan in order to bring the production of this resin to an industrial scale, 9 species of the genus are listed in the Red Book of Uzbekistan and taken under protection [5]. The *Ferula* blooms, forming a large yellow or white inflorescence that attracts a large number of insects. The fact that many members of this genus are monocarpic shows how important the role of natural insect pollinators is for the preservation of their natural populations, as well as for the productivity of nurseries [6]. The volume of research on the entomofauna of this genus is small. In Uzbekistan, these studies have

Published:
May 26, 2025

Selection and Peer-review under the responsibility of the 6th BIS-STE 2024 Committee

been conducted with respect to the entomofauna of *F. assa-foetida* in the conditions of Kyzylkum [7], [8]. Entomofauna of *F. kuhistanica* were studied in the Zarafshan range [9], [10], [11] and in the conditions of the Hissar range [12]. In this study, we tried to analyze the relationships of some species of the genus *Ferula* with representatives of the family Syrphidae, that is, with family [12], which are the most diverse and important pollinators among Diptera. It turned out that the fauna of pollinators of different *Ferula* species differ at different taxonomic levels.

Method

The research was conducted mainly in the Central (Jizzakh, Samarkand, Navoi, and Bukhara) and Southern (Kashkadarya and Surkhandarya) regions of Uzbekistan. The study took place in deserts, foothills, mountains, and subalpine areas at altitudes ranging from 150 to 3,400 meters above sea level (Figure 1). The species of flies collected were determined, their number was calculated, and a collection was assembled. Insects were captured using a standard entomological net as they landed on or flew around a Ferula inflorescence. In total, more than 700 samples of hoverflies were collected and processed during the study. The species was determined by the second author using the determinants of Barkalov and Peck [13], [14] and Stackelberg [15]. The collected beetle collection is kept in the entomological collection of Samarkand State University. Diagrams created by Origin Pro software.

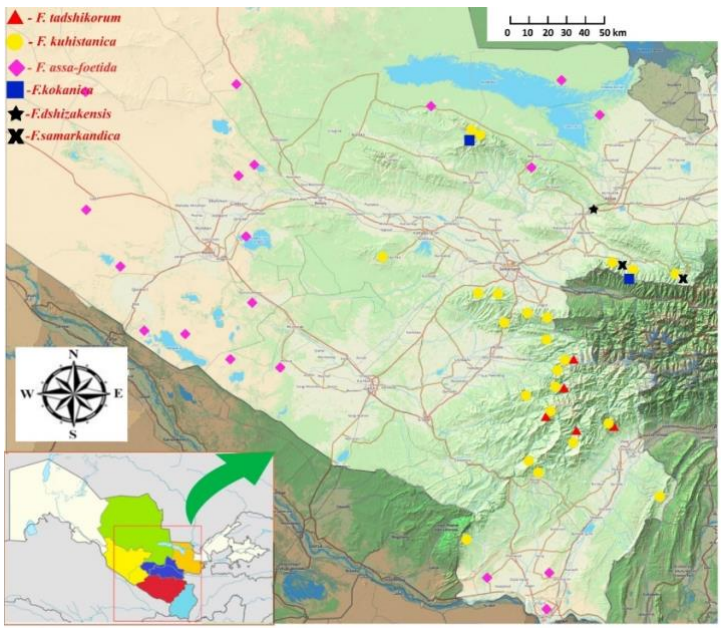

Figure 1. Studied Ferula species and their distribution areas

Results and Discussion

Results

In total, 93 species of hover flies belonging to 33 genera were found in the collected material. Most of them belong to 2 subfamilies Eristalinae (48 species) and Syrphinae

(43), while only one species of the Pipizinae subfamily (*Pipizella mesasiatica*) has been recorded.

It is known from the results of studying the anthecology of individual plant species that pollination efficiency is influenced not only by the number of pollinators, but also by diversity, that is, the higher the diversity of pollinators, the more effective pollination [16]. We found that representatives of 13 tribes are associated with the studied plants. (Figure 2) Tribes differ in the number of species, as well as in the abundance of individuals. Some fungi, such as Syrphini, being diverse (28% of the total number of species belong to this tube), account for only 10% of the individuals visiting the *Ferula*. In contrast, the genus *Paragus* accounts for 8% in terms of species diversity and 18% in terms of abundance of individuals. This condition is also observed in the Chrysogasterini and Cheliosini tribes.

According to the results of observation of some species associated with hover flies, it can be said that among them, *F. kuhistanica* turns out to be the most attractive for hover flies. 53 species of hover flies belonging to 23 genera have been recorded on this plant. Next comes *F. tadshikorum*, 45 species of hover flies have been recorded in the inflorescences of this species, which belong to 22 genera. Widespread in desert and xerophilic regions, *F. assa-foetida*, although found in biotopes with low diversity, attracts relatively more species due to the fact that it is an extremely prominent element of these biotopes. 31 species of hover flies from 15 genera have been recorded in the inflorescence of this plant. *F. samarkandica*, *F. kokanica* and *F. dshizakensis*, 34, 17 and 22 species of hover flies have been recorded, respectively. The differences in them are obvious when analyzing the composition of pollinators according to the tribes noted in these *Ferula* species (Figure 3).

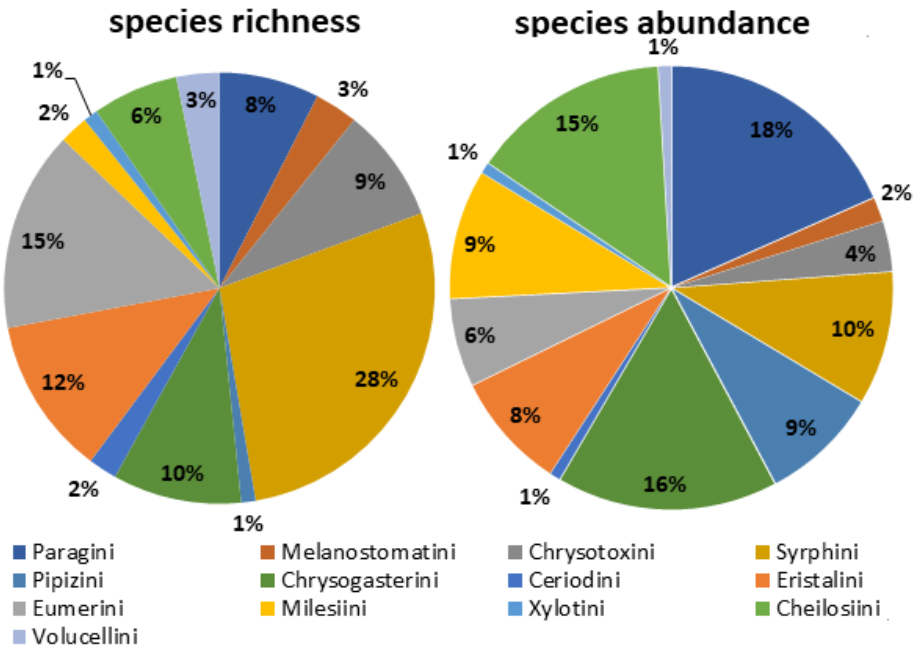

Figure 2. Species richness and species abundance of Ferula polllinator hover flies tribes

Discussion

The analysis of the collected material showed that the composition of diptera pollinators of species of the genus *Ferula* is largely related to the characteristics of the altitude zone and the biotope in which the plant grows, and it cannot be unequivocally said that there are diptera pollinators that depend on a particular plant species. It has been observed that the same insect species can occur in all ferule species found in different high-altitude areas and in the same biotopes.

Species of the genus *Ferula* L. They are quite common, they are found in almost all steep regions, as part of a diverse group of plants. The distribution of species of the genus *Ferula* by altitude zones proposed by K.Z. Zakirov (1962) are as follows: *F. kokanica* in mountainous and pasture areas, *F. assa-foetida* in desert, foothill and mountainous areas, *F. tadshikorum* in foothill and mountainous areas, *F. kuhistanica* in foothill, mountainous and subalpine areas, *F. dshizakensis* in foothills and in mountainous areas, *F. samarqandica* is distributed in foothill, mountainous and pasture areas [17].

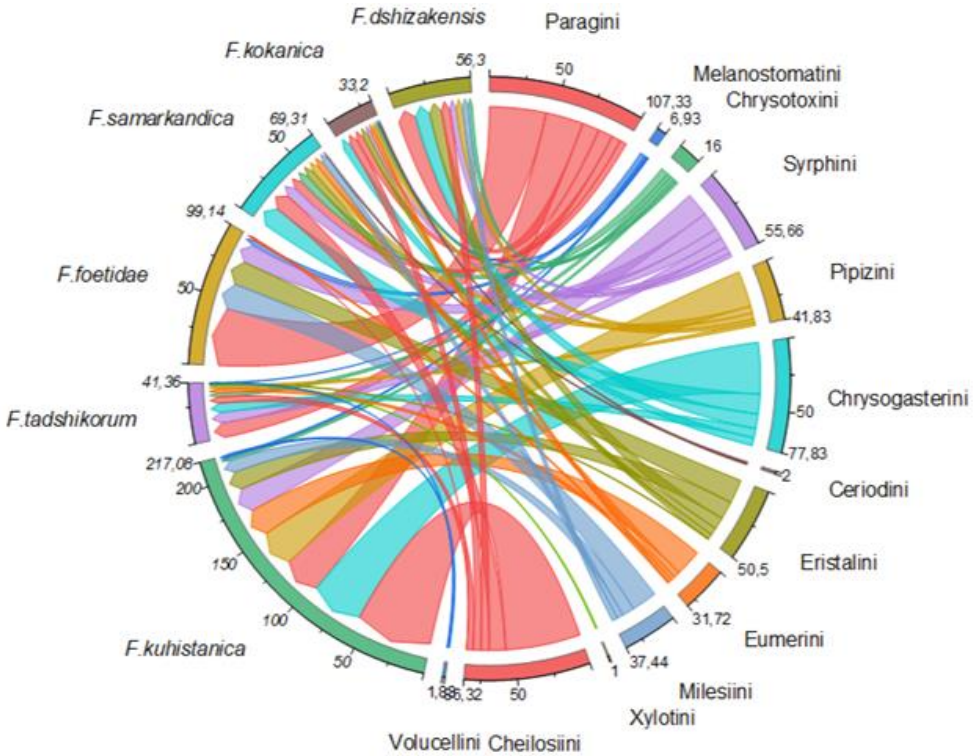

Figure 3. Distribution of pollinators by tribe in different *Ferula* species

The species of hover flies noted in them also correspond to these regions. For example, representatives of the genera *Ischiodon, Eristalinus, Mythropa* characteristic of deserts, tugai and other lowland areas are found only in *F. assa-foetida* [12]. The genus *Rohdendorfia*, characteristic of high-altitude areas, was recorded only in *F. tadshikorum*, which grows at high altitudes [18]. Differences in pollinator hover flies between *F. kuhistanica* and *F. samarqandica* distributed at relatively similar heights can be explained by morphological differences between these plants. Inflorescence *F. kuhistanica* consists of large dense inflorescences, as a result of which it seems to attract insects more [18], [19].

Conclusion

Thus, the taxonomic composition of the fauna of syrphid pollinators of different species of the genus Ferula is influenced by the shape of the inflorescence and the nature of the biotope in which these plants grow, due to the climatic conditions of the area.

References

[1] O.N. Avalbaev, U.N. Usanov and N.U. Umirov, "The pests of ferula genus plants distributed around the Aydar-Arnasay lake system" Life Sciences and Agriculture, pp. 24-27 2020. (In Uzbek)

[2] A.V. Barkalov, V.A. Mutin, D.B. Daminova and M.R. Rakhimov, "New species of the genus Eumerus Meigen, 1822 (Diptera, Syrphidae) from Central Asia" Far Eastern Entomologist vol. 417, pp. 1 – 7, 2020. https://doi.org/10.25221/fee.417.1

[3] A.V. Barkalov, L.V. Peck, "Hover flies of the genus Cheilosia (Diptera, Syrphidae) Central Asia. 2. The determinant," Zoological Journal, vol. 76. No. 12. pp. 1370-1380. 1997. (In Russian)

[4] A.G. Davletshina and M.A. Radzivilovskaya, "Entomofauna of Kavrak" Uzbek biololgical magazine, No. 1. pp. 57-62. 1965 (In Russian)

[5] K. Faegri and L. van der Pijl, The principles of pollination ecology. Oxford; New York: Pergamon Press, 1979 XII, 244 p.

[6] F.Khalimov, M. Rakhimov, R. Khamzaev, E. Abdullaev, and U. Usanov, "Composition and structure of the entomofauna of Ferula (Ferula kuhistanica) in different sections of the Zarafshan Ridge," Journal of the Entomological Research Society, 25(2), pp. 275-286. 2023 https://doi.org/10.51963/jers.v25i2.2287

[7] E.P. Korovin "Illustrated monograph of the genus Ferula (Tourn.) L." Tashkent. Publishing house of the Academy of Sciences of the UzSSR. 1947. (In Russian).

[8] I.U. Mukumov, N.R. Usmonova, and M.A. Nurmuratova "Genus Ferula L. in the flora of the Turkestan Range" Science Bulletin No. 1 (22) vol. 2. pp. 268 - 274. 2020. (In Russian)

[9] U. Rahmonkulov and O. Avalboev, Ferulas of Uzbekistan. - Tashkent. Science and Technology, 2016. p. 244 (in Uzbek)

[10] M.R. Rakhimov "To the fauna of hoverflies (Diptera, Syrphidae) of the Zarafshan Range" Bulletin of Khorazm Academy of Mamun, vol. 70 No. 1 pp. 49-54 2021 (In russian)

[11] M.R. Rakhimov "Consortial relationships of hoverflies with flowering plants in the conditions of central and southern Uzbekistan," Food security: national and global issues, No. 4 pp. 32-39, 2023 (In Russian)

[12] M.R. Rakhimov "Check list of hover flies (Diptera, Syrphidae) of west part of Zarafshan mountain ridge," Acta Biologica Sibirica vol. 9: pp. 167–193. 2023. https://doi.org/10.5281/zenodo.7835401

[13] M.R. Rakhimov, F.Z. Khalimov, R.A. Hamzaev, E.N. Abdullaev, and U.N. Usanov "Ecological analysis of the ferula entomofauna (Ferula kuhistanica) in different areas of the Zarafshan ridge" Uzbek Biological Journal, vol. 3, pp. 44-51, 2021 (in Russian)

[14] M.R. Rakhimov and G.F. Shodieva, "Hoverflies (Diptera, Syrphidae) of the tugai forests of central and southern Uzbekistan," Scientific Bulletin of NamSU, issue 7. pp. 136-140, 2022 (in Russian)

[15] O.T. Sobitov, Sh.H. Abdumalikov, B.A. Karimov, B.K. Karimov, and Z.O. Yusupov "Distribution and conservation status of Ferula L. species included in The Red Book of Uzbekistan," Scientific bulletin of Namangan State University, vol. 5. pp. 242–245. 2024

[16] A.A. Stackelberg, "Palaearctic species of the genus Eumerus Mg. (Diptera, Syrphidae)," Horae Societatis Entomologicae Unionis Soveticae, vol. 48: 181–229. 1961. (In Russian)

[17] D.L. Wagner, "Insect Declines in the Anthropocene," Annual Review of Entomology, vol. 65, pp. 457-480, 2019 https://doi.org/10.1146/annurev-ento-011019-025151

[18] M. Yamamoto, C.I. Silva, S.C. Augusto, A.A. Barbosa and P.E. Oliveira, "The role of bee diversity in pollination and fruit set of yellow passion fruit (Passiflora edulis forma flavicarpa, Passifloraceae) crop in Central Brazil" Apidologie vol. 43, pp. 515-526, 2012

[19] K.Z. Zakirov Flora and vegetation of the Zarafshan river basin - Tashkent. Ed. Academy of Sciences of the UzSSR, 1955. 1, 207 p. 1962, 2, 446 pp. (In Russian).