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A Study on the Diversity of Flower-Visiting Hoverflies (Diptera: Syrphidae) in Maquis Shrublands Near Ajaccio, South-Western Corsica, France

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ABSTRACT

Hoverflies (Syrphidae, Diptera), comprising approximately 6,000 species across 200 genera globally, represent a highly diverse and ecologically significant group of pollinators, second only to wild bees (Hymenoptera). This study examined the diversity of flower-visiting Syrphidae within low shrubland maquis habitats across three compensatory sites in the Ajaccio area (Corsica, France). In total, 138 hoverfly individuals were collected, encompassing 27 species from 16 genera. Among the subfamilies, Syrphinae exhibited the greatest diversity compared to Milesinae and Eristalinae. Seven species—Eumerus barbarus, Sphaerophoria scripta, Chrysotoxum intermedium, Episyrphus balteatus, Syritta pipiens, Melanostoma mellinum, and Melanostoma scalare—dominated the syrphid assemblages, accounting for 67% of all records. Most of the findings reported here represent novel data for the Ajaccio region. The Loretto site stood out for both higher species richness and greater hoverfly abundance compared to the other two locations. Regarding daily activity patterns, flower visits by hoverflies predominantly occurred in the morning across all sites, with Asteraceae flowers being the most frequently visited. Seasonal patterns were also evident, as the majority of flower visits took place in autumn (September to November), a period when other floral visitors were scarce or absent.

Keywords: Syrphidae, Anthophily, Corsica, Flower diversity, Daily activity, Seasonality

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Introduction

Hoverflies (family Syrphidae, order Diptera, suborder Brachycera) are widely distributed across nearly all continents, with Antarctica being the only exception. The family comprises roughly 6,000 species within more than 200 genera, organized into three subfamilies: Syrphinae, Eristalinae, and Milesinae [1, 2]. Larval feeding strategies are highly diverse, ranging from saproxylic and phytophagous to saprophagous, aphidophagous, and generalist zoophagous diets, while adults are mainly restricted to consuming nectar and pollen [3–7]. Because of this adult specialization, hoverflies play a crucial role as floral visitors, frequently observed on both cultivated crops and wildflowers, particularly in temperate regions [8, 9]. Globally, they are considered the third most significant pollinator family after Apidae and Halictidae, participating in the pollination of over half of crop species [1]. In natural ecosystems, hoverflies are also highly relevant, potentially visiting more than 70% of insect-pollinated wildflowers in Europe [1].

In Mediterranean ecosystems, hoverflies are equally abundant and functionally important. They are commonly associated with wooded and shrubby habitats such as maquis and shrublands, where dense vegetation provides suitable resources [10, 11]. Some hoverfly species exhibit strict habitat preferences, making them effective bioindicators of environmental conditions [5, 10]. Nevertheless, human-induced habitat modifications are

increasingly threatening Syrphidae diversity [6]. In Corsica, 168 hoverfly species have been recorded, compared to 578 in mainland France [12, 13]. Research on Corsican Syrphidae has a long history dating back to the 19th century, with both historical and recent studies documenting endemic and rare species [7, 14–24]. More recent entomological surveys, such as those conducted by the National Museum of Natural History in Paris (La Planète revisitée), have primarily targeted hilly and mountainous habitats, reporting 24 new species for the island, including several Corsican and Corso-Sardinian endemics such as Eumerus niehuisi Doczkal, 1996, Platycheirus cintoensis van der Goot, 1961, and Paragus ascoensis Goeldlin & Lucas, 1982 [25].
Despite these investigations, data on hoverflies in the Ajaccio region remain limited. The only known record is from September 2021 by the Observatory & Conservatory of Insects of Corsica (OCIC), which identified eight species: Chrysotoxum intermedium Meigen, 1822, Chrysotoxum cisalpinum Rondani, 1845, Milesia semilectifera (Villers, 1789), Myathropa florea (Linnaeus, 1758), Paragus bicolor (Fabricius, 1794), Syritta pipiens (Linnaeus, 1758), Syrphus ribesii (Linnaeus, 1758), and Xylota segnis (Linnaeus, 1758) [12].
This study was conducted within the context of an industrial mitigation plan, the ERCA sequence, for the Loregaz project managed by Engie in Ajaccio. The project aims to protect three priority taxa across three maquis habitats: Hermann's tortoise (Testudo hermanni Gmelin, 1789) and two orchid species (Serapias neglecta De Not., 1844 and Serapias parviflora Parl., 1837). The maquis is a Mediterranean shrubland ecosystem characterized by evergreen, small-leaved shrubs and small trees, typically 2–5 m tall, often developing on siliceous soils over crystalline and metamorphic bedrock. Historical human activities, including agro-pastoralism and slash-and-burn practices, have shaped these landscapes, favoring fire-adapted shrubs while limiting tree growth [26].
Within this conservation framework, we conducted a nine-month survey of adult hoverflies visiting flowers across the three managed sites in Ajaccio. Rather than attempting a full species inventory, our focus was on documenting functional interactions between hoverflies and flowers (Section 2 provides methodological details). Therefore, the taxonomic list presented here is partial and represents a preliminary view of the region's Syrphidae diversity.
The objectives of this study were to: (i) compare hoverfly species diversity and abundance across the three sites, (ii) analyze seasonal and daily activity patterns, and (iii) record the diversity of plant species visited by hoverflies.

Materials and Methods

Study sites

The research was carried out at three locations near Ajaccio: Loretto, Suartello, and Vignola **(Figure 1 and Table 1)**. These areas serve as ecological compensation zones for Engie's Loregaz project and are managed on its behalf by the Conservatoire d'Espaces Naturels de Corse. All three sites are dominated by Mediterranean maquis vegetation, and the sampling design accounted for environmental heterogeneity to ensure adequate representation of the local ecosystems **(Table 1)**.
The Loretto site lies just a few hundred meters from Ajaccio's city center, adjacent to the industrial Loregaz facility, and features a mosaic of habitats including open areas interspersed with old olive groves **(Figure 1)**. Suartello is situated at the edge of a woodland and also exhibits a mosaic of habitats, combining open grasslands with shrubland areas. The Vignola site, located approximately 200 meters inland from the coast, was partially degraded by intensive rotary tilling in 2018, four years prior to this study. Sampling at Vignola included both the recovering sections and the denser, closed vegetation that constitutes most of the site.
Due to their close geographic proximity, the three sites experience similar average temperatures and precipitation levels **(Figure 1)**. Overall, the climate is warm temperate, with a mean annual temperature of 1°C and average yearly rainfall of 526 mm. Minor site-specific differences exist: Vignola is influenced by sea spray, whereas Suartello tends to be slightly shadier.

Table 1. Locality and sites characteristics.

Locality	Geographical coordinates		Orientation	Main vegetation	Area (ha)
	Latitude, longitude	Altitude (m)			
Loretto	41°93′35″ N 8°71′82″ E	85	South	Wasteland [CORINE-Biotope: 87.1] Matorral with olive trees and mastic trees [CORINE-Biotope: 32.12]	1.9
Suartello	41°95′31″ N 8°75′58″ E	90	South–South-East	Grassland [CORINE-Biotope: 34.4]	2.5

				High maquis of the western Mediterranean [CORINE-Biotope: 32.311]	
Vignola	41°91′19″ N 8°65′00″ E	30	Southwest	Medium maquis with *Cytisus laniger* and *Pistacia lentiscus* in mosaic with *Olea europea* [CORINE-Biotope: 32.215] Maquis with *Cistus monspeliensis* [CORINE-Biotope: 32.341]	18

Figure 1. Map showing the positions of the three research sites (highlighted by yellow rectangles) on the outskirts of Ajaccio. The inset indicates the location of the Ajaccio region in southwest Corsica (yellow rectangle).

Sampling method

Hoverflies were surveyed at the three study locations every two weeks between mid-February and mid-November 2022, but only when individuals were observed visiting flowers during daylight hours (09:00–17:00). Rather than relying on passive collection tools such as malaise traps, emergence traps, or colored plates, specimens were actively captured with a butterfly net [27]. This approach was chosen to focus specifically on documenting which plant species were visited by flower-loving hoverflies, rather than compiling an exhaustive inventory of syrphid species. Additionally, the selected sites are ecologically sensitive, so minimizing disturbance to local pollinator communities was a priority.

Two complementary observation strategies were applied at each site. First, dynamic transect surveys were conducted along two linear paths measuring 30 × 2 meters, with observers moving slowly for about 30 minutes per transect. Collected hoverflies were temporarily stored frozen, then later mounted for the collection or preserved in 70% ethanol. Each visited flower or inflorescence was identified to the species level. Second, short static observations were performed for 5 minutes on two consecutive plants across six abundant species per sampling session, resulting in 12 observations per hour. Plant selection varied throughout the year in accordance with seasonal flowering patterns.

Over the nine-month study at Vignola, 60 transects were surveyed, totaling approximately 30 hours of dynamic and 25 hours of static observations. Loretto and Suartello were surveyed in the same manner, with 56 transects each, corresponding to roughly 28 hours of dynamic and 26 hours of static observations.

Hoverfly identification

Specimens were identified morphologically under a stereomicroscope using reference works on French hoverflies, Western European species, and Mediterranean taxa [2, 7, 28–34]. The Corsican species list from the French National Museum of Natural History ("Planète revisitée") was also consulted [25, 35]. Certain identifications were validated by experts, including Eumerus (Cavailles S. & Lebard T., pers. comm.) and Merodon chalybeus Wiedemann in Meigen, 1822 (Sarthou V., pers. comm.). Seven specimens remain undetermined at the species level but are treated as distinct morpho-species for diversity analyses, with identification ongoing.

Statistical analysis

Data analysis and figure generation were conducted using Past software v4.16c [36]. Differences in beta-diversity among sites were examined using Bray-Curtis dissimilarities and the betadisper function from the vegan package in RStudio 12.1 [37]. Flower–visitor network structures were visualized using the plotweb function in the bipartite package [38, 39].

Results and Discussion

Composition of hoverfly flower visitors

Hoverflies contributed 3.4% of total floral visits when considering the four primary insect orders (Hymenoptera, Coleoptera, Diptera, and Lepidoptera), yet accounted for 51% of Diptera observations [40]. In general, syrphids behaved as generalist flower visitors, interacting with about one-third of the flowering plant species, with notably higher activity on Foeniculum vulgare (Section 3.5). Plants visited by hoverflies were typically also visited by other insect families, averaging 10 per plant (ranging from 2 for unidentified Poaceae to 25 for Foeniculum vulgare). Most hoverfly species displayed generalized foraging, although Eumerus basalis and Eristalinus taeniops may show some specialization (Section 3.5). Relative abundances of hoverflies were below 20% of all insect visitors for individual plant species (e.g., 9% for Dittrichia viscosa, 12% for Foeniculum vulgare, 19% for Raphanus raphanistrum). Notably, during autumn (September to mid-November), hoverflies emerged as numerically significant flower visitors, approaching the abundance levels of Hymenoptera (Section 3.3) [40].

Hoverfly diversity and richness

During the survey, 138 hoverfly specimens were recorded visiting flowers, representing 27 species across 16 genera **(Table 2)**. The subfamily Syrphinae exhibited the highest diversity, comprising 9 genera and 13 species, while Milesinae included 3 genera with 8 species, and Eristalinae consisted of 4 genera and 6 species. The seven most frequently observed species accounted for 67% of the total hoverfly abundance: Eumerus barbarus (Coquebert, 1804) and Sphaerophoria scripta (Linnaeus, 1758) with 19 individuals each, Chrysotoxum intermedium (15), Episyrphus balteatus De Geer, 1776 and Syritta pipiens with 12 each, and Melanostoma mellinum (Linnaeus, 1758) and Melanostoma scalare (Fabricius, 1794) with 8 and 7 specimens, respectively.

Hoverfly abundance varied notably among the study sites: Loretto yielded the highest number of individuals (65), nearly double that recorded at Suartello (37) or Vignola (36). Compositional dominance was slightly lower at Loretto ($D = 0.096$) compared with Suartello ($D = 0.114$) and Vignola ($D = 0.127$). At the site level, the most abundant species contributed 25% of the total flower-visiting hoverfly population at Loretto (Eumerus barbarus, $N = 16$) and Vignola (Chrysotoxum intermedium, $N = 10$), while at Suartello, the dominant species (Sphaerophoria scripta, $N = 11$) represented 30% of total abundance.

Species richness also differed across sites, with Loretto hosting 19 species, Suartello 15, and Vignola 13 **(Table 2)**. Shannon diversity indices followed the same pattern, being highest at Loretto (2.68), followed by Suartello (2.53) and Vignola (2.35). Approximately half of the species were shared between any two sites (ranging from 7 to 10 species), while Loretto contained a greater number of unique species (6) compared to Suartello and Vignola (3 each) **(Figure 2)**. Beta-diversity analysis using the Harrison 2 metric indicated lower dissimilarity between Loretto and either Suartello or Vignola (0.263 in both comparisons) than between Suartello and Vignola (0.40). These variations likely reflect differences in geographical features, dominant vegetation types, anthropogenic pressures **(Table 1)**, as well as intrinsic differences in species diversity.

Estimates of total flower-visiting hoverfly richness suggested that Loretto's potential diversity ranged from 26.9 to 28.2 species based on Chao1 and abundance-based coverage estimators, respectively. Corresponding estimates were lower for Suartello (24.1–24.8) and Vignola (19.8–25.3), indicating that the 19 species observed at Loretto likely represented a higher proportion (~68%) of its total potential diversity compared to Suartello and Vignola (52–60%).

Table 2. Species list of syrphids visiting flowers for each studied site and the corresponding total number of captures (from 15 February to 15 November 2022).

Subfamily	Species	Vignola	Loretto	Suartello	Total
Syrphinae	*Chrysotoxum intermedium* Meigen, 1822	10	2	3	15
	Dasysyrphus albostriatus (Fallén, 1817)	0	1	0	1
	Episyrphus balteatus De Geer, 1776	2	5	5	12
	Eupeodes corollae (Fabricius, 1794)	1	0	3	4
	Melanostoma mellinum (Linnaeus, 1758)	4	4	0	8
	Melanostoma scalare (Fabricius, 1794)	0	6	1	7
	Meliscaeva auricollis (Meigen, 1822)	1	1	1	3
	Paragus bicolor (Fabricius, 1794)	0	2	0	2
	Paragus haemorrhous Meigen, 1822	1	0	1	2
	Paragus quadrifasciatus Meigen, 1822	1	1	1	3
	Paragus sp1 Latreille, 1804[a]	1	1	0	2
	Sphaerophoria scripta (Linnaeus, 1758)	0	8	11	19
	Syrphus ribesii (Linnaeus, 1758)	0	1	1	2
Eristalinae	*Eristalinus megacephalus* (Rossi, 1794)	1	0	0	1
	Eristalinus taeniops (Wiedemann, 1818)	4	0	0	4
	Eristalis similis (Fallén, 1817)	0	0	1	1
	Eristalis tenax (Linnaeus, 1758)	0	3	0	3
	Helophilus pendulus (Linnaeus, 1758)	0	0	1	1
	Myathropa florea (Linnaeus, 1758)	0	1	0	1
Milesinae	*Eumerus barbarus* (Coquebert, 1804)	0	16	3	19
	Eumerus basalis Loew, 1848	0	3	2	5
	Eumerus pulchellus Loew, 1848	0	1	0	1
	Eumerus sp1 Fabricius, 1798[a]	2	5	0	7
	Merodon chalybeus Wiedemann in Meigen, 1822	0	0	1	1
	Merodon sp2 (Meigen, 1803)[a]	0	1	0	1
	Syritta pipiens (Linnaeus, 1758)	7	3	2	12
	Syritta sp1 (Lepeletier et Audinet-Serville, 1828)[a]	1	0	0	1

aAuthors' names for unidentified species are related to the genus descriptor.

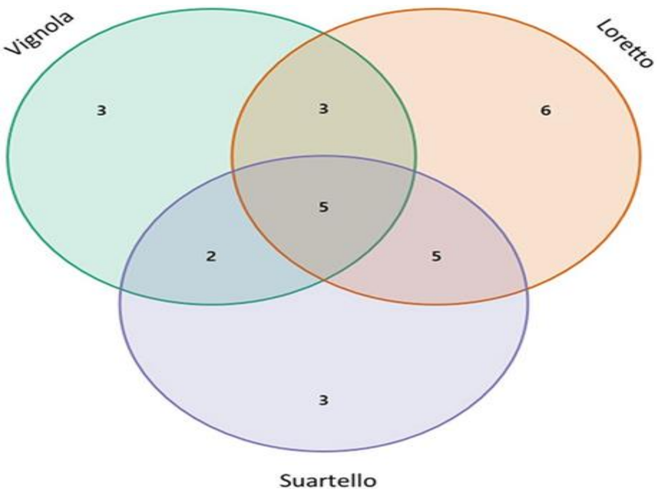


Figure 2. Venn diagram showing the distribution of Syrphid species that are shared or unique among the

three study sites: Vignola, Loretto, and Suartello.

Seasonal patterns

Hoverfly activity and species richness on flowers showed clear monthly fluctuations, following a bimodal pattern with peaks in early spring (March) and late autumn (November) **(Figure 3)**. The highest levels of both abundance and diversity were observed in October, when 16 species were recorded and 54 individual hoverflies were captured across the study sites **(Figure 3)**. Overall, autumn was the period of greatest hoverfly activity, with nearly 60% of all specimens collected between September and mid-November **(Figure 3)**. During this period, flower-visiting diversity also peaked, with 19 of the 28 total species documented. Among all recorded species, nine were singletons, each represented by a single individual.

Hoverfly presence was comparatively lower outside the peak months. From late February through June, only 4–13 individuals were observed per month, spanning 3–6 species, except in March, which showed a secondary peak with 25 individuals across 10 species. Activity during summer was minimal, with merely one hoverfly observed on flowers in both July and August **(Figure 3)**.

Considering species composition throughout the year, approximately two-thirds of the data were informative, as nine species were rare singletons. These singletons were detected sporadically across seasons but were absent during summer, with several appearing only in spring (March: 3; April: 1; May: 1) or autumn (September: 1; October: 2; November: 1).

Certain hoverfly species were consistently present throughout the main flowering season, from late winter or early spring to late autumn. These included Chrysotoxum intermedium, Episyrphus balteatus, Eumerus sp. 1, Eupeodes corollae (Fabricius, 1794), Meliscaeva auricollis (Meigen, 1822), Sphaerophoria scripta, and Syritta pipiens. Other species, such as Eumerus barbarus, Eumerus basalis Loew, 1848, Paragus bicolor, Paragus haemorrhous Meigen, 1822, and Paragus quadrifasciatus Meigen, 1822, were active from late spring to late autumn. Finally, a few species displayed strictly seasonal activity, visiting flowers only in spring (Melanostoma mellinum (Linnaeus, 1758), Melanostoma scalare, Eristalis tenax (Linnaeus, 1758)) or autumn (Eristalinus taeniops, Paragus sp. 1, Syrphus ribesii).

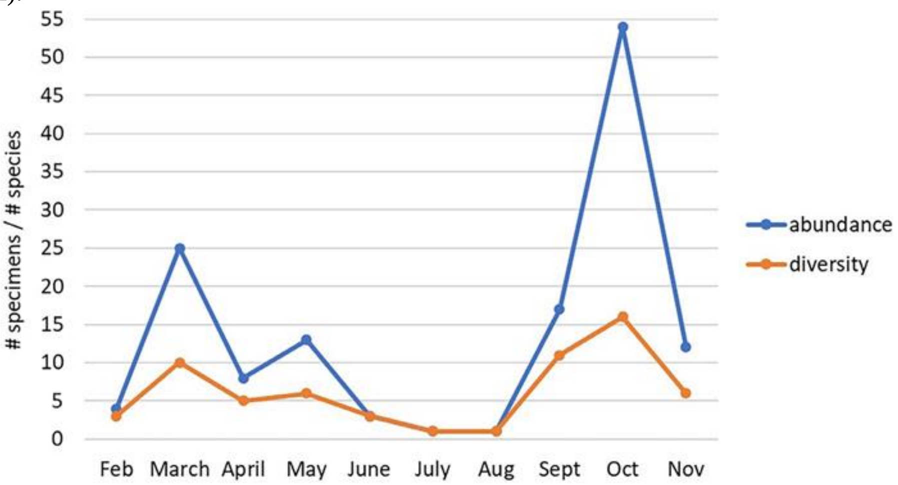


Figure 3. Monthly trends in hoverfly (Syrphidae) abundance and species richness on flowers, aggregated across the three study sites.

Daily activity

The abundance and species richness of hoverflies displayed similar patterns across the three study sites when assessed on a daily basis **(Figure 4)**. Overall, hoverflies were most frequently observed visiting flowers during the morning, especially in the earliest hours, with lower activity recorded in the afternoon **(Figure 4)**. The two peak periods for hoverfly abundance were 09:00–10:00 (37 individuals) and 11:00–12:00 (27 individuals). In total, 58% of all hoverflies were collected during the morning window (09:00–12:00), whereas after noon, only 9–14 individuals were captured per hour **(Figure 4)**.

Regarding species diversity, the majority of hoverfly species (approximately 70%) were also observed during the morning period (09:00–12:00). Species that were recorded exclusively in the afternoon—mostly between 14:00 and 15:00—were primarily singletons (6 out of 10 species). Six species demonstrated activity throughout the entire day, while four others exhibited prolonged, but not continuous, periods of flower visitation. For instance, Eristalinus taeniops was active from 11:00 to 17:00, whereas Eristalis tenax, Eumerus pulchellus, and Myathropa florea were observed both in the morning and afternoon.

The remaining six species appeared to favor more specific times of day for flower visits. Eupeodes corollae, Melanostoma mellinum, Paragus quadrifasciatus, and Eumerus basalis were primarily active in the morning, Syrphus ribesii peaked around midday, and Paragus sp. 1 was mainly observed during the afternoon.

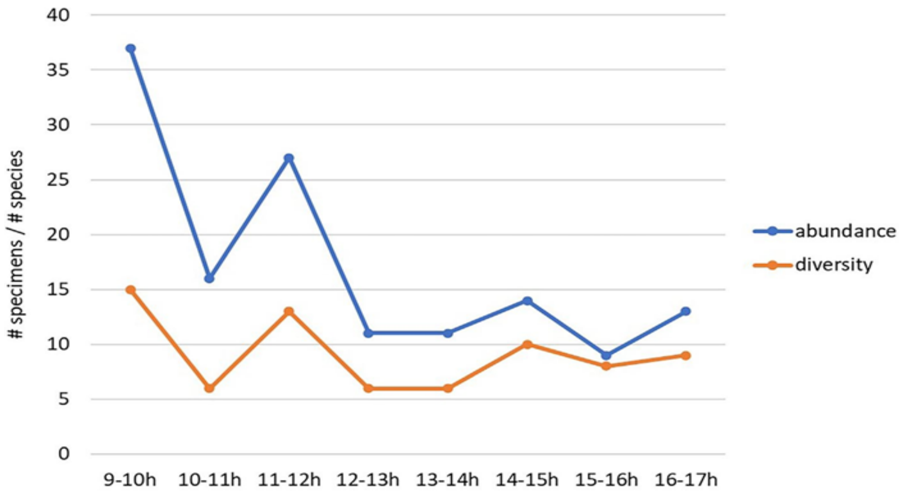


Figure 4. Changes in Syrphidae specimen numbers and species diversity across different time intervals while visiting flowers, aggregated across the three study locations.

Diversity of visited flowers

During the study period, hoverflies were observed visiting 21 different angiosperm species across 12 plant families. The family Asteraceae stood out as the most species-rich, contributing 10 of the recorded species, whereas the remaining 11 families were represented by a single species each. The five plant species that accounted for the majority of visits—together comprising 73% of all observations—were Foeniculum vulgare (34 percent), Raphanus raphanistrum (16 percent), Dittrichia viscosa (11 percent), Reichardia picroides (7 percent), and Leontodon tuberosus (6 percent). Other notable plants included three daisies (Anthemis arvensis, Calendula arvensis, Glebionis segetum) and the rockrose Cistus monspeliensis **(Figure 5a)**. In terms of hoverfly species richness, most of these dominant plants—except for Anthemis arvensis and Glebionis segetum—attracted a high diversity of hoverfly species **(Figure 5b)**.

Seasonal patterns indicated that hoverfly visitation was lower during spring and summer than in autumn for most key plants (Foeniculum vulgare, Dittrichia viscosa, Reichardia picroides, and Leontodon tuberosus), with the exception of Raphanus raphanistrum, which peaked in May.

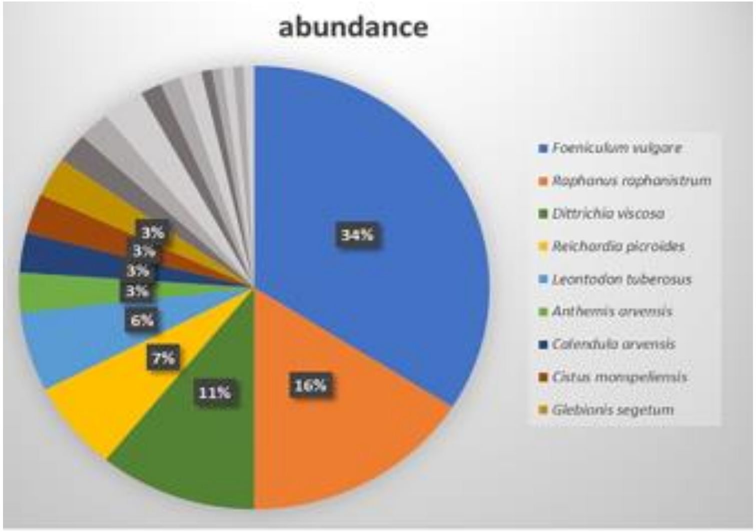
The bipartite network in **Figure 6** illustrates interactions between hoverflies and their floral hosts. Among species represented by only one individual, four were recorded on various Asteraceae (Anthemis arvensis, Dittrichia viscosa, Glebionis segetum, and Reichardia picroides), while five others were found on Foeniculum vulgare (2 species), Erica arborea (2 species), and Raphanus raphanistrum (1 species) **(Figure 6)**. All of these plant species, except Erica arborea, were also visited by multiple hoverfly species. The majority of hoverflies (18 species) exhibited generalist foraging behavior, frequently visiting the most abundant floral resources **(Figure 6)**.

Several species showed more selective flower choices. Sphaerophoria scripta primarily visited Raphanus raphanistrum (26%) and Anthemis arvensis (16 percent), but also nine other plants, mainly Asteraceae (7 species). Episyrphus balteatus concentrated on Foeniculum vulgare (25%) and Leontodon tuberosus (25 percent), with occasional visits to six additional species, mostly Asteraceae. Chrysotoxum intermedium and Syritta pipiens each visited six plant species, showing a preference for Dittrichia viscosa (20 percent and 33 percent, respectively) and Foeniculum vulgare (47 percent and 33 percent, respectively) **(Figure 6)**.

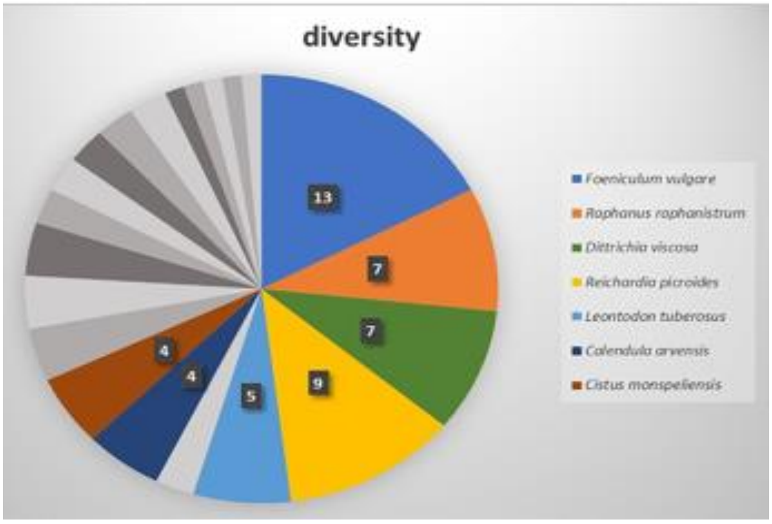
Some hoverflies appeared oligolectic. Melanostoma scalare and Melanostoma mellinum largely foraged on Raphanus raphanistrum (88 percent and 71 percent, respectively) with only one or two other species visited; notably, M. mellinum was the sole visitor recorded on Vicia villosa. Eumerus barbarus predominantly used Foeniculum vulgare (89%) but occasionally visited two other plant species. Two species seemed highly specialized: Eristalinus taeniops on Dittrichia viscosa (4 individuals from Vignola) and Eumerus basalis on

Foeniculum vulgare (5 individuals from Loretto and Suartello), though these results are preliminary given the limited sample sizes.

From the plant perspective, most species (76%) received visits from at least two hoverfly species. Four plants—Foeniculum vulgare, Raphanus raphanistrum, Dittrichia viscosa, and Reichardia picroides—served as critical floral resources, attracting 21 hoverfly species and representing 78 percent of the total hoverfly diversity **(Figure 6)**. Conversely, five species (Asphodelus ramosus, Sherardia arvensis, Urospermum dalechampii, Vicia villosa, and an unidentified Poaceae) were each visited by only a single hoverfly species **(Figure 6)**.



a)



b)

Figure 5. Distribution of hoverfly visits to flowers in terms of abundance (a) and species diversity (b) across the recorded plant taxa, pooled from all three study sites. For clarity, plant species representing less than 3% of visits and those attracting fewer than four hoverfly species are grouped together in grey on the pie charts.

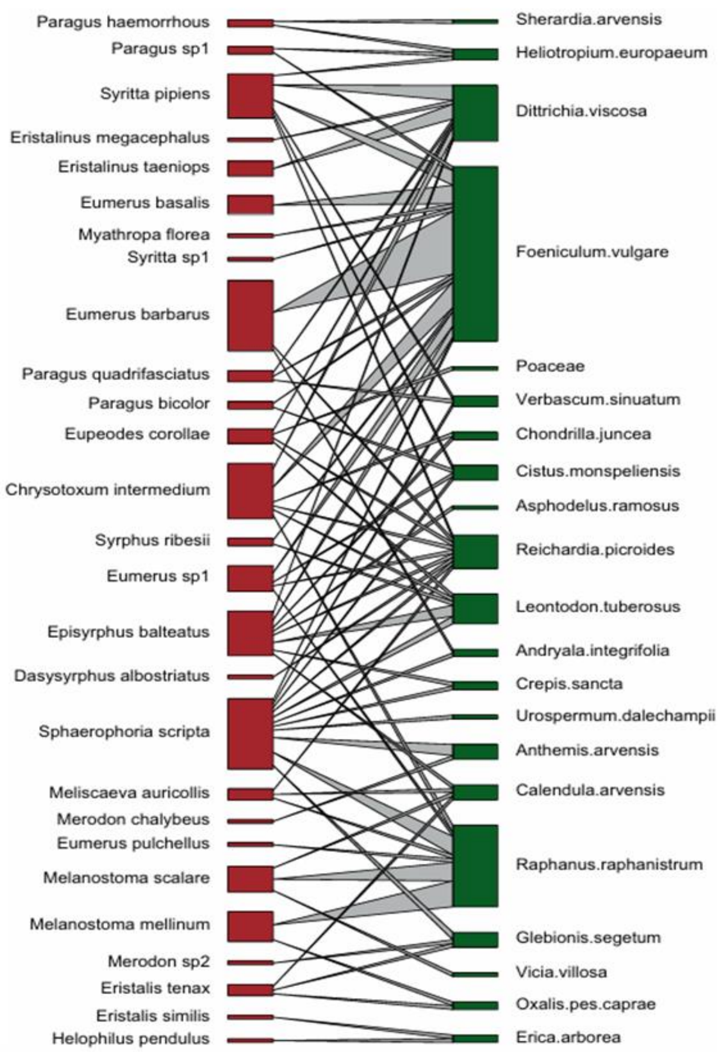


Figure 6. Network representation of Syrphidae–flower interactions, showing species diversity pooled across the three study sites.

All hoverfly taxa identified in this survey had been previously documented from Corsica [12, 20, 24, 25, 35]. However, 22 species are reported here for the first time in the Ajaccio region **(Table 2)**. In contrast, three taxa that were earlier listed from Ajaccio by the OCIC inventory—Chrysotoxum cisalpinum, Milesia semilectifera, and Xylota segnis—were absent in our nine-month sampling campaign (Cornuel-Willermoz A., pers. comm.), most likely because our collecting strategy was less exhaustive compared with broader surveys [27, 35]. Although the vegetation at all three localities (Vignola, Suartello, and Loretto) corresponds to a low maquis formation, each site presents environmental nuances (vegetation layering, closeness to woodland or coastal areas) that could account for part of the observed differences in hoverfly assemblages. Site-specific taxa represented between 20% and 32% of the total richness at each site **(Figure 2)**. Yet, these unique species were rare in captures (one or two individuals), implying that broader sampling would likely reveal them at the other locations as well. The community at Loretto was noteworthy for showing slightly greater richness and abundance, together with the lowest dominance index, despite the strong local representation of Eumerus barbarus (up to 25% of the captures). Interestingly, this species, abundant at two sites during our study **(Table 2)**, had only recently been added to the Corsican fauna among 20 newly reported hoverflies from the "Planète revisitée" expeditions [35]. Anthropogenic disturbance also influences these maquis zones, as site management practices such as clear-cutting for mechanical maintenance (Maestracci P-Y., pers. obsv.) could alter hoverfly communities, though more targeted studies are needed to quantify such impacts.

Monthly trends in species turnover support known activity periods for several taxa, including Chrysotoxum intermedium, Episyrphus balteatus, Eumerus barbarus, Eumerus basalis, Syritta pipiens, and Sphaerophoria scripta [28]. Notably, for three species—Paragus haemorrhous, Paragus quadrifasciatus, and Eristalinus taeniops—our records extend their documented flight season into October or even mid-November [28]. This late persistence is likely facilitated by the mild Mediterranean autumn and the availability of diverse floral resources **(Figure 3)**.

Because every hoverfly specimen was collected during floral visits, our approach enabled the establishment of a local inventory of plant–hoverfly associations and provided insights into their potential pollination roles. We documented previously unreported plant family associations for as many as 13 species [28, 41]. For instance, Episyrphus balteatus was observed on Apiaceae and Asphodelaceae; Chrysotoxum intermedium, Dasysyrphus albostriatus (Fallén, 1817), and Syrphus ribesii on Asteraceae; Melanostoma scalare on Brassicaceae; Eristalis similis on Ericaceae; and Eristalis tenax on Oxalidaceae. Two widespread taxa showed additional associations: Syritta pipiens on Apiaceae and Boraginaceae, and Melanostoma mellinum on Brassicaceae and Oxalidaceae. For Paragus spp. (P. bicolor, P. haemorrhous, P. quadrifasciatus, and P. sp1), three further plant families were added—Boraginaceae, Cistaceae, and Rubiaceae. The floral preference of Merodon chalybeus was previously unknown, but our single observation recorded it visiting Anthemis arvensis (Asteraceae) [28].

Overall, most hoverfly taxa behaved as generalist foragers, some being recorded on up to 11 plant species. Cases where taxa were found on only two or three plant species usually corresponded to species that were rare in the dataset, with only one capture per species. By contrast, two species exhibited a narrow specialization: Eumerus basalis almost exclusively on Foeniculum vulgare, and Eristalinus taeniops predominantly on Dittrichia viscosa at Vignola **(Table 2).**

Conclusion

The survey of hoverflies across the three maquis shrubland sites—Loretto, Suartello, and Vignola—revealed a comparatively rich fauna, though with notable site-specific variation. Among them, Loretto emerged as the most species-rich and the most densely populated site for flower-visiting syrphids. At the subfamily level, Syrphinae showed the highest representation, with 13 taxa, making up roughly half of the total species richness recorded.

Patterns of flower visitation revealed a clear diel rhythm, with peak activity concentrated in the morning hours across all study areas. Seasonality was also pronounced, as the majority of floral visits were concentrated in the autumn months (September–November). In terms of floral resources, Asteraceae was the most frequently visited plant family, with hoverflies recorded on Dittrichia viscosa, Crepis sancta, Leontodon tuberosus, Reichardia picroides, Anthemis arvensis, Chondrilla juncea, and Calendula arvensis.

Two species dominated the captures: Sphaerophoria scripta (Syrphinae), a widespread generalist observed on flowers from 11 plant species at the sites, and Eumerus barbarus (Milesiinae). The abundance of E. barbarus is likely linked to its larval habits, which are phytophagous on bulbs and roots of plants belonging to the Asparagales [33]. The presence of Asphodelus ramosus (L., 1753), a common Asparagales species in all sites, may therefore explain the high representation of this hoverfly.

Most of the observations reported here are new for the Ajaccio region, apart from the few earlier records from the OCIC inventory [12]. Despite the well-recognized importance of syrphids as pollinators of crops and wild flora, our results emphasize how limited current knowledge remains on their ecology and their integration into plant–pollinator networks in semi-natural habitats. The majority of taxa behaved as generalist flower visitors, with a tendency to exploit the most common plant species, but their pollination efficiency still requires assessment. Their substantial abundance in autumn highlights their likely importance for late-blooming wildflowers as well as certain agricultural crops planted during this season.

Overall, hoverflies can be regarded as valuable bioindicators in Mediterranean shrublands, where their diversity and abundance provide a useful measure of how land management practices affect local ecosystems. In this context, they also represent a key taxon to be considered in conservation planning within a mitigation hierarchy framework.

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