Does traffic intensity affect insect communities? Impact on pollinator mortality

Tea Skendžić[1*], Sanja Veselić[1], Andrijana Andrić[2], Dušanka Vujanović[2], Maja Arok[2], Tamara Tot[1], Sonja Mudri-Stojnić[1] and Ante Vujić[1]

[1]University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia; tea.skendzic@dbe.uns.ac.rs

[2]University of Novi Sad, BioSense Institute- Research and Development Institute for IT biosystems, Dr Zorana Đinđića 1, 21000 Novi Sad, Serbia

INTRODUCTION AND AIM

Pollinators play a critical role in maintaining ecosystem functionality and supporting global food security; however, their populations are experiencing significant declines driven by factors such as habitat degradation, pesticide exposure, climate change, pathogenic pressures, and landscape fragmentation.

Newly arising threats, such as traffic, may serve as significant local factors contributing to the decline of pollinator populations. Road construction presents an increasing threat to pollinators by directly contributing to habitat fragmentation. Additionally, pollinators face risks from road traffic.

This study aimed to contribute to our understanding of the impact of traffic on the abundance of insects (due to direct collision) and examine the differences in their presence in minor and major roads, focusing on two groups of pollinators — bees and butterflies.

MATERIALS AND METHODS

Insects were examined at 24 localities in northern Serbia during three seasons in 2023, along two types of roads (12 minor and 12 major road types) within areas dominated by either agricultural or semi-natural habitats. To measure the direct insect mortality caused by traffic, sticky traps measuring 10cm x 25cm were attached to a car, which was driven along the 1.25km stretch of road in both directions at a constant speed of 60km/h (Fig 1).

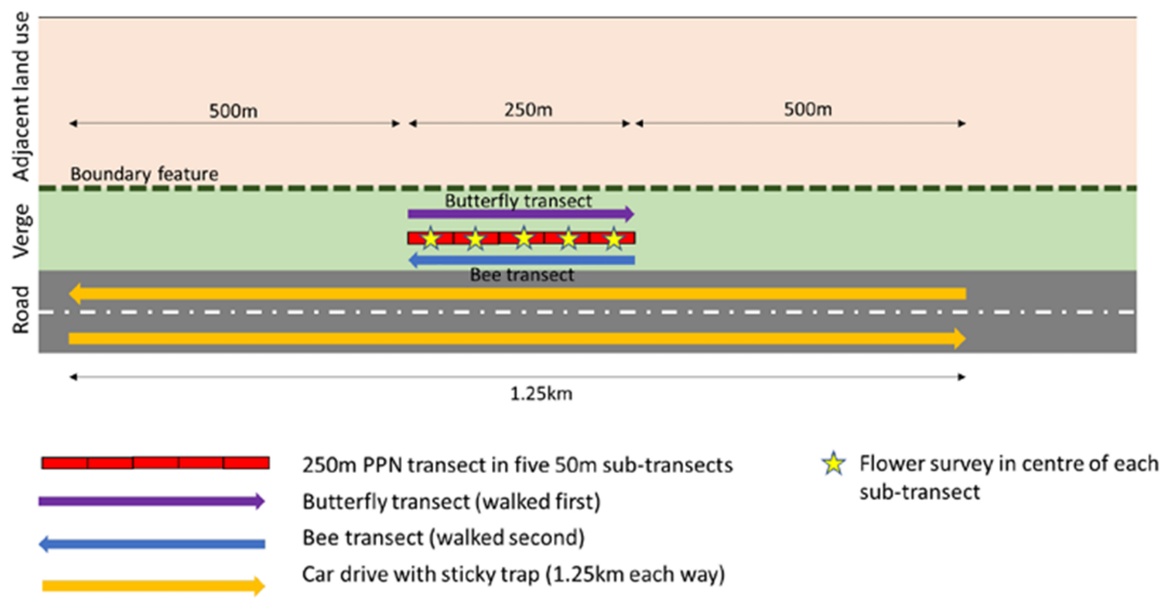

Fig 1. Schematic showing the location of the walking and car experiment, with verge, boundary feature and adjacent land use (Credit : Safeguard Task 2.6 (ii) Traffic study)

RESULTS AND DISCUSSION

A total of 476 insect specimens were documented on sticky traps, including only six bees and two butterflies. Hymenoptera, especially parasitoid wasps, were the insects most affected by traffic, accounting for up to 25% of the total number of insects caught on traps (Fig 2). These findings suggest that traffic may have a greater effect on the mortality of smaller insects.

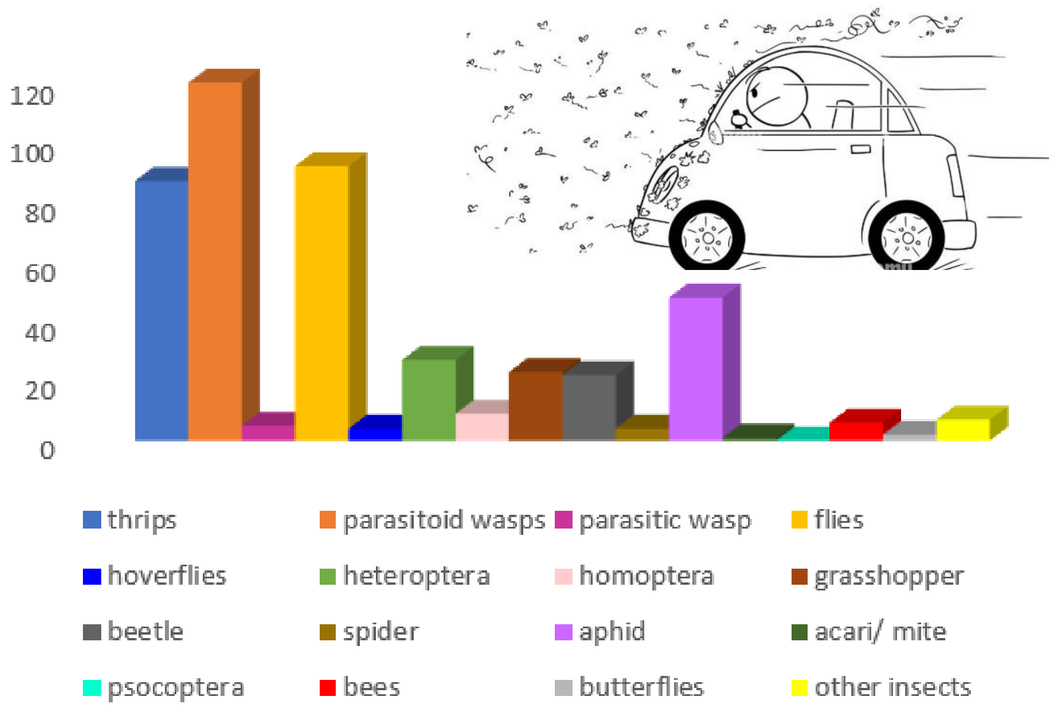

Fig 2. Diversity of insect specimens captured on sticky traps

Insect counts were 14% higher on sticky traps on minor roads compared to major roads, with 75% of targeted pollinators recorded on minor roads (Fig 3).

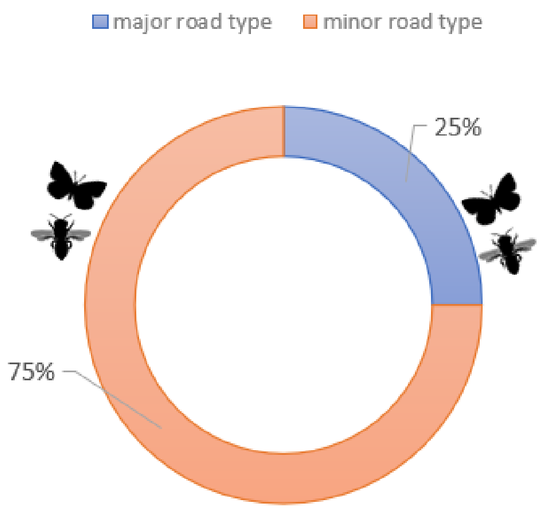

Fig 3. Percentage of target pollinators captured on sticky traps along minor and major road types

CONCLUSION

- The traffic poses a greater risk to smaller insect, such as parasitoid wasps, while bees and butterflies appear less affected by direct collisions.
- Insect abundance was higher on minor roads, particularly those in semi-natural landscapes, highlighting the importance of road type and surrounding habitat in shaping insect communities.
- Further studies should explore the long-term effects of traffic on different insect taxa, the role of road verge vegetation quality, and effective management strategies to enhance pollinator habitats along roadsides.

Acknowledgments

This paper is supported by the EU's Horizon 2020 R&I program under grant agreement No. 101003476, project Safeguard and the Ministry of Science, Technological Development and Innovation of the RS (Grants No. 451-03-66/2024-03/200125, 451-03-65/2024-03/200125 & 451-03-66/2024-03/200358).

References:

1. Klein, A.-M., Vaissière, B. E., Cane, J. H., Steffan-Dewenter, I., Cunningham, S. A., Kremen, C., & Tscharntke, T. (2007). Importance of pollinators in changing landscapes for world crops. Proceedings of the Royal Society B: Biological Sciences, 274(1608), 303–313
2. Potts, Simon G., Jacobus C. Biesmeijer, Claire Kremen, Peter Neumann, Oliver Schweiger, and William E. Kunin. (2010) Global pollinator declines: trends, impacts and drivers. Trends in ecology & evolution 25(6), 345-353
3. Fitch, G., & Vaidya, C. (2021). Roads pose a significant barrier to bee movement, mediated by road size, traffic and bee identity. Journal of Applied Ecology, 58(6), 1177–1186
4. Muñoz, P. T., Torres, F. P., & Megías, A. G. (2015). Effects of roads on insects: a review. Biodiversity and Conservation, *24*, 659-682