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MONITORING INSECT POPULATIONS WITH THE SUCTION TRAP

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Abstract

This research investigates the biodiversity of insect populations utilizing suction traps for effective monitoring in the Regio of NRW, Germany. In 2020 and 2021, a detailed entomological study was conducted to monitor arthropod and insect fauna in an experimental agricultural field. The field was cultivated with various crops and treated with multiple herbicides and insecticides each year. Insects were collected using a suction trap placed near Carpinus betulus bushes, experimental fields, and nearby young tree plantations. Samples were collected weekly from April to July, and the collected specimens were identified in the laboratory. The results of the study revealed that in 2020, a total of 50,573 insects were captured, with the Diptera order representing the most dominant (48%) of the total catches. Other significant orders included Thysanoptera (16.52%), Coleoptera (11.68%), Hymenoptera (10.61%), and Hemiptera (10.54%). In 2021, a total of 50,659 insects were captured. The most dominant order was once again Diptera (48.73%), followed by Thysanoptera (32.05%), Hymenoptera (8.82%), Coleoptera (5.81%), and Hemiptera (3.18%). Notably, the highest insect activity was recorded in April and July, with variations in monthly catch dynamics influenced by environmental conditions such as humidity, precipitation, and temperature. The present study focuses on identifying and assessing the diversity of entomofauna near plant protection experimental fields, while also providing comprehensive information on the population dynamics of beneficial insects over the specified period.

Key words*: monitoring, insect, mites, biodiversity, vacuum trap evolution.*

INTRODUCTION

A considerable number of ecosystems depend on insects for their continued functioning. These insects fulfil several important ecological functions that contribute to the maintenance and stability of these ecosystems. Despite their relatively small body size, these organisms play a crucial role in maintaining the natural balance of these ecosystems. According to recent publications (Hallmann et al., 2017; Lister & Garcia, 2018; Forister et al., 2019; Seibold et al., 2019; van Strien et al., 2019; Grabener et al., 2020; Hallmann et al., 2020; Sánchez-Bayo & Wyckhuys, 2021) the number of insect populations is decreasing due to the practice of intensive agriculture and climate change (Wagner, 2020; Grabener et al., 2020; Borzykh et al., 2023) which appears more and more frequently. The maintenance of biodiversity is of significant consequence to the health and productivity of ecosystems. Furthermore, greater biodiversity facilitates ecosystem adaptation, enabling them to cope with the challenges of global climate change. The presence of a greater number of species increases the probability that some organisms will possess the necessary characteristics to survive, thus enhancing the resilience of ecosystems (Daly et al., 2018; Sharashy, 2022). To apply the best phytosanitary protection methods against pests without causing significant damage to the existing biodiversity, it is first necessary to identify and monitor the

insect populations in the respective area (Teulon et al., 2004; Strażyński, 2005; Teulon & Scott, 2006; Thorbek & Topping, 2009; Rheinds et al., 2010; Bell et al., 2015; Merickel et al., 2015; Lagos-Kutz, 2020; Grabener et al., 2020; Honěk et al., 2020; Costea et al., 2023). This is also crucial for predicting the emergence of potentially invasive species populations. Over time, in several countries in Europe, suction trap devices have been used to monitor insects in larger areas, particularly to monitor *aphids* that can transmit viruses from one plant to another by their feeding activity (Teulon et al., 2004; Teulon & Scott, 2006; Rhainds et al., 2010). With the help of these devices, it is also possible to detect in time the invasion or already the establishment of certain invasive insects in the respective area (Lagos-Kutz et al., 2020), which may change their geographical range due to global warming (Robinet & Roques, 2010; Renault et al., 2018; Lagos-Kutz et al., 2020) and that could have significant negative impacts on the existing ecosystem (Thackeray et al., 2010; Martay et al., 2017; Lagos-Kutz et al., 2020). The present study is concerned with the identification and determination of entomofauna diversity in the vicinity of plant protection experimental fields. Additionally, it can provide information regarding the population of useful insects over the specified period.

MATERIALS AND METHODS

Study area

The region is situated in the western region of Germany, in close proximity to Köln GPS Coordinator (51°00'07.1"N 6°50'45.7"E). The city of Köln is situated within a temperate oceanic climate zone, characterised by relatively moderate temperatures, a moderate amount of rainfall, and varying degrees of sunshine throughout the year. The average annual temperature in Cologne aria is approximately 10.5°C. Summers are characterised by mild to warm conditions, with average high temperatures in July and August reaching approximately 24°C. Winters are relatively cold but not extreme, with average low temperatures in January dipping to around 0°C. Spring and autumn are transitional seasons, with temperatures typically ranging from 10°C to 15°C. Cologne is characterised by a relatively consistent precipitation regime throughout the year, with an average annual precipitation of approximately 800 mm. The distribution of rainfall across months is relatively uniform, with an average of 150 to 160 rainy days per year.

The region in question receives an average of 1,500 to 1,600 hours of sunshine annually. The months of May through August are the sunniest, with each month receiving approximately 200 hours of sunshine. In contrast, the winter months of November, December, and January are characterised by the lowest levels of sunlight, with each month averaging approximately 40 to 50 hours of sunshine (Universität Köln, 2015).

One single free space line

Experimental field

The suction trap was located (Figure 1) in close proximity to the *Carpinus betulus* bushes. On the opposite side, one can find the plant protection experimental field, followed by a grass field. In the immediate vicinity, there is a young tree plantation comprising a diverse array of species. The plant protection experimental field was planted with *Apium graveolens* var. *dulce, Brassica oleracea* convar. *oleracea* var. *gemmifera, Raphanus sativus* and *Brassica oleracea* convar. *caulorapa* var. *gongylodes* during the 2020 growing season. The cultures were treated with herbicide, comprising Butisan (1.5 L/ha), Centium 36 CS (0.2 L/ha), and Butisan (0.8 L/ha). Furthermore, insecticides were applied, including Karate Zeon (0.075 L/ha) and Scatto (0.2 L/ha). Over the following year 2021, the field was cultivated with several species, including *Brassica oleracea* convar. *capitata* var. *capitata* f. *alba, Rheum rhabarberum, Phaseolus vulgaris* ssp. *vulgaris* var. *nanus* and *Lactuca sativa*. The herbicide treatments comprised the following products: Kerb FLO (3 L/ha), Cadou SC (0.48 L/ha), Centium 36 CS (0.2 L/ha), Butisan (1.5 L/ha), Oblix (0.6 L/ha), Belkar (0.25 L/ha), and Trebon 30 EC (0.2 L/ha). The insecticide applications included Kumar (2 kg/ha), Karibu (0.4 L/ha), Eradicoat Max (20 L/ha), Trebon 30 EC (0.2 L/ha), Minecto One (0.1875 kg/ha), Benevia (0.75 L/ha), Coragen (0.125 L/ha), Hasten TM (1 L/ha), and similar pickling agents, namely Force 20 CS (62.5 ml/ha) and Force Evo (16 kg/ha).



Figure 1. Drone images show the position of the suction trap near the trial fields in Germany - Köln (Source: Original)

Sample collection

The monitoring of insect entomofauna was carried out during April-July 2020-2021. To collect the insects in the area of the experimental fields, it was used the suction trap from MEKU-Erich Pollähne GmbH. The suction trap allows studies on the insect density at a height of 1.65 to 2 above the ground with a suction power of approximative 32 m³/min. The flow velocity reaches a value of 2-3 m/s at a distance of 250 mm from the suction center. A REITZ ventilator mounted on four vibration dampers is installed in the interior of the MEKU insect traps. Attracted insects were collected with the help of a funnel, at the end of which were the 500 ml plastic containers. These were filled halfway with tap water, to which 2-3 drops of Detergent liquid were added to relax the water surface tension. The sample collection is controlled by a programmable timer. The operating time of the device during the week was between 9 am and 7 pm. After sampling, the sample collector always returns to the rest position (closed position) so that particles cannot enter the individual sample containers during breaks in the unit's operation. The suction device had 8 holes, to which 8 containers for collection were attached. Containers were changed at 7-day intervals. The biological material collected in the containers was transferred to the laboratory, and the collected insects were identified using a Zeiss binocular with maximum 50x magnification.

Identification

All samples collected from the study area were identified according to (Chinery, 1984; Wachmann et al., 2004; 2007; 2008; Biedermann & Niedringhaus, 2004; Klausnitzer, 2011; Alford, 1997; Moritz, 2006). Additionally, assistance with identification is provided by entomologists from the Landwirtschaftskammer NRW-Köln, who possess considerable expertise in the field of insect identification.

Data analysis

The diversity of insect species in the study area was determined and explained using a range of biodiversity indices, including Margalef (Waite, 2000; Sina & Zulkarnaen, 2019; Alwi et al., 2021; Wardhana et al., 2022; Pramudita et al., 2023) Shannon-Wiener Diversity (Floder & Sommer, 1999; Sina & Zulkarnaen, 2019; Alwi et al., 2021; Wardhana et al., 2022; Al-Keriawy et al., 2023; Pramudita et al., 2023; Buburuz et al., 2024) species richness index, and Simpson (Guajardo, 1999; Pitts, 2005; Starks, 2009; Alcocer Guajardo, 2015; Sina & Zulkarnaen, 2019).

RESULTS AND DISCUSSIONS

In the Figure 2 is represented the total number of catches for the year 2020, with 50,573 specimens were collected, which systematically belong to 17 families from 9 orders.

Most of the catches were in the order of *Diptera* with a number of 24,411 individuals, which corresponds to (48%) of the total catches. *Diptera* from both suborders were reported: *Nematocera* (mainly from the family *Psychodidae and Tipulidae*) and *Brachycera* (mainly from the family *Syrphidae*). The second order in several catches is the order *Thysanoptera*, with 8,356 individuals, representing (16.52%) of the total, followed by the order *Coleoptera* with 5,909 individuals, this order participating with (11.68%) in the structure of total catches. The most important families of this order were the *Staphylinidae*, *Coccinellidae*, *Cantharidae* and *Curculionidae*. The *Hymenoptera* order is represented by 5,366 collected insects, representing (10.61%) of all catches. Most captured were from the parasitoid families *Ichneumonidae* and *Proctotrupidae*, which are useful entomofauna species. From the order *Hemiptera*, 5,331 specimens were caught, which corresponds to (10.54%) of the total catch. Most of the catches in this order were from the superfamily *Aphidoidea*, especially from the species: *Aphis fabae* Scopoli*, Myzus persicae* Sulzer, and *Cacopsylla pyri* Linnaeus. In orders *Phthiraptera* and *Psocoptera*, a number of 426 individuals were captured, representing (0.84%) of the total catch. From the order *Lepidoptera*, which accounted for 0.48% of the total catch with 246 insects, from the family *Gracillariidae*, the family *Tortricidae* a total number of 16 individuals were accounted, representing (0.03%). By the class of insects (*Insecta)*, the lowest percentage of catches came from the order *Neuroptera* with eight individuals (0.02%) of total catches represented by species from the family *Chrysopidae*, which are predatory species that feed in particular on insects from the superfamily *Aphidoidea*. From the phylum *Arthropoda*, class *Arachnida*, order *Araneae*, 520 individuals were captured, representing (1.03%) of all cached individuals, and 88 mites from the order *Acari,* representing (0.17%) of the total captures.

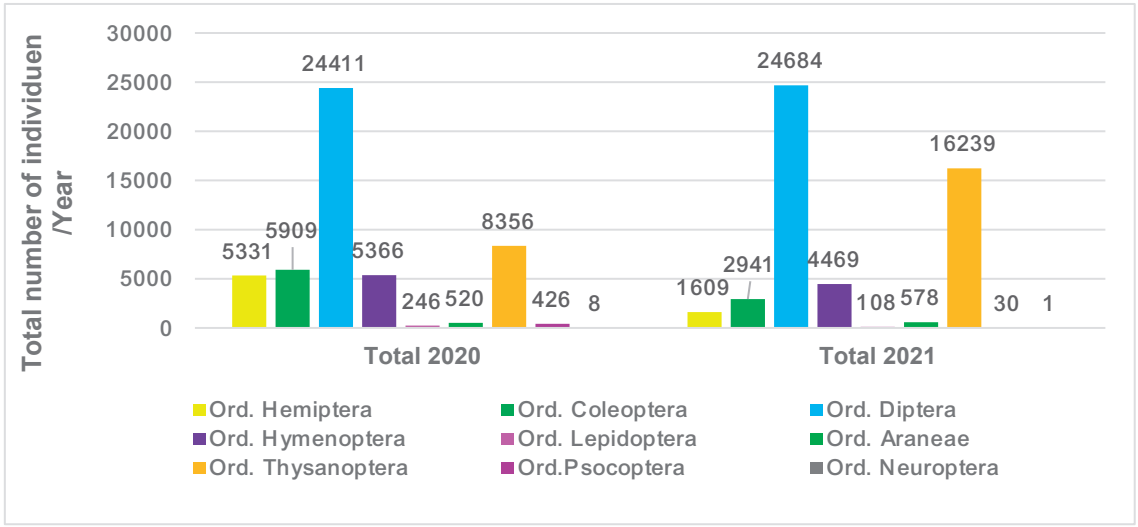


Figure 2. Total number of catches for the 4 months April, Jun, July, August 2020-2021

In 2021, 50,659 individuals were captured, with 86 more specimens than the previous year. Again, the *Diptera* order stood out with 24,684 individuals, representing (48.73%) of the total catches. This year the most representative families in this order were the *Tipulidae* and *Syrphidae.* From the *Thysanoptera* order, there were 16,239 individuals representing (32.05%) of the total catches. The *Hymenoptera* order is represented by 4,469 individuals (8.82%) of the total catch, from parasitoids belonging to the families *Ichneumonidae* and *Proctotrupidae*, predators belonging to the family *Vespidae* and phytophagous species, especially from the family *Tenthredinidae.* The order *Coleoptera* represents (5.81%) of the total catch, with 2,941 individuals, consisting of insects belonging to the carnivorous families *Staphylinidae*, *Coccinellidae*, *Cantharidae,* and pests belonging to the family *Curculionidae*. In the order *Hemiptera*, insect pests from the suborders *Heteroptera* and *Auchenorrhyncha* have been

identified, especially from the superfamily *Aphidoidea* and the family *Psyllidae*. Of this order, 1,609 is (3.18%) of the total annual catch. The next lowest values are from the phylum *Arthropoden,* order *Araneae* 578 individuals, which corresponds to (1%) of the total catch, followed by the orders *Lepidoptera*, and *Neuroptera* between 0.8% and 0.02% of the total catch.

As illustrated in Figure 3 and Figure 4 show the percentage of beneficial entomofauna in the examined period.

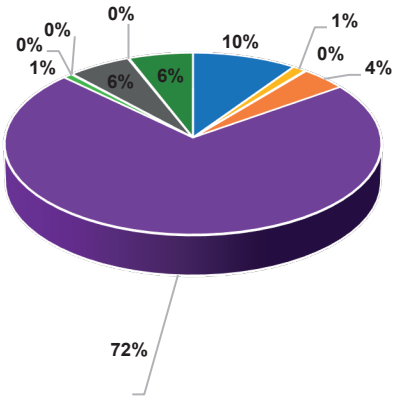


Figure 3. Percentage occurrence of beneficial insects in 2020 detected by suction trap nearby an experimental site with *Apium* graveolens var. *dulce*, *Brassica oleracea* convar. *oleracea* var. *gemmifera, Raphanus sativus* and *Brassica oleracea* convar. *caulorapa* var. *gongylodes*

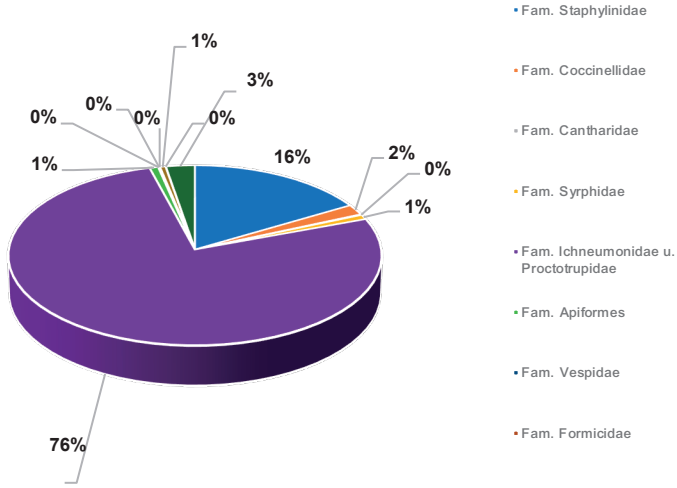


Figure 4. Percentage occurrence of beneficial insects in 2021 detected by suction trap nearby an experimental site with *Brassica oleracea* convar. *capitata* var. *capitata* f. *alba*, *Rheum rhabarberum*, *Phaseolus vulgaris* ssp. *vulgaris* var. *nanus* and *Lactuca sativa*

Thus, it is evident that insects belonging to the family of parasitic wasps (Fam. *Ichneumonidae* and *Proctotrupidae*) reached the highest percentage,72%, in 2020 (Figure 3), and 76%, in 2021 (Figure 4), of the total amount. In the case of the *Staphylinidae* family, a significant percentage was also obtained, 10%, in 2020, and 16% in 2021.

In addition, the *Cantharidae* family recorded a significant decline in 2021, with only 3% of the total catch caught compared to 2020. This represents a notable reduction from the 6% observed in 2020. The *Coccinellidae* family also exhibited a decline in total catches, accounting for 4% of the total in 2020 and 2% in 2021. In alignment with the findings of another study (Lister & Garcia, 2018; Siebold et al., 2019; van Strien et al., 2019; Grabener et al., 2020) and with this work it was also a reduction of arthropods observed. The analysis of the other families *Coccinellidae, Syrphidae*, and *Apiformes*, shows that they did not record significant percentages. The presence of host plants can influence the population and dynamics (Sollai et al., 2024) of hymenopterans by providing the necessary resources for feeding, reproduction, and shelter. The study of insects and their natural predatory communities is of pivotal importance in the field of agricultural pest management (Chen et al., 2022) particularly with regard to the reduction of pesticide usage.

As illustrated in Figure 5 the period of insect and arthropod monthly flight activity between April and July over the two-year monitoring period spanning 2020 to 2021. For the *order Hemiptera* (Sap-Feeding Insects), the highest peak was in May with the highest activity of 2 401 individuals for 2020 year and for the next year 2021 the highest flight activity it was in July with 866 individuals. The high activity in 2020 suggests that the order *Hemiptera* was a major presence, likely impacting the health of the plant. The lower activity in 2021 could indicate

effective pest management or less favorable conditions for these insects. By the order *Coleoptera* (Beetles) the major peak for 2020 it was recorded in July with a total of 3,727 individuals and for the next year 2021, the highest fly activity was in the month June with 1,341 individuals. In the case of the *Diptera* order, the highest fly activity was in April 2020 with 7,864 individuals. For the next year 2021 the highest fly activity it was in April with 9,355 individuals. In the order *Hymenoptera* (Bees, Wasp), the peak for this order it was in July 2020 with a total of 2,202 individuals, and for the next year 2021, the highest fly activity it was in moth July with 2,063 individuals. The highest fly activity for the order *Thysanoptera* was in the June with 3,399 individuals recorded in 2020. For the next year 2021, the major peak fly activity it was in July, with 9,459 individuals.
The Figure 6 illustrates that the highest mean of insects and arthropod count of 1,401 was recorded in June 2020.

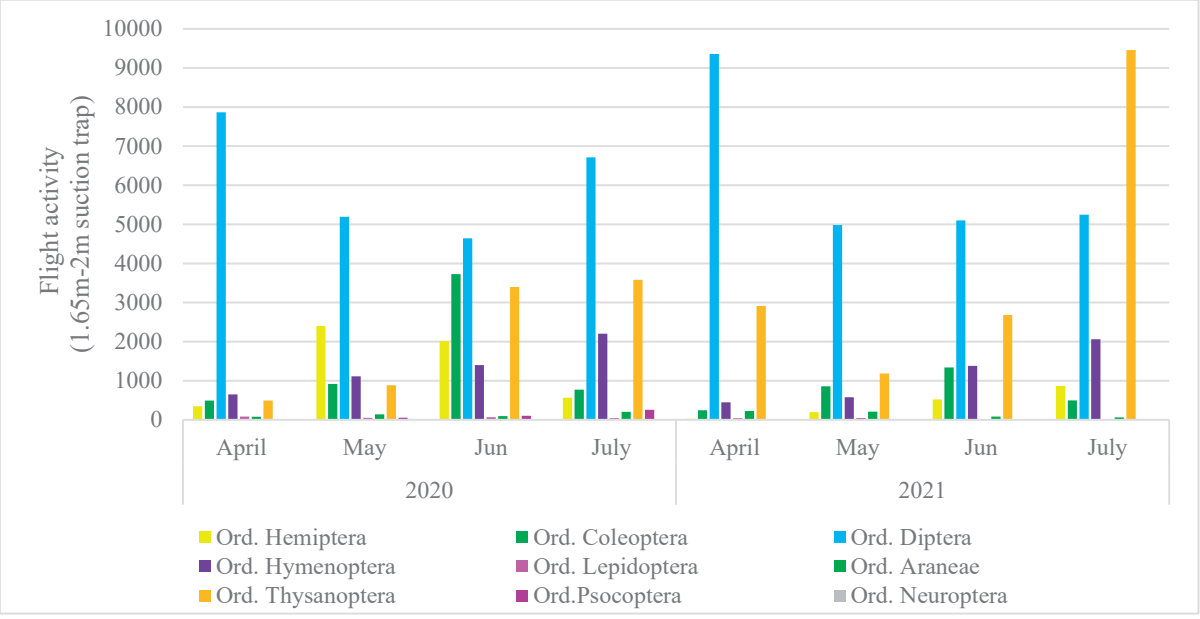


Figure 5. The monthly flight activity of the insects and arthropod 2020-2021 detected by suction trap nearby an experimental site with *Apium graveolens* var. *dulce*, *Brassica oleracea* convar. *oleracea* var. *gemmifera* and *Brassica oleracea* convar. *caulorapa* var. *gongylodes*, in 2020 and with *Brassica oleracea* convar. *capitata* var. capitata f. *alba*, *Rheum rhabarberum*, *Phaseolus vulgaris* ssp. *vulgaris* var. *nanus* and *Lactuca sativa* in 2021

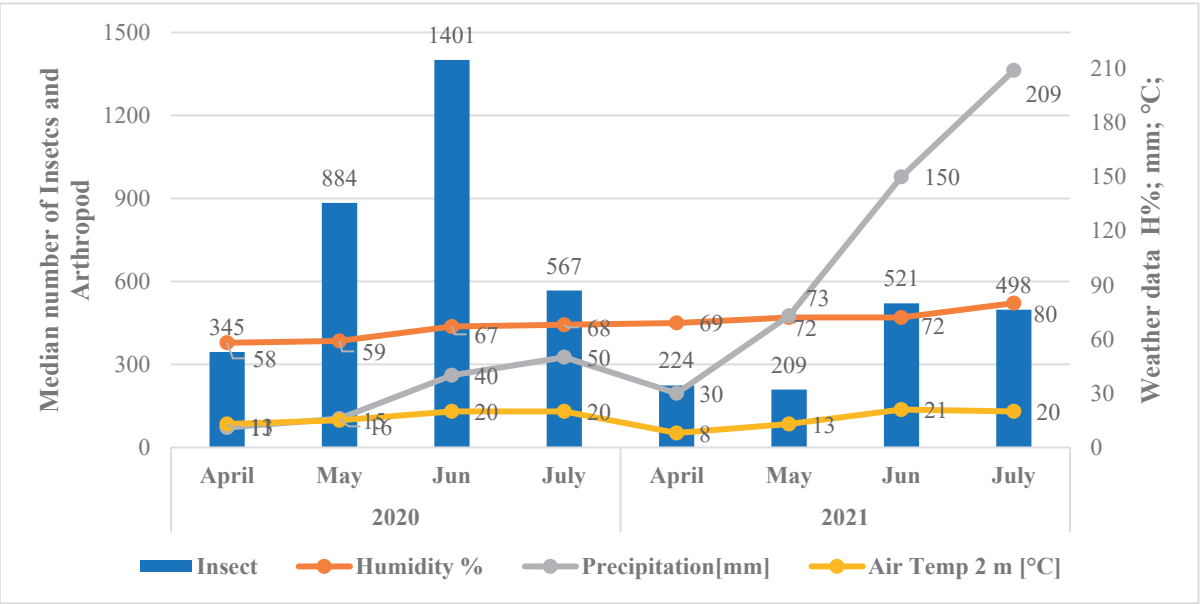


Figure 6. A comparative analysis of insects and arthropod development in relation to meteorological data from 2020 to 2021

This period was characterised by a median humidity of 67%, a median precipitation of 40 mm, and a median air temperature of 20°C above the ground. In comparison, the second-highest insects and arthropod count was recorded in May, with a total of 884 specimens. Furthermore, the median humidity levels recorded during this period were 59%, coupled with a median precipitation of 16 mm and a median air temperature of 15°C. The lowest number of specimens was recorded in April 2020, with a total of 345. During this period, the median humidity was 58%, the median precipitation was 11 mm, and the median air temperature at a height of 2 meters above the ground was 13°C. The data for 2021 indicates that the highest number of specimens was also recorded in June, with a median count of 521 specimens. During this period, the median humidity was 72%, the median precipitation was 150 mm, and the median temperature, measured at a height of 2 metres above the ground, was 21°C. The second highest peak in terms of insects and arthropods population was observed in July, with a median count of 498 individuals. The median humidity was 80%, precipitation reached 209 mm, and the median temperature was 20°C at a height of 2 metres above the ground. In April 2021, the lowest number of insects and arthropods was recorded, with a median count of 224 specimens. The median humidity was 69%, and the median air temperature, measured at a height of 2 metres above the ground, was 8°C. In this study was also observed that the flight activity of the arthropods could be influenced by environmental conditions (Høye & Forchhammer, 2008; Pawson et al., 2017). The highest recorded insect population was observed in June, with an average humidity ranging from 67% to 72% and a median temperature between 20°C and 21°C. The capture of the arthropods may have been influenced by extended periods of aridity or a deficiency of sunlight. Such conditions, particularly at low temperatures, have been demonstrated to exert an influence on insect biomass (Dennis & Sparks, 2007; McDermott Long et al., 2017; Hallman et al., 2017).

Biodiversity index for the Order *Hemiptera*

The biodiversity indices for the Order *Hemiptera*, as depicted in Figure 7, illustrate notable trends over a two-year period based on data collected by suction traps near the experimental plots. For the Order *Hemiptera*: The Shannon-Wiener index (H') exhibited its highest value in 2021, at 3.39, compared to 2.42 in 2020. This increase signifies a notable expansion in the diversity of the *Hemiptera* population, indicating a more diverse and evenly distributed species composition. The Margalef index demonstrated an increase from 1.38 in 2020 to 1.9 in 2021, suggesting an enhancement in species richness. This implies that a greater number of *Hemiptera* species were present in 2021 compared to the previous year. The Simpson's index (D) exhibited a decrease from 2.73 in 2020 to 2.3 in 2021. This decline indicates an increase in diversity, as lower values reflect a more diverse population with no single species dominating the community. These indices collectively highlight significant trends in the diversity and species richness of the Hemiptera order over the two-year period, reflecting substantial ecological shifts within the population.

Biodiversity index for the Order *Coleoptera*

The biodiversity indices for the Order *Coleoptera*, as illustrated in Figure 7, demonstrate significant trends over the observed period. The Shannon-Wiener index (H') increased from 2.67 in 2020 to 2.71 in 2021, indicating a rise in beetle population diversity. This suggests a more varied distribution of beetle species within the community. Additionally, the Margalef index showed an increase from 1.74 in 2020 to 2.29 in 2021, reflecting an enhancement in species richness. This indicates that a greater number of beetle species were present in 2021 compared to the previous year. Conversely, the Simpson's index (D) exhibited a decline from 2.51 in 2020 to 1.96 in 2021. This decrease signifies an increase in diversity, as lower values indicate a lesser probability of two randomly selected individuals belonging to the same species. Therefore, no single beetle species dominated the community, contributing to a more balanced and diverse population. These indices collectively provide evidence of a growing and more evenly distributed beetle population in 2021, with a greater number of species present compared to 2020.

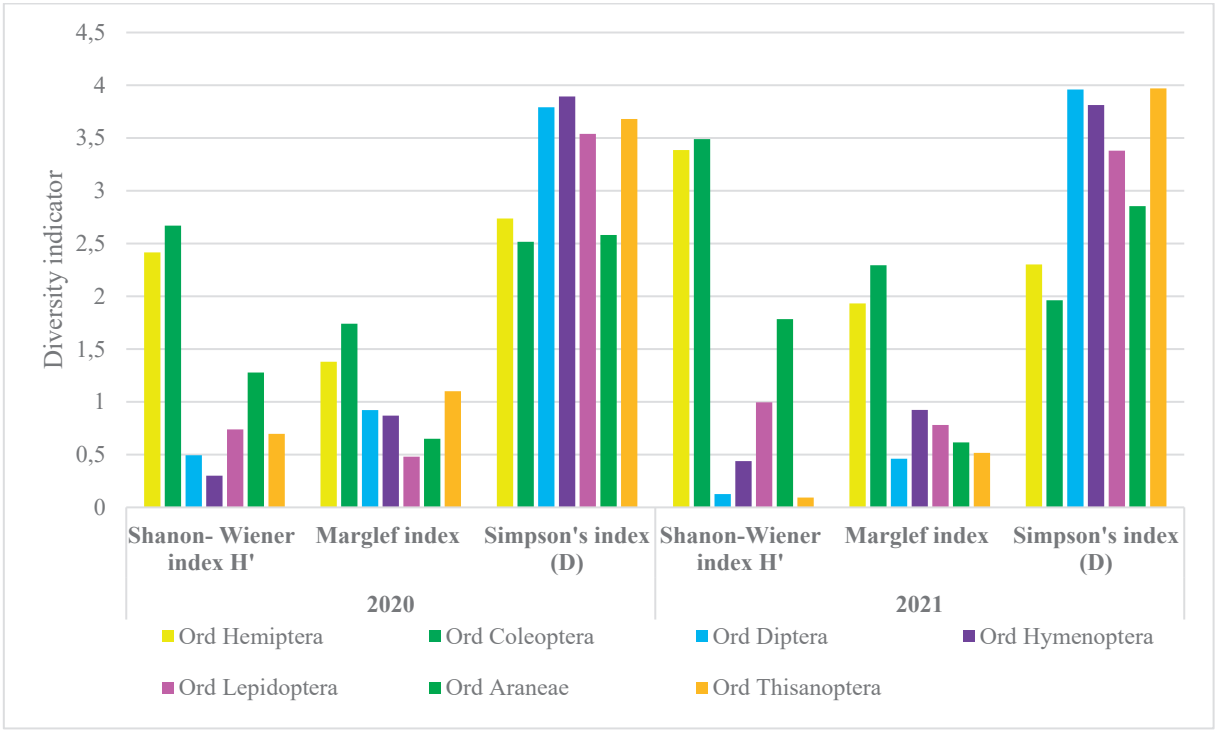


Figure 7. Indices of the biodiversity of each order for the two years 2020 and 2021, as recorded by the suction trap

Biodiversity index for the Order *Diptera*

The results of a study on *Diptera* (flies) (Figure 7) indicate a decline in diversity within the fly population for 2020 the value it was 0.49 and then it decreased for the next year 2021 to 0.13. The decrease in the Shannon-Wiener index (H') indicates a reduction in diversity within the order *Diptera*. This suggests that the fly population has become less diverse, with fewer species and a less even distribution. The Marglef Index value also decreased from 0.92 in 2020 to 0.46 in 2021. The decrease in the Marglef index indicates a reduction in species richness. This means that there were fewer fly species present in 2021 compared to 2020. The increase in Simpson's index from 3.79 in 2020, to 3.96 in 2021 indicates a decrease in diversity. Higher values indicate that the fly community has become less diverse, with one or a few species dominating the community.

Biodiversity index for the order *Hymenoptera*

The biodiversity indices for the Order *Hymenoptera* indicate notable trends from 2020 to 2021. An increase in the Shannon-Wiener index (H') (Figure 7) from 0.30 in 2020 to 0.44 in 2021 suggests a modest enhancement in diversity, reflecting a more even distribution of species within the population of ants, bees, and wasps. The Margalef index shows an increase from 0.87 in 2020 to 0.92 in 2021, indicative of a slight rise in species richness, implying a greater number of *Hymenoptera* species present in 2021. Conversely, the Simpson index (D) decreased from 3.89 in 2020 to 3.81 in 2021, further affirming a slight increase in diversity, as lower values denote a more diverse community with reduced dominance by any single species. These indices collectively suggest an overall improvement in the diversity and species distribution within the *Hymenoptera* order during this period.

Biodiversity index for the Order *Lepidoptera*

The increase in the Shannon-Wiener index (H') (Figure 7) from 0.74 in 2020 to 0.99 in 2021 is indicative of an expansion in diversity within the Order *Lepidoptera*. This suggests that the *Lepidoptera* population has become more diverse, with a more uniform distribution of species. Similarly, the increase in the Marglef index from 0.48 in 2020 to 0.78 in 2021 also indicates an increase in species richness. This suggests that the number of butterfly and moth species present in 2021 was greater than that observed in 2020. A reduction in Simpson's index (D) from 3.54 in 2020 to 3.84 in 2021 is indicative of an increase in diversity. A

reduction in the value of the index indicates an increase in the diversity of the butterfly and moth community, with no single species as dominant influence.

Biodiversity index for the Order *Araneae*

The Shannon-Wiener index (H') (Figure 7) demonstrates a notable increase from 1.28 in 2020 to 1.78 in 2021, indicating a significant expansion in diversity within the Order *Araneae*. This represents that the spider population has become more diverse, with a more even distribution of species. However, the Marglef index demonstrates a slight decrease, which suggests a reduction in diversity. Higher values indicate that the spider population has become less diverse, with one or a few species dominating the community. The increase in Simpson's Index from 2.58 in 2020 to 2.85 in 2021 indicates a drop in diversity. Higher values suggest that the spider population became less diverse, with one or a few species dominating the community.

Biodiversity index fr the order *Thysanoptera*

Biodiversity indices for the Order *Thysanoptera* indicate a substantial decline in diversity during the study period. The Shannon-Wiener index (H') (Figure 7) demonstrated a pronounced reduction from 0.69 in 2020 to 0.09 in 2021, signifying a significant decrease in thrips diversity. Similarly, the Margalef index showed a decline in species richness, with values decreasing from 1.10 in 2020 to 0.52 in 2021, indicating a reduction in the number of thrips species present. The Simpson's index (D) increased from 3.68 in 2020 to 3.97 in 2021, further corroborating the decline in diversity. This rise in the Simpson's index denotes a heightened probability that two randomly selected individuals will belong to the same species, thereby reflecting a less diverse thrips population. These indices collectively underscore a significant reduction in both the diversity and species richness of the Order *Thysanoptera*, highlighting the ecological impact on the thrips population within the study area. The significance of insect biodiversity has become increasingly evident in the field of research, extending beyond the domain of academic inquiry to impact our daily lives. In alignment with the findings of another study (Hallmann et al., 2017; Lister & Garcia, 2018; Seibold et al., 2019; van Strien et al., 2019; Grabener et al., 2020; Hallmann et al., 2020, Sánchez-Bayo & Wyckhuys, 2021; Raghavendra et al., 2022), a slight decline in the population of the *Arthropoda* Class *Insecta* was observed throughout the investigated interval. In light of the findings of other researchers and our works (Szénási et al., 2016; Favret et al., 2019; Honěk et al., 2019; Teulon et al., 2022; Romanowski et al., 2024), it can be concluded that the suction trap represents an efficacious methodology for monitoring insect populations within a geographical area. The utilisation of suction traps in the monitoring of the arthropod's population is of particular significance in the field of entomology, due to their capacity to provide comprehensive, consistent, and valuable data (Sánchez-Bayo & Wyckhuys, 2019; Favret et al., 2019). This is essential for the understanding of ecosystem health and the identification of changes in insect populations over time. The ability of suction traps to assess and monitor heterogeneity, particularly within highly diverse and sensitive taxa, holds substantial value for biological conservation initiatives (Olden, 2006; Socolar et al., 2016; Favret et al., 2019). The utilisation of suction traps facilitates the identification of invasive arthropods (Teulon et al., 2004) and the capture of a highly diverse insects entomofauna. To implement best practice management strategies for insect pests, suction traps provide important data on the population dynamics and development of arthropods in the specific area under study. These tools are indispensable for determining the necessary interventions to mitigate pest-related diseases. According to the European Union, reducing the use of various pesticides and insecticides is essential for safeguarding human health, protecting the environment, and preserving biodiversity. Suction traps contribute to this effort by offering precise data that inform targeted and sustainable pest management practices. The utilization of suction traps can also have negative effects on the population of beneficial arthropods, such as those within the Order *Hymenoptera*. This unintended consequence may lead to a reduction in the abundance of beneficial insect taxa and may perturb overall insect population dynamics, disrupting ecosystem homeostasis by non-

selectively capturing both pest species and ecologically beneficial taxa. The data obtained from this method can provide valuable insights into the biodiversity of the area under study.
The population size and distribution of a species can be influenced by various factors, including altitude, climate, and related ecological conditions, such as the availability of host plants (Sollai et al., 2024). Despite the continuous decline in global biodiversity caused by anthropogenic changes (Sollai et al., 2024) this device can serve as an essential tool for monitoring the biodiversity of arthropods in the studied area. Its use can significantly contribute to the discovery of new species. Moreover, since the captured insects remain nearly intact, their morphological identification becomes considerably easier.

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CONCLUSIONS

Despite the proximity of the study area to an experimental field with extensive use of insecticides and herbicides, suction traps have proven to be an effective method for monitoring the development of arthropod and insect populations. Between April and July of 2020 and 2021, a slight decrease was observed in the total number of individuals within the phylum *Arthropoda* and the class *Insecta*. The biodiversity of the insect population remains high, as does the diversity of the vegetation within the study area. The floral diversity provides various habitats and resources, supporting a wide range of insect species. Climatic conditions, such as temperature, humidity, and precipitation, also play a significant role in influencing the variability and development of arthropod and insect populations. The insects captured during the study were suitable for precise and accurate identification. This study provides valuable insights into the evolution of biodiversity in the vicinity of these experimental fields. The data collected offer a substantial amount of information regarding changes in species composition, abundance, and distribution over time. These findings can help in understanding the ecological impact of agricultural practices and environmental factors on local biodiversity. However, further research is needed to gain a more precise understanding of the evolutionary processes involved. Long-term studies and additional data collection are essential to identify trends, assess the resilience of insect populations, and develop effective conservation strategies. Overall, the use of suction traps has proven to be a valuable tool in monitoring and understanding the dynamics of arthropod and insect populations in agricultural landscapes, despite the challenges posed by nearby pesticide applications.

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