Sustainability and Biodiversity Conservation

Experience of using a Malaise trap to analyze the seasonal activity of some insects

Mikhail N. Esin
Joint Directorate of the Mordovia State Nature Reserve and National Park «Smolny», Russia
Email: esinmishka@gmail.com

Received: 17 July 2022 / Revised: 28 September 2022 / Accepted: 01 October 2022/ Published online: 02 October 2022.
How to cite: Esin, M.N. (2022). Experience of using a Malaise trap to analyze the seasonal activity of some insects. Sustainability and Biodiversity Conservation, 1(1), 84-88**. DOI:** https://doi.org/10.5281/zenodo.7135083

Abstract
Various methods of insect catching are used to monitor seasonal activity. The Malaise trap is not always popular with researchers because it is bulky and difficult to maintain. Seasonal experiments were conducted to analyze the possible use of the Malaise trap in studying the activity of four groups of insects: Orthoptera, Hemiptera (Heteroptera), Mordellidae (Coleoptera), Asilidae (Diptera). From May to October 2021, 914, 101, 662, and 173 individuals were recorded in the Malaise trap, respectively. For all groups, except Hemiptera, the maximum abundance during the season was revealed. The Malaise trap can be successfully used to study the seasonal dynamics of the number of species of different insect groups.
Keywords: insects, insect collection methods, seasonal population dynamics, traps

Introduction

Insect monitoring and studies of insect fauna are necessary factors for making decisions regarding integrated pest control. Monitoring requires a lot of time and costs. The most diverse methods of capturing insects are used to monitor insects. Recently, systems that can significantly reduce the cost of comprehensive pest control programs by automatizing time-consuming operations for monitoring insect populations have appeared. In addition, such systems will provide producers with unprecedented real-time, high-resolution insect population data (Holguin et al., 2010). However, traditional methods of catching insects are still relevant. Entomologists widely use pitfall traps, green Lindgren funnel traps, suction traps, light traps, flight in-perception traps, and bait traps (Jalas 1960; Taylor, 1962; Dobony, Edwards, 2001; Alexeev, Aleksanov, 2017).

Among such methods of catching insects, the Malaise trap is popular. At all times, it has been an indispensable tool for taxonomists and collectors of insects. It was used as a tool to increase the catch and collect rare or ephemeral representatives. Many variants have been developed, and most of them are aimed at making the trap more portable and/or effective for collecting a certain group of insects (Jackman, Nelson, 1995; Skvarla et al., 2021). However, to date, the Malaise trap has received little attention in environmental studies. In our opinion, it has significant potential in almost any field study involving flying insects, especially in environmental studies. In this

article, attention was paid to the seasonal activity of some insect groups, which were studied using the stationary Malaise trap.

Materials and methods

The material was collected in 2021 in the central part of European Russia (on the territory of the Mordovia State Nature Reserve, Republic of Mordovia). It is located on the wooded right bank of the Moksha River. From the north, the border runs along the river the border goes along rivers Chernaya, Satis, and Moksha. Forest-steppe approaches from the south, naturally delineating the boundary of the protected area. According to the natural zoning, the forest area of the reserve is included in the zone of coniferous-deciduous forests on the border with the forest steppe. The climate is continental. The frost-free period lasts 120-135 days (from the beginning of May to the second half of September). The stable sub-zero temperature is in November. The maximum absolute temperature is 40°, and the minimum is -48° (winter 1978-1979). An average of 530 mm of precipitation falls per year.

The Malaise trap was installed in a large clearing in the center of the forest (coordinates 54.7277°N 43.1510°E). The clearing is surrounded on three sides by broad-leaved and mixed forests. On one side it is bounded by the shore of Lake Inorskoye (Fig. 1). Thus, there is a significant variety of biotopes in the clearing where the trap was installed.

Figure 1. The Malaise trap was installed in a clearing.

The studies were conducted from May to October. Collecting from the trap was done regularly with a frequency of 2 to 10 days. To obtain relative values, all calculations were presented by individuals/day. Insects were determined to the order or to the family.

Results and discussion

In the experiments, the number of all individuals of Orthoptera, Hemiptera (Heteroptera), Mordellidae (Coleoptera), and Asilidae (Diptera) was counted. These orders and families are distinguished by their activity and are often found in catches using the Malaise trap. From May to October, a total of 914 Orthoptera individuals, 101 Hemiptera individuals, 662 Mordellidae individuals, 173 Asilidae individuals were trapped. The first Orthoptera individuals began to appear in traps only in early June (Fig. 2). However, the maximum number of this order was observed in the middle of August. Hemiptera has been trapped during the whole season. The numbers were low and there was no significant maximum. The family Mordellidae was found in the trap from May to mid-August. Two peaks in numbers were noted: June 22-25 and July 12-15 (Fig. 2). Asilidae are active predators from the order Diptera. The first individuals of this family were observed at the end of May, but the peak number was one on June 22-25. In mid-August, Asilidae was no longer found in the trap.

Usually, the Malaise traps are installed in any place where flying insects are supposed to appear, including forests, open grassy areas, and prairies, as well as windswept mountain ranges. However, it is important to fix them well when winds are expected. The location of traps affects the collected taxa. Diptera and Pinniptera tend to be numerically dominant taxa in the Malaise traps, while Diptera often represents the majority of collected specimens (Skvarla et al., 2021). In addition to Diptera and Hymenoptera, the Malaise traps were used to collect a variety of Coleoptera, Hemiptera, Homoptera, and other insects (Bomar, 2001; Abraham et al., 2003; Ohsawa, 2010; Le Cesne et al., 2015).

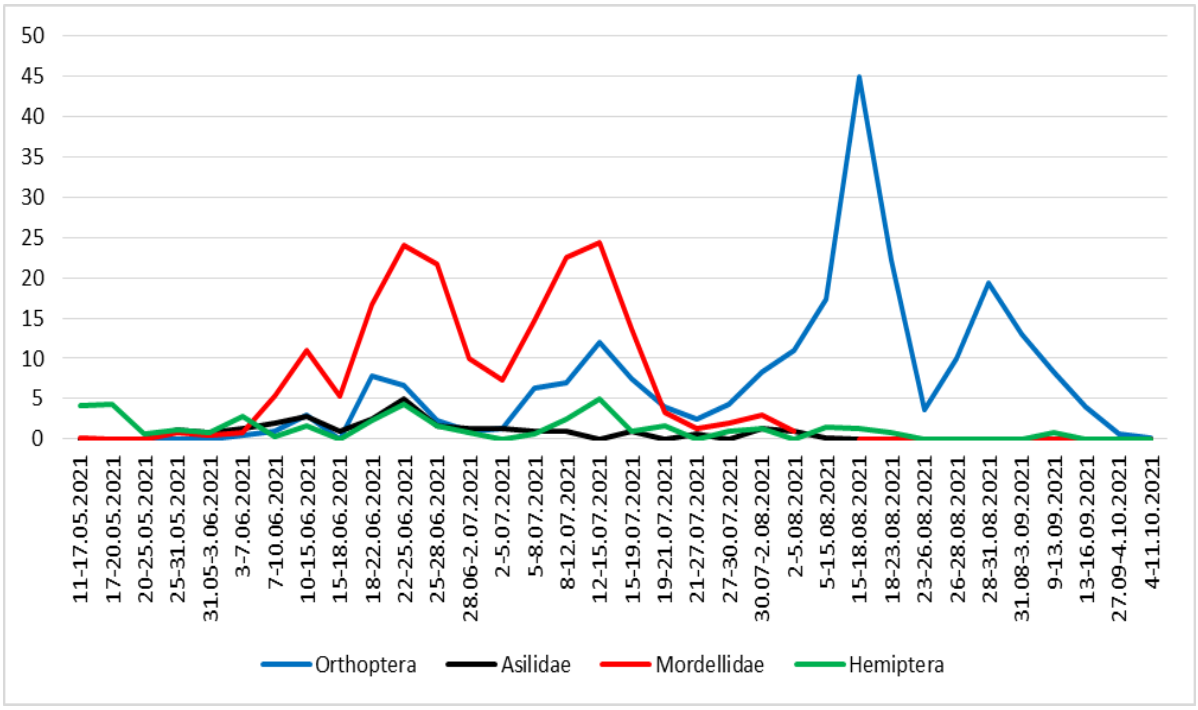

Figure 2. Seasonal abundance of individuals of four insect groups in the Malaise trap.

The Malaise traps were very rarely used to study Orthoptera. Thus, Samways and Moore (1991) and Boomer (2001) used this trap to analyze Orthoptera clusters in pastures and prairies. However, seasonal activity is not given in these publications. Le Sexe et al. (2015) successfully used the Malaise trap to study the abundance and species diversity of Hemiptera at different altitudes. However, information on the seasonal dynamics of the number of this group was not provided. There is one famous publication made by Jackman and Nelson (1995), where the authors describe the seasonal dynamics of the Mordellidae, determined using the Malaise trap installed in Texas (USA). Despite completely different natural conditions in Texas, the authors, as well as in our experiments, noticed two peaks in the number of Mordellidae in the Malaise trap. The results obtained are still difficult to explain on the basis of one publication and our research.

Based on the activity of predatory Asilidae, it is assumed that not all methods of collecting this group can be used to analyze seasonal activity. But in this case, the Malaise trap is a reliable tool for collecting such information (McCray, 2017; Martin-Park et al., 2018). For example, McCray and Bass (2011) successfully used the Malaise trap. They determined that six of the eight most common species had predominantly mid-season or earlier summer activity; two species had maximum abundance in the mid-late or late season.

The research has shown that the Malaise trap can be successfully used to analyze the seasonal activity of some groups of insects that differ in ecology and activity. The trap must be installed in clearings where insect activity is higher. It should be noted that the seasonal dynamics of the number of insects in different groups were shown differently.

References

Abraham, L., V.Marko, Vas, J. (2003). Investigations on a neuropteroid community by using different methods. Acta Phytopathol. Entomol. Hung. 38: 199–207.

Alexeev, S.C., Aleksanov, V.V. (2017). Pitfall trap construction affects the efficacy of ground beetle counts. Zoologicheskii Zhurnal 96(3): 295–304. DOI: 10.7868/S00 44513417010032

Bomar, C.R. (2001). Comparison of grasshopper (Orthoptera: Acrididae) communities on remnant and reconstructed prairies in western Wisconsin. J. Orthoptera Res. 10: 105–112.

Dobony, C.A., Edwards, J.W. (2001). A new flight-interception trap for arthropod sampling. Entomology News. 112: 217-220.

Holguin, G.A., Lehman B.L., Hull L.A., Jones V.P., Jones V.P., Park J., (2010). Electronic traps for automated monitoring of insect populations. IFAC Proceedings Volumes, 43(26): 49-54, https://doi.org/10.3182/20101206-3-JP-3009.00008

Jackman J.A., Nelson, C.R. (1995). Diversity and phenology of tumbling flower beetles (Coleoptera: Mordellidae) captured in a Malaise trap. Entomological News. Vol. 106, № 3. P. 97–107.

Jalas, I. (1960). Eine leichtgebaute, leichttransportable Lichtreuse zum Fangen von Schmetterlingen. Ann. Entomol. Fenn. 26: 44-50.

Le Cesne, M., S. W.Wilson, Soulier-Perkins A. (2015). Elevational gradient of Hemiptera (Heteroptera, Auchenorrhyncha) on a tropical mountain in Papua New Guinea. Peerj3: e978.

Martín-Park, A., Delfín-González, H., Sosenski, P., E. Reyes-Novelo, V., Meléndez-Ramírez, J. Navarrete-Carballo, S. Ibáñez-Bernal, F. Dzul-Manzanilla, A. González-Moreno, P. Manrique-Saide. (2018). Diversity of Tabanidae, Asilidae and Syrphidae (Diptera) in natural protected areas of Yucatan, Mexico. J. Insect Conserv. 22: 85–97.

Mccravy, K.W. (2017). An Analysis of Malaise-Trap Effectiveness in Assessing Robber Fly (Diptera: Asilidae) Species Richness. Northeastern Naturalist 24(1), 15-24. https://doi.org/10.1656/045.024.0102

Mccravy, K.W., Baxa, K.A. (2011). Diversity, Seasonal Activity and Habitat Associations of Robber Flies (Diptera: Asilidae) in West-Central Illinois. American Midland Naturalist 166(1), 85-97. https://doi.org/10.1674/0003-0031-166.1.85

Ohsawa, M. 2010. Beetle families as indicators of Coleopteran diversity in forests: a study using Malaise traps in the central mountainous region of Japan. J. Insect Conserv. 14: 479–484.

Samways, M.J., Moore, S.D. (1991). Influence of exotic conifer patches on grasshopper (Orthoptera) assemblages in a grassland matrix at a recreational resort, Natal, South Africa. Biol. Conserv. 57: 117–137.

Skvarla, M.J., Larson, J.L., Fisher, J.R., Dowling, A.P.G., (2021). A review of terrestrial and canopy Malaise traps. Annals of the Entomological Society of America, 114(1), 27–47, https://doi.org/10.1093/aesa/saaa044

Taylor, L.R. (1962). The absolute efficiency of insect suction traps. Annals of Applied Biology. 50 (3), 405-421. https://doi.org/10.1111/j.1744-7348.1962.tb06036.x