JARDINS DE PAPALLONES: 2025 RESULTS OF FONTMARTINA'S GARDEN

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JARDINS DE PAPALLONES

CBMS Catalan Butterfly Monitoring Scheme

MUSEU DE CIÈNCIES NATURALS DE GRANOLLERS

ICO Institut Català d'Ornitologia

ESTACIÓ BIOLÒGICA DEL MONTSENY

Cover photo: Some pollinators observed in the Fontmartina garden in 2025.
Julie & Soazic Jouffe, 2025.

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INTRODUCTION

1) Butterflies and their decline

Butterflies are essential insects for the proper functioning of ecosystems. As pollinators, they play an active role in the reproduction of many wild and cultivated plants. Their life cycle, which depends closely on the availability of host plants for the caterpillars and nectar-producing flowers for the adults, makes them valuable bioindicators: their presence, diversity and fluctuations in abundance directly reflect the health of natural environments.

However, butterflies are particularly sensitive to environmental changes, such as habitat loss, urbanisation, pesticide use, climate change and the introduction of invasive species, which has led to a marked decline in many species in Europe over recent decades (*Hallmann et al., 2017*; *Wagner et al., 2021*; *Tassin de Montaigu & Goulson 2024*). Thanks to the long-term monitoring of butterflies through the CBMS (the Catalan, Andorran and Balearic Butterfly Monitoring Scheme), we know that over the past 30 years most butterfly species have undergone severe population declines in Catalonia (*Jardins de Papallones.org*).

In this context, monitoring populations and creating favourable habitats, such as gardens, have become key priorities for their conservation.

Taken individually, single gardens may seem to be of little biological significance, but together they represent a potentially important shelter, nesting habitat, and food resource for urban wildlife (*Tassin de Montaigu & Goulson 2024*). They can help maintain connectivity between larger patches of habitat, acting as steppingstones for populations of flora and fauna (*Doody et al., 2010*; *Rudd et al., 2002*).

Figure 1: Papilio machaon caterpillar on Foeniculum vulgare
Photo credit: Soazic & Julie Jouffe

INTRODUCTION

2) Presentation of the *Jardins de Papallones* project

The “Jardins de Papallones” project is an initiative aimed at helping reverse the decline of butterflies in Catalonia and promoting biodiversity in urban and peri-urban areas through the creation of butterfly-friendly habitats, known as “butterfly gardens.” This initiative is accompanied by a monitoring program for butterflies and other pollinators, thereby contributing to improving our knowledge of these insects in human-modified environments (*Jardins de Papallones.org*).

Figure 2: Leptotes pirithous (left) and Polyommatus icarus (right) feeding on Origanum vulgare
Photo credit: Soazic & Julie Jouffe

INTRODUCTION

3) Objectives

The objectives of this study are, first, to **assess the diversity of pollinators** present in the Fontmartina garden; second, to **monitor the phenology of butterflies**; third, to **analyse their behaviour** within the garden; and fourth, to **record the plant species** and highlight their **ecological roles**, whether as **nectar sources or host plants**.

Figure 3: Mating of Argynnis paphia
Photo credit: Soazic & Julie Jouffe

MATERIALS & METHODS

1) Study Site and Period

The monitoring was carried out in the Fontmartina garden of the Montseny Bird station, located in the municipality of Fogars de Montclús (Parc Natural del Montseny).

The garden covers an area of approximately 2,000 m², with a vegetated zone representing about three-quarters of the total surface.

It is surrounded by forest (mainly *Pseudotsuga menziesii* and *Quercus ilex*), and no herbicides or insecticides are used.

A (partial) list of the plant species present in the garden is provided in *Appendix 3*.

The first survey was conducted on June 6th, 2025, and the last on October 28th, 2025. Four surveys per month were carried out (except in August, with five), for a total of 21 surveys.

Figure 4: The Fontmartina garden, our study site

Photo credit: Julie & Soazic Jouffe

2) Protocol

The monitoring is based on a 15-minute survey during which all butterfly species observed in the garden are recorded, along with their behaviours and the flowering plants present at the time of the survey.
The observed behaviours can be the following:

- L: nectar feeding = feeding on a flower
- O: oviposition = laying eggs
- S: searching for an oviposition site = female in slow, hovering flight around a plant, looking for a place to lay eggs.
- M: mud-puddling = feeding on mud, feces, sap, fruits...,
- C: copulation
- T: territorial behaviour = behaviour of some males, which mainly perch on a leaf, rock, ground or bark in a clearly visible spot (to which they return after inspection flights), or chase other butterflies away from the area.
- P: courtship display = the male performs reconnaissance flights in search of a female, attracting her attention with twists and turns and pheromones. If the female accepts the male's advances, she then joins the dance.
- A: other = for example butterfly flying
- (leave the column blank if no behaviour is observed)

Butterfly monitoring was carried out once a week.
The count is realised by walking around the garden and stopping for a few minutes in areas with flowering plants, following a route that can vary each time as long as it lasts 15 minutes and stays within the area recorded as the garden.

All butterflies present in the garden are counted, taking care not to count the same individuals twice (record the maximum number of individuals of the same species observed at the same time).
The 15-minute count can be paused if necessary, for example, to identify a butterfly using a field guide. In this case, the timer is stopped until the survey resumes.
Finally, flowering plants are also recorded, using a categorical scale.

MATERIALS & METHODS

In addition to counting butterflies, other pollinators in the garden can also be recorded.

The environmental conditions at the time of the count should be recorded: the percentage of sunlight, temperature, and wind. Monitoring is ideally carried out between around 10 a.m. and 3 p.m., as long as the weather conditions are favourable. The optimal conditions for butterflies are:

- Minimum temperature of 15 °C,
- More than 50% sunlight,
- Light wind (maximum force 3 on the Beaufort scale).

When these conditions are not met, the activity of butterflies decreases considerably.
Cloud cover (expressed as a percentage) and wind speed (estimated according to the Beaufort scale) should be recorded at the end of the count.

Required materials: a chronometer, the field sheet, a camera to facilitate identification, and a butterfly identification guide.

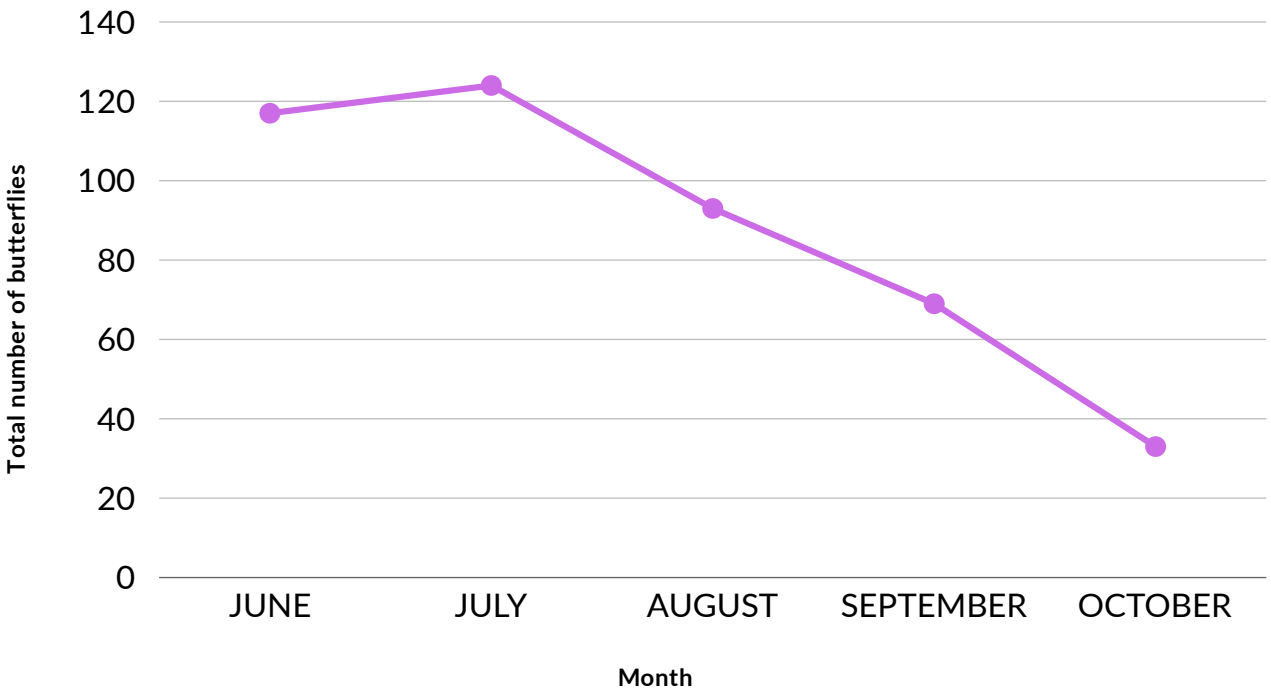
All data are recorded on the field sheet (*Appendices 2A and 2B*), and then entered on the website https://www.jardinsdepapallones.org. Once submitted, the data are checked by the project's coordinating scientists.

RESULTS

1) Number of species observed

A total of 436 butterflies were recorded in the garden during the counts, belonging to 44 species (list on *Appendices 1A and 1B*).

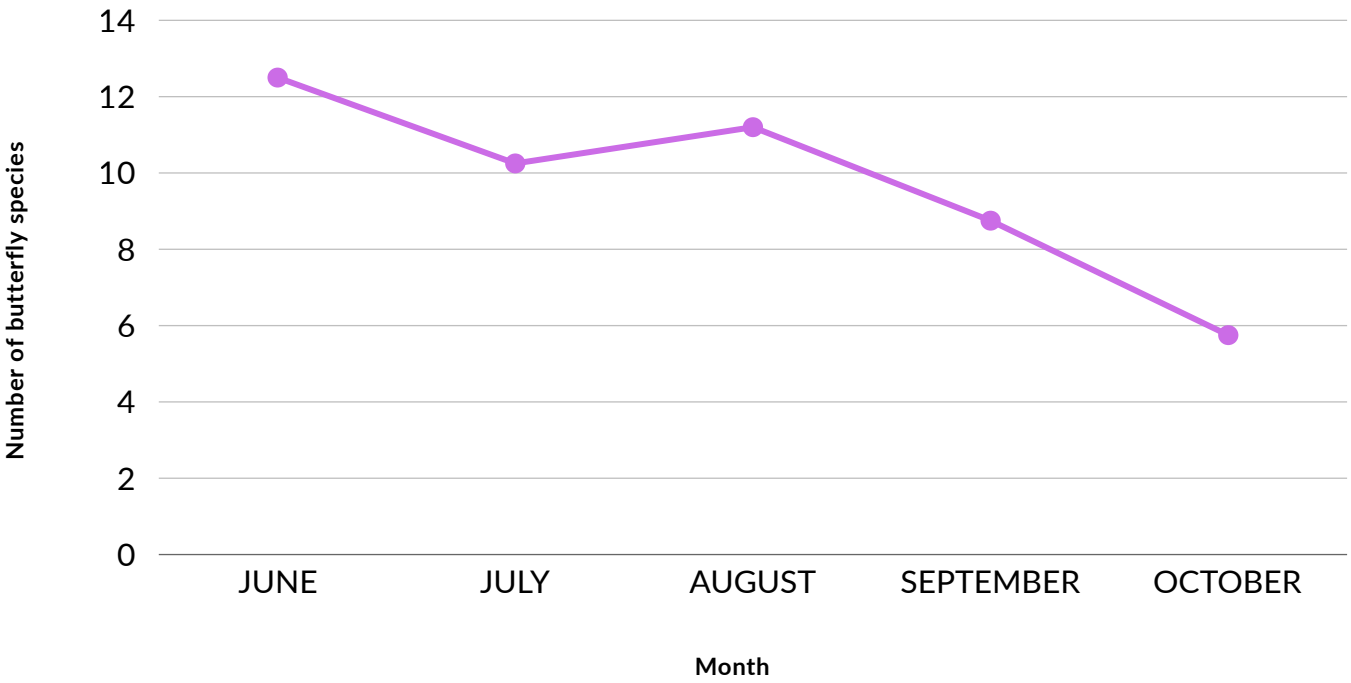
The highest number of butterflies was observed in July, with 124 individuals (*Graph 1*) and an average of 31 butterflies per count. In contrast, October had the lowest number of butterflies, with 33 individuals (*Graph 1*) and an average of 8.25 butterflies per count.



Graph 1: Total number of butterflies observed per month

RESULTS

The number of butterfly species is higher in June, with an average of 12.5 species per count (*Graph 2*). In contrast, it is lower in October, with an average of 5.75 species per count (*Graph 2*).



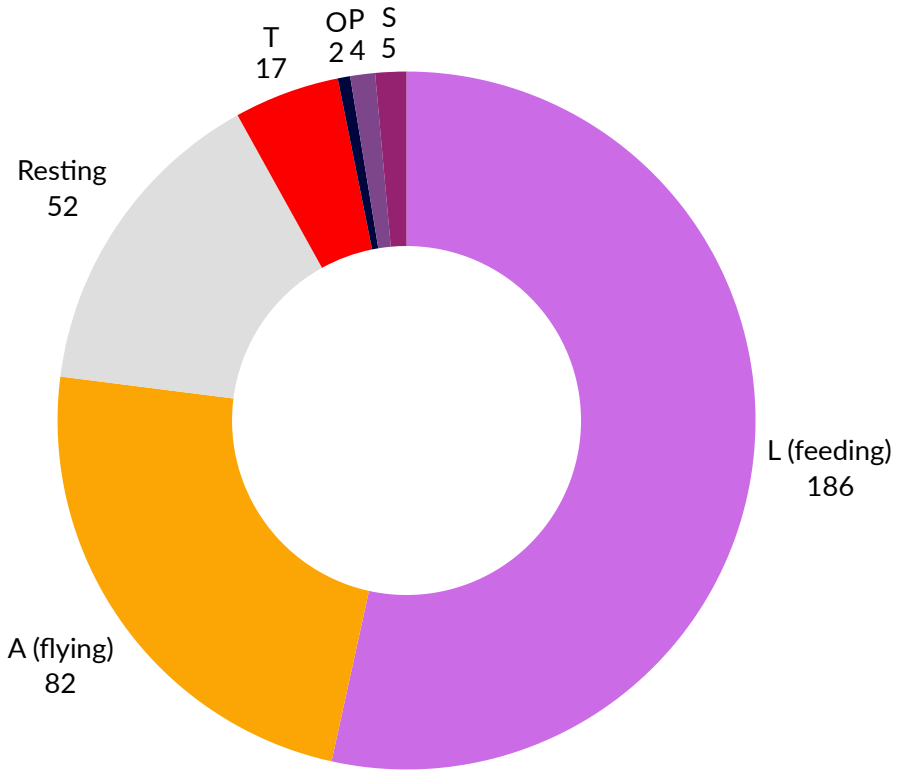
Graph 2: Average number of butterfly species observed per month

Abundance: The most recorded species in the garden are the Iberian Marbled White (*Melanargia lachesis*), with 49 individuals counted, and the Silver-washed Fritillary (*Argynnis paphia*), with 43 individuals.

Presence throughout the season: The Cleopatra (*Gonepteryx cleopatra*) is the species most frequently observed during our monitoring, recorded in 14 out of 21 counts, followed by the Silver-washed Fritillary (*Argynnis paphia*), recorded in 12 out of 21 counts.
In terms of flight period, the Silver-washed Fritillary was observed from June 22 to September 18, while the Cleopatra was present from June 22 to October 21, making it the species visible over the longest period.

2) Observed behaviours

Butterflies were most frequently observed feeding on a flower (186 observations), flying (82 observations), or resting on a non-flower substrate (ground, wall, grass, etc.) (52 observations) (*Graph 3*).



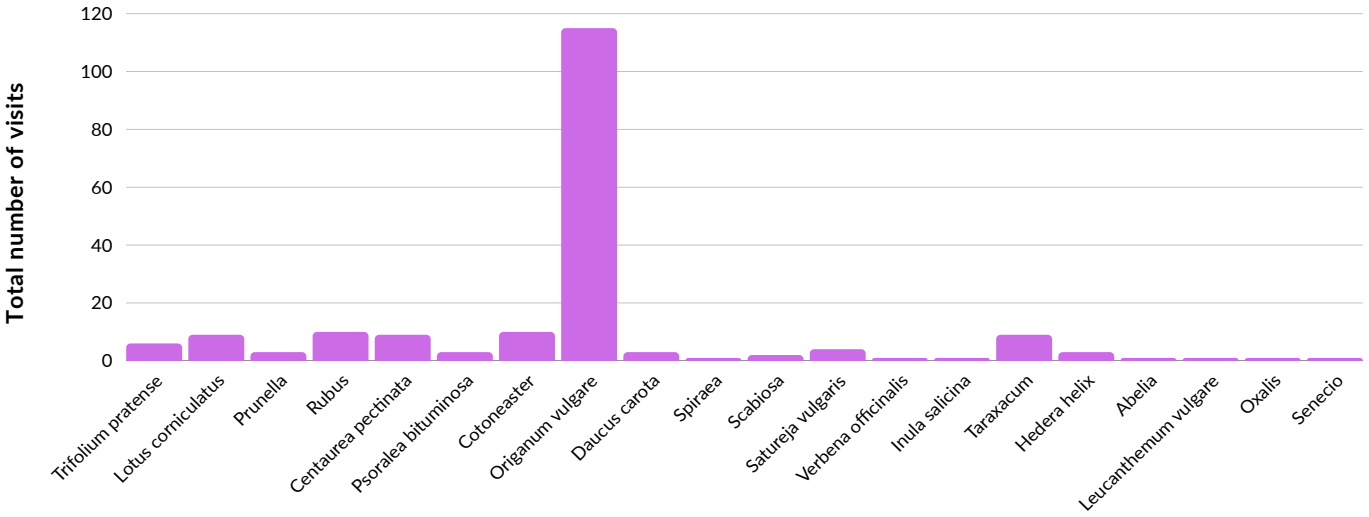
Graph 3: Abundance of observed behaviours

T = territorial behaviour; O = Oviposition; P = courtship display;

S = searching for an oviposition site

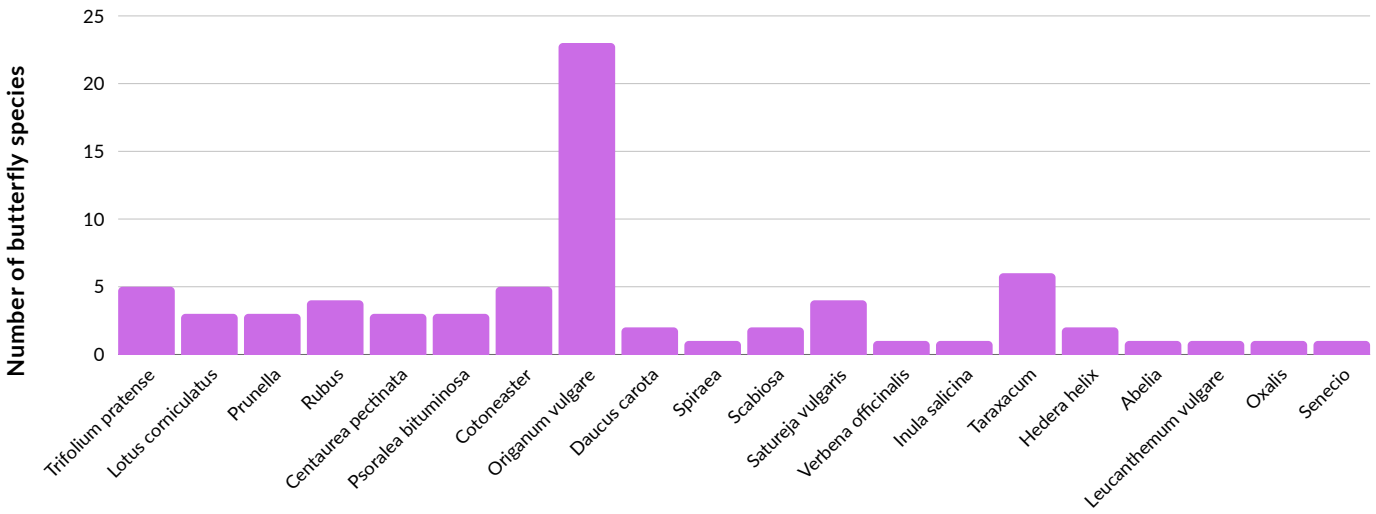
3) Interactions with flowers

A total of 20 flowering plant species were visited by the butterflies. Among them, *Origanum vulgare* was the most visited, with over 115 observations on this plant (*Graph 4*).



Graph 4: Total number of butterfly visits per flower species

Origanum vulgare is also the flower visited by the highest number of butterfly species, with 23 species (*Graph 5*).



Graph 5: Number of butterfly species visiting each flower

RESULTS

4) Flowering

Among the seven plants that attracted the most butterflies for feeding, *Origanum vulgare* produced the most flowers and over the longest period (more than 1,000 flowers for over three months).

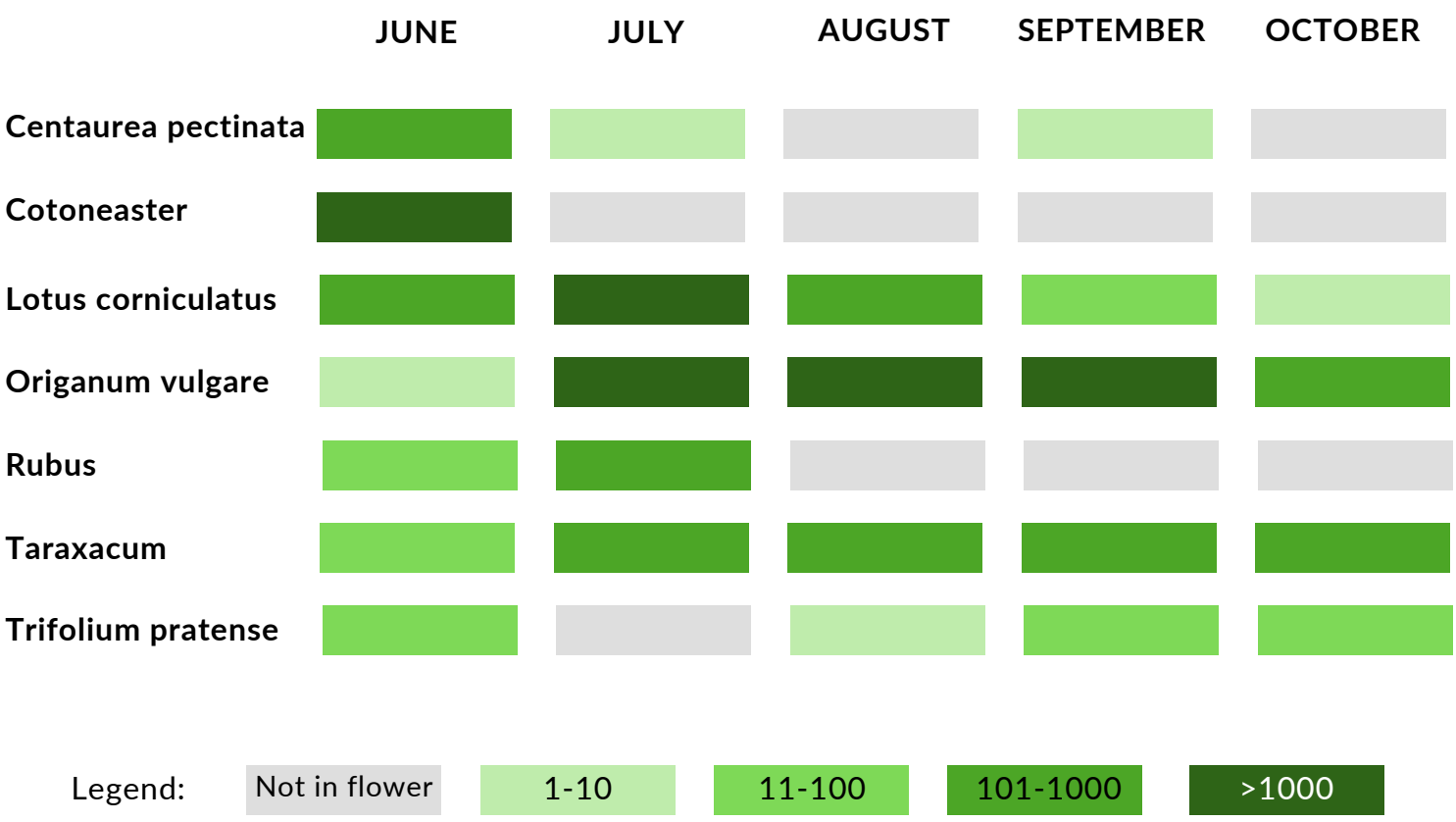


Figure 5: Number of flowers per plant over the season

5) Oviposition

During the survey, only two oviposition behaviours were observed: a Clouded Yellow (*Colias crocea*) laying eggs on *Lotus corniculatus* and a Purple Hairstreak (*Favonius quercus*) laying eggs on *Quercus ilex*.

Outside of the counts, other ovipositions were observed: Iberian Swallowtails (*Iphiclides feisthamelii*) on *Prunus spinosa*, Holly Blues (*Celastrina argiolus*) on *Rubus*, Grayling (*Hipparchia semele*) on *Poaceae*, and finally, Berger's Clouded Yellow (*Colias alfacariensis*), Long-tailed Blues (*Lampides boeticus*), and Common Blues (*Polyommatus icarus*) on *Lotus corniculatus*.

A Swallowtail (*Papilio machaon*) was observed attempting to lay eggs, without success (due to the absence of *Foeniculum vulgare* in the garden).

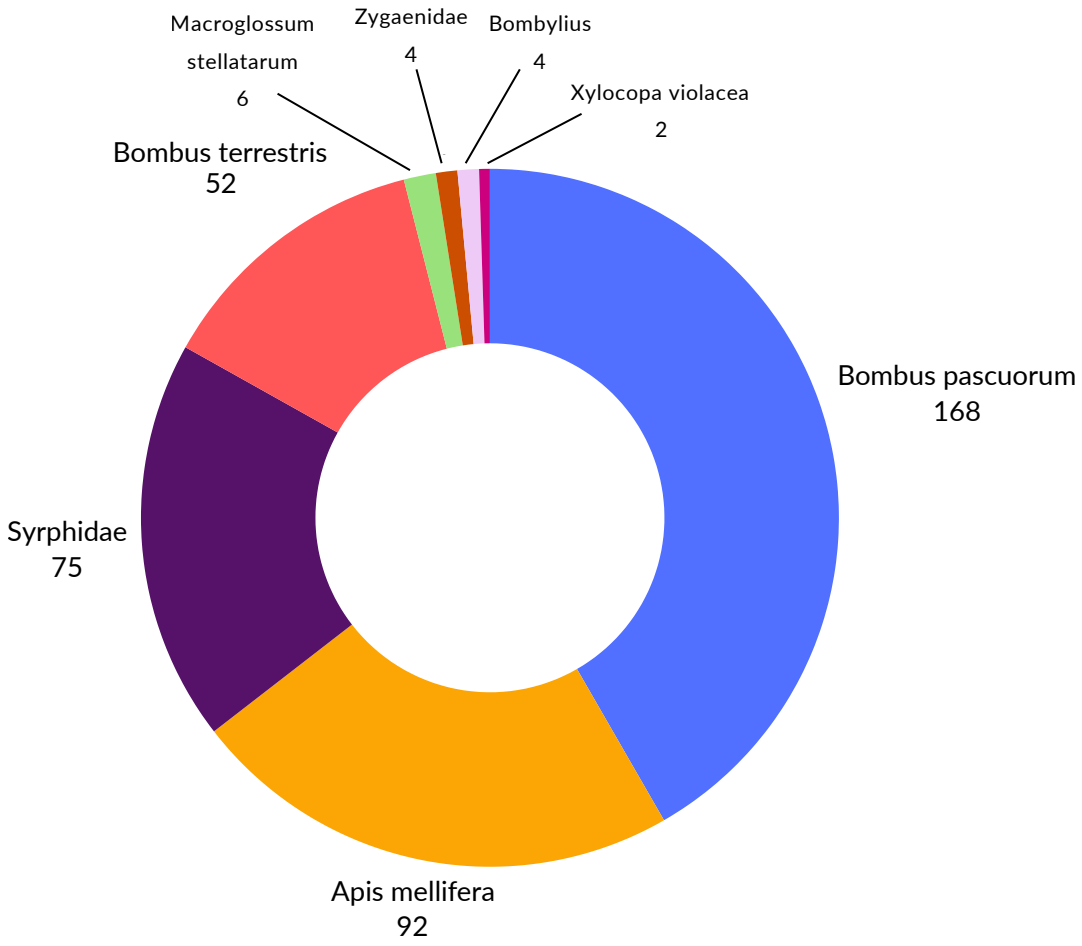
Figure 6: Egg of Iphiclides feisthamelii on Prunus spinosa

Figure 7: Hipparchia semele laying eggs on Poaceae

Photo credit: Soazic & Julie Jouffe

6) Other pollinators

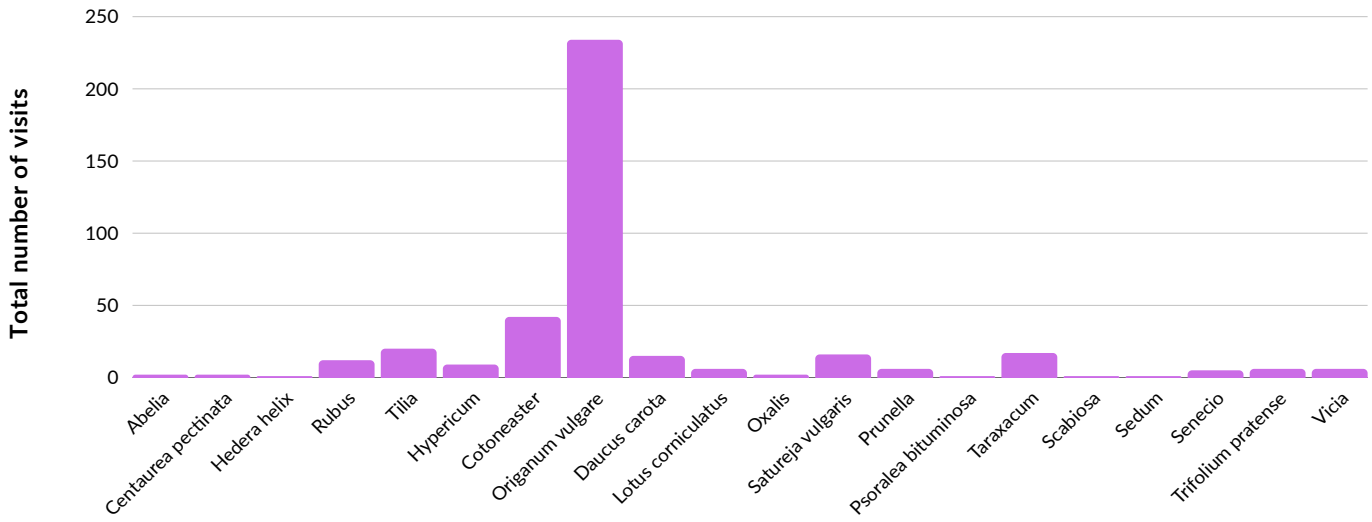
Among the other pollinators observed in the garden during the counts, the Common carder bee (*Bombus pascuorum*) was the most recorded with 151 individuals, followed by the European honey bee (*Apis mellifera*) with 89 individuals (*Graph 6*).



Graph 6: Abundance of other pollinators observed in the garden

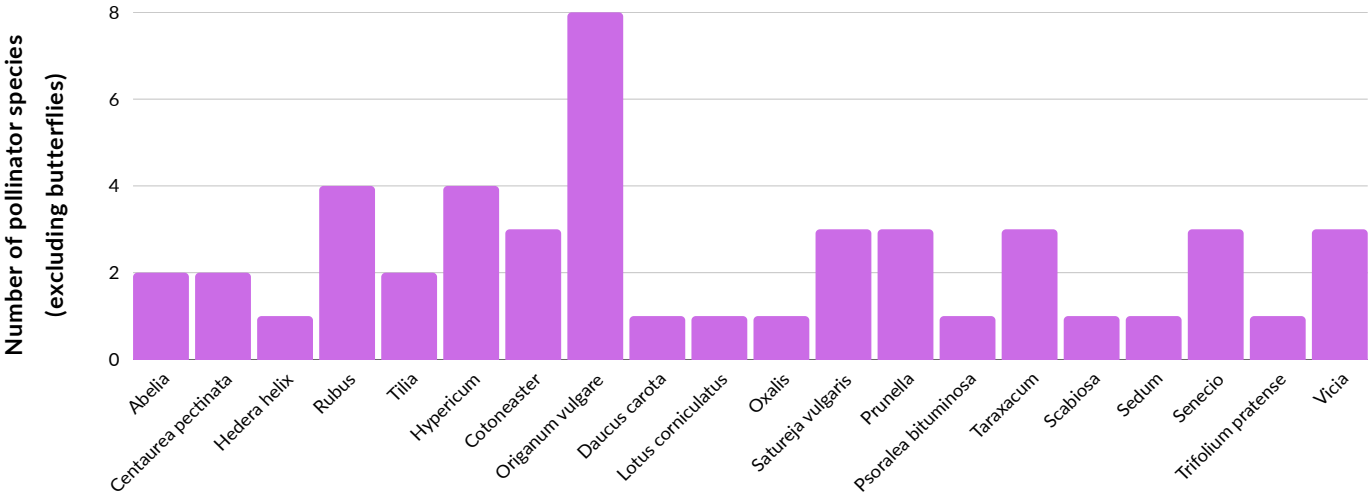
RESULTS

20 species of flowers were visited by pollinators (excluding butterflies). Among these, *Origanum vulgare* was the most visited, with over 234 observations on this plant (*Graph 7*).



Graph 7: Total number of visits by pollinators (excluding butterflies) per flower species

Origanum vulgare is also the plant visited by the highest number of pollinator species (excluding butterflies), with 8 species (*Graph 8*).



Graph 8: Number of pollinator species (excluding butterflies) visiting each flower

DISCUSSION

The monitoring carried out in the garden recorded a great diversity of butterflies, with a total of 44 species. This high diversity can be explained by the relatively large variety of flowers available over a long period. Indeed, the more varied and abundant the floral resources are, the higher the diversity of pollinators is *(Neumann et al., 2024)*.

July shows the highest number of individuals, while species richness reaches its peak in June. This corresponds to the flight peaks of many Mediterranean species (*CatalanBMS.org*) and to the period when flowering is most abundant.

The dominant species, such as the Iberian Marbled White (*Melanargia lachesis*) and the Silver-washed Fritillary (*Argynnis paphia*), are typical of open, nectar-rich habitats, showing the importance of maintaining flower-rich meadows and open areas (*Neumann et al., 2024*; *Hordley & Fox 2024*; *Tassin de Montaigu & Goulson 2024*).

Behavioural observations reveal a high proportion of foraging activity, demonstrating the important role of the garden as a nectar source. Among the available plants, *Origanum vulgare* clearly stands out: it is both the most visited plant and the one attracting the greatest number of species, including butterflies as well as other pollinators. Indeed, it produces many flowers over a long period, benefiting all pollinators.

Oviposition behaviours observed during the counts remained rare, which is not surprising, as 15-minute surveys greatly reduce the chance of observing an individual laying eggs. However, observations outside of the counts show that the garden contains several host plants. The presence of these plants indicates that the garden functions not only as a food source for adults but also for larvae, which is essential for the long-term persistence of populations *(Hardy et al, 2007; Majewska & Altizer 2020)*.

CONCLUSION

The observations realised for the *Jardins de Papallones* project shows that the Fontmartina garden is a favourable habitat for butterflies and other pollinators.

Indeed, the monitoring revealed a rich pollinator assemblage, showing that the garden currently supports a high level of biodiversity.

Moreover, the presence and use of both nectar plants and host plants indicates that the garden provides resources for the entire life cycle of butterflies, contributing to the long-term sustainability of butterfly populations.

Overall, this survey demonstrates the importance of gardens as refuges for pollinators. By favouring seasonal floral diversity, conserving host plants and maintaining open habitats, the garden will be able to continue supporting local biodiversity effectively and contribute to the goals of the *Jardins de Papallones* programme.

RECOMMENDATIONS

These results show the importance of continuing to manage the garden in a good way.
Adding in the garden nectar-producing plants that flower in spring and autumn would help ensure a continuous supply of resources during the entire butterfly flight season, which would particularly benefit early and late species.
Some examples of useful nectar plants to add in the garden (found on *jardinsdepapallones.org*):
-*Diplotaxis erucoides*, *Lobularia maritima*, flowering in winter, spring, and autumn.
-*Scabiosa*, flowering in spring, summer and autumn.

Some examples of useful host plants to add in the garden (found on *jardinsdepapallones.org*):
-*Foeniculum vulgare* for the Swallowtail (*Papilio machaon*)
-*Urtica dioica* for the Red Admiral (*Vanessa atalanta*), the Peacock (*Aglais io*) and the Painted Lady (*Vanessa cardui*)
-*Viola sp.* for the Silver-washed Fritillary (*Argynnis paphia*), the Queen of Spain Fritillary (*Issoria lathonia*) and the Dark Green Fritillary (*Speyeria aglaja*)

Moreover, it is essential to maintain open areas and prevent *Gramineae* from becoming dominant, as their expansion can reduce the availability of wildflowers and, consequently, the diversity of pollinators.

An important point to mention concerns vegetation management in the park:
A rich area of *Lotus corniculatus*, located just outside the garden, near the weather station, held many eggs and caterpillars of Clouded Yellow (*Colias crocea*), Berger's Clouded Yellow (*Colias alfacariensis*) and several *Lycaenidae* species. It was also an important nectar source for many pollinators. Unfortunately, this area was completely cut at two key moments in the larvae's development (in June and August), before their cycle had finished.
Similar cutting took place in other parts of the park in june-july (the Fontmartina camping, roadsides, around Plana Amagada, etc.), which had a negative impact on butterfly populations.
It would therefore be helpful to raise awareness among the rangers of the park about the importance of using mowing practices that are compatible with pollinator conservation.

RECOMMENDATIONS

According to the list on the CBMS website, some endangered or almost endangered species are present in Montseny, but not in the Fontmartina garden, maybe, by adding their host plants in the garden, we can increase the chances of them appearing and help support their populations:

- Lesser spotted fritillary, *Melitaea trivia* (Status NT)

-*Verbascum*: mainly *Verbascum thapsus*, but also *Verbascum delphicum*, *Verbascum densiflorum*, *Verbascum longiflorum* and *Verbascum speciosum*

- Ringlet, *Aphantopus hyperantus* (Status NT)

-Lots of *Poaceae*

- Tufted marbled skipper, *Carcharodus floccifera* (Status NT)

-*Marrubium*, such as *Marrubium vulgare* and *Marrubium peregrinum*

-*Stachys*: *Stachys officinalis*, *Stachys recta* and *Stachys roegneri*

- Chequered blue, *Scolitantides orion* (Status NT)

-*Sedum*, such as *Sedum album*, *Sedum telephium*, *Sedum hispanicum* and *Sedum maximum*

- Southern small white, *Pieris mannii* (Status NT)

-*Brassicaceae* such as *Iberis linifolia*, *Iberis saxatilis*, *Diplotaxis tenuifolia* and *Lobularia maritima* (also good for nectar)

- Large blue, *Phengaris arion* (Status VU)

-*Origanum vulgare* (already present in the garden) and *Thymus*

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https://www.jardinsdepapallones.org

https://www.jardinsdepapallones.org/plantes-nectariferes (list of some nectar plants)

https://www.jardinsdepapallones.org/plantes-nutricies (list of some host plants)

https://www.catalanbms.org

https://www.catalanbms.org/en/especies/ (status of the butterflies in Catalonia)

APPENDIX 1A

List and numbers of the butterflies recorded during our surveys, as well as their status and trend, based on the 2024 CBMS data:

SPECIES	NUMBER	STATUS	TREND
Iberian Marbled White (*Melanargia lachesis*)	49	LC	Moderate decrease
Silver-washed fritillary (*Argynnis paphia*)	43	LC	Moderate decrease
Small white (*Pieris rapae*)	36	LC	Moderate increase
False ilex hairstreak (*Satyrium esculi*)	36	LC	Stable
Common blue (*Polyommatus icarus*)	27	LC	Moderate decrease
Meadow brown (*Maniola jurtina*)	23	LC	Stable
Cleopatra (*Gonepteryx cleopatra*)	21	LC	Moderate increase
Southern brown argus (*Aricia cramera*)	15	LC	Moderate decrease
Lycaenidae sp.	15		
Clouded yellow (*Colias crocea*)	14	LC	Stable
Purple Hairstreak (*Favonius quercus*)	13	LC	Stable
Red-underwing skipper (*Spialia sertorius*)	13	LC	Moderate increase
Brimstone (*Gonepteryx rhamni*)	11	LC	Moderate increase
Brimstone/Cleopatra Female (*Gonepteryx sp.*)	11	LC	Moderate increase
Pearly heath (*Coenonympha arcania*)	9	LC	Moderate decrease
Spotted fritillary (*Melitaea didyma*)	8	LC	Stable
Large white (*Pieris brassicae*)	8	LC	Moderate decrease
Speckled wood (*Pararge aegeria*)	7	LC	Moderate decrease
Holly blue (*Celastrina argiolus*)	6	LC	Moderate increase
Queen of Spain fritillary (*Issoria lathonia*)	6	LC	Moderate decrease
Long-tailed blue (*Lampides boeticus*)	6	LC	Moderate decrease
Painted lady (*Vanessa cardui*)	6	LC	Moderate decrease
Rock grayling (*Hipparchia hermione*)	5	LC	Stable
Lang's short-tailed blue (*Leptotes pirithous*)	4	LC	Stable

APPENDIX 1B

List and numbers of the butterflies recorded during our surveys, as well as their status and trend, based on the 2024 CBMS data (continued):

SPECIES	NUMBER	STATUS	TREND
Provençal fritillary (*Melitaea deione*)	4	LC	Stable
Nettle-tree butterfly (*Libythea celtis*)	3	LC	Moderate increase
Pieridae sp.	3		
Gatekeeper (*Pyronia tithonus*)	3	LC	Moderate decrease
Brown Hairstreak (*Thecla betulae*)	3	LC	Moderate decrease
Peacock (*Aglais io*)	2	LC	Stable
Wood White (*Leptidea sinapis*)	2	LC	Moderate decrease
Southern white admiral (*Limenitis reducta*)	2	LC	Moderate decrease
Purple-shot Copper (*Lycaena alciphron*)	2	LC	Moderate decrease
Small copper (*Lycaena phlaeas*)	2	LC	Moderate decrease
Melitaea sp.	2		
Large Skipper (*Ochlodes sylvanus*)	2	LC	Moderate decrease
Green-veined White (*Pieris napi*)	2	LC	Moderate decrease
Red admiral (*Vanessa atalanta*)	2	LC	Moderate decrease
Great banded grayling (*Brintesia circe*)	1	LC	Moderate increase
Two-tailed pasha (*Charaxes jasius*)	1	LC	Stable
Berger's clouded yellow (*Colias alfacariensis*)	1	LC	Moderate decrease
Grayling (*Hipparchia semele*)	1	LC	Stable
Spanish swallowtail (*Iphiclides feisthamelii*)	1	LC	Moderate decrease
Wall brown (*Lasiommata megera*)	1	LC	Stable
Knapweed fritillary (*Melitaea phoebe*)	1	LC	Moderate decrease
Swallowtail (*Papilio machaon*)	1	LC	Moderate decrease
Bath white (*Pontia daplidice*)	1	LC	Moderate decrease
Dark green fritillary (*Speyeria aglaja*)	1	LC	Stable

APPENDIX 2A

FITXA DE CAMP

Programa de seguiment
Jardins de Papallones

NOM/CODI JARDÍ	DATA		%SOL*
INVESTIGADORS	HORA	VENT*	TEMP. (°C)

PAPALLONES	Comp. * comportament	Planta	Núm. indiv.	Comp.	Planta	Núm. indiv.	Comp.	Planta	Núm. indiv.	TOTAL

ALTRES POL·LINITZADORS	Ús de flors: a quina planta?	Núm. indiv.	Ús de flors: a quina planta?	Núm. indiv.	Ús de flors: a quina planta?	Núm. indiv.	TOTAL

Comentaris

(*) El %SOL és una aproximació de quanta estona el sol ha estat destapat: si ha estat destapat durant bona part del mostreig hi posarem >75%, més de la meitat del mostreig 50-75% i menys de la meitat <50%.
El VENT l'anotem segons l'escala de Beaufort on: 0- El fum s'eleva verticalment. 1- El moviment del fum indica amb prou feines la direcció del vent. Quasi no es mouen les fulles. 2- El vent se sent a la cara. Branques i fulles es poden sentir lleugerament. 3- Fulles i branques es mouen constantment. Fulles seques són aixecades de terra. 4- Es mouen les branques petites. S'aixeca pols i papers del terra. 5- Es mouen arbres petits i branques grans. 6- Branques grans es mouen amb facilitat i constantment.
Els COMPORTAMENTS (Comp.) poden ser interaccions amb plantes com: libar (L), ovoposició (O), searching (S); o altres com: mud-puddling (M), còpula (C), territori (T), parada nupcial (P) o altres (A), en aquest últim cas cal especificar quin a comentaris. També podeu deixar aquest espai en blanc. En ALTRES POL·LINITZADORS només anotarem les interaccions amb les plantes per obtenir pol·len o nèctar.

APPENDIX 2B

Després dels 15 minuts cal anotar quines plantes estaven florides i en quina quantitat:

NOM DE LES PLANTES	Número de flors per cada espècie de planta:				
	Cap	1-10	11-100	101-1.000	>1.000

Si no sabeu de quina espècie es tracta podeu fer servir l’aplicació PlantNet, i si tot i així no n’esteu segurs podeu posar el nom de la família (p.ex. Asteraceae o composta, Brassicaceae o crucífera) i adjuntar una fotografia de la planta quan pengeu les dades a Els meus jardins i nosaltres us ajudarem a identificar-la.

APPENDIX 3

The (partial) list of the plant species present in the garden

SPECIES	
Abelia	*Oxalis*
Agrimonia	*Petrorhagia*
Anagallis arvensis	*Poaceae*
Bellis	*Polygala*
Castanea sativa	*Prunella*
Centaurea pectinata	*Prunus spinosa*
Centaurium erythraea	*Pseudotsuga menziesii*
Cistus salviifolius	*Psoralea bituminosa*
Corylus avellana	*Pyracantha*
Cotoneaster	*Quercus ilex*
Cytisus	*Ranunculus*
Daucus carota	*Rubus*
Echium vulgare	*Sanguisorba minor*
Erica arborea	*Satureja vulgaris*
Euphorbia	*Scabiosa*
Geranium pusillum	*Sedum*
Hedera helix	*Senecio*
Helianthemum	*Spiraea*
Hypericum	*Taraxacum*
Inula salicina	*Tilia*
Leucanthemum vulgare	*Trifolium pratense*
Lotus corniculatus	*Trifolium repens*
Medicago lupulina	*Verbena officinalis*
Ononis	*Viburnum tinus*
Origanum vulgare	*Vicia*