

## SHORT COMMUNICATION

# *Teira dugesii* (Squamata: Lacertidae) visiting flowers: new observations and a review

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Interactions between plants and lizards remain understudied, though it is widely acknowledged that these reptiles interact with flowering plants across various parts of the world (Correcher *et al.* 2023). Such interactions are particularly well-documented on islands, where lizard populations often reach high densities, and resources like arthropods are scarce (Buckley and Jetz 2007). This scarcity encourages lizards to broaden their diet to include alternative resources, such as flowers and fruits, allowing them to take on new ecological roles like pollination and seed dispersal (Pérez-Mellado 1989, Traveset and Sáez 1997, Pérez-Mellado and Casas 1997, Olesen and Valido 2003). This phenomenon, known as niche expansion or “ecological release” (Cox and Ricklefs 1977), is especially notable in lacertid species that were originally insectivorous but, upon colonizing islands, adapted to use a wider range of resources (Van Damme 1997).

By consuming nectar and fruit, lizards function as effective pollinators and dispersers if they visit the flowers and disperse the pollen and seeds to suitable locations (Traveset and Sáez 1997, Hansen and Müller 2009). In turn, plants provide essential resources for lizards such as water and nectar, which contains various nutrients, and insect prey on the flowers (Olesen and Valido 2003).

The Madeiran Wall Lizard, *Teira dugesii* (Milne-Edwards, 1829), is endemic to the Madeira archipelago and the Selvagens Islands. It has an average body size of 64 mm (Cook 1979). In recent years, multiple records have documented its visits to flowers, highlighting its potential ecological role in plant interactions across diverse habitats. The first record was by Elvers (1977), followed by subsequent studies reporting visits to various flowers, including *Musschia aurea* (L.) Dumort. (Elvers 1978, Olesen and Valido 2003, Olesen *et al.* 2002, 2012) and *Musschia isambertoi* M. Seq., R. Jardim, Magda Silva & L. Carvalho (Sequeira *et al.* 2007). The lizards have also been observed interacting with plants in other archipelagos, such as the Azores—*Azorina vidalii* (H. C.

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Wats.) Feer (Ferreira *et al.* 2016)—and the Selvagens—*Mesembryanthemum crystallinum* L., *Schizogyne sericea* (L.f.) DC., *Lotus glaucus* subsp. *selvagensis* (R. P. Murray) Sandral & D. D. Sokoloff (Ferreira *et al.* 2016). More recent studies have confirmed *Teira dugesii* as a pollinator of *Echium candicans* L.f. (Costa 2019, Esposito *et al.* 2021), further emphasizing its role in plant reproduction within its habitats.

In this study, we expand the existing data on interactions of *Teira dugesii* with flowers and compile all previously recorded observations of its floral visits. Observations were conducted over 75 days, totalling 101 hours. Most of the time, only one observer was present, and on rare occasions, two observers were involved. In such cases, one observer recorded data while the other observed and took photographs. Observations took place during three main periods: July–August 2023, March–May 2024, and July–August 2024, between 09:40 h and 17:20 h. No observations were conducted on rainy days. Additionally, some observations were obtained between February and early April 2025 during other field trips. We conducted the study on Madeira Island in various locations. We observed interactions at Rua Nova da Igreja (32°38'55" N, 16°53'04" W), Prazeres (32°45'15" N, 17°12'09" W), Miradouro de D. Sebastião (32°40'12" N, 17°03'46" W), Porto Novo (32°39'44" N, 16°48'29" W), Jardim Botânico (32°39'46" N, 16°53'42" W), Rua Dr Fernando José Martins D'Almeida Couto (32°39'44" N, 16°55'51" W), Caminho da Ladeira (32°40'02" N, 16°56'19" W), Parque de Santa Catarina (32°38'43" N 16°54'51" W), and Lido (32°38'11" N, 16°56'04" W) (Figure 1). Although we conducted observations at several other locations, we did not record any lizard-flower interactions. These locations included Monte Palace Garden, Funchal Municipal Garden, Palheiro Gardens, São Martinho Garden, Encumeada Levada, Ponta de São Lourenço Trail, Madalenas Garden, Rua do Lazareto, Ajuda Garden, Amparo Garden, Larano Levada, and Santana Theme Park. This result likely occurred because *Teira dugesii* has a highly

varied diet (Sadek 1981) and may choose other food sources. In areas with dense forests, the low number or absence of lizards reduced the likelihood of these interactions (pers. obs.). The interactions we observed took place in areas where lizards had abundant sunlight exposure and access to herbaceous and shrubby vegetation.

We collected data according to the different stages of flowering. To avoid influencing the lizards' behavior, we maintained a distance of 4 m from the plants, as closer approaches typically caused the lizards to flee. This precaution was essential to allow natural interaction behaviors to be observed without human interference. Each observation lasted approximately 30–45 minutes and was repeated on different days to confirm that this behavior was common. Not all locations were revisited. We used a Nikon P1000 camera to capture photographs and recordings.

During the interactions, we recorded various behaviors, including nectar feeding. The lizards' approach varied depending on the plant species. On plants with inflorescences, the lizards tended to climb directly onto them, while on species with single flowers, such as *Hibiscus rosa-sinensis* L., they often secured their tails around the stamen to prevent falling. We observed licking movements, as well as alert postures where the head and anterior body were elevated, the tail was fully extended and resting, and the eyes remained open. Additionally, incidental passages occurred when the lizards used the flowers as stepping points to reach another stem or plant.

We conducted a literature review to identify studies and records on the floral visitation of *Teira dugesii*, with a particular focus on Madeira Island. Using the Web of Science and Google Scholar databases, we searched with the following combination of keywords and Boolean operators: ('lizard' OR 'reptile') AND ('flower visit in Madeira Island' OR 'pollination' OR 'nectar' OR 'nectarivory' OR 'flower' AND 'diet').

We included peer-reviewed articles and studies that specifically examined interactions



**Figure 1.** Locations of observations of the interactions between *Teira dugesii* and flowers on Madeira Island in this study.

between *Teira dugesii* and plants or analyzed its diet involving nectar consumption or flower visits. To ensure comprehensive coverage, we applied no time restrictions, incorporating both historical and contemporary studies.

Through our direct observations and analysis, we documented interactions between lizards and the flowers of 34 plant species, 30 of which were newly recorded on Madeira Island (Table 1). Approximately 88.2% of these interactions are novel. Our study accounts for 69.7% of the recorded plant-lizard interactions. The most frequently visited species in this study were *Foeniculum vulgare* Mill., *Crithmum maritimum* L., and *Hibiscus rosa-sinensis*, followed by *Rhododendron* spp. and *Opuntia* spp. (Table 2).

The Madeiran wall lizards displayed varied interactions with different flowers, but legitimate visits were by far the most common across all plant species, accounting for 97% of the observations, while illegitimate visits represented only 3%. A visit was considered legitimate when the lizard directly approached the flower to engage in nectar-feeding behavior, such as

licking nectar, or in cases like *Opuntia* spp., where lizards also used the flowers for resting and thermoregulation. In contrast, visits were classified as illegitimate when the lizard had no apparent intention of interacting with the flower but made incidental contact with it, such as stepping on the petals while moving through the vegetation. None of the documented interactions involved behavior that damaged the plants' reproductive organs, such as the florivory observed in *Hibiscus rosa-sinensis* (Câmara and Jesus *In press*).

This study documents new flower-lizard interactions in 30 plant species, suggesting that the Madeiran wall lizard (*Teira dugesii*) may be the lacertid species with the highest number of recorded floral interactions. Comparable records are scarce, with few studies documenting more than 20–40 interactions per species, and only Romero-Egea *et al.* (2023) reporting similarly high numbers of records.

Among the 30 species, three are endemic: *Aeonium glutinosum* (Aiton) Webb & Berthel. (Madeira archipelago and Selvagens

**Table 1.** Data on visits of *Teira dugesii* to flowers. Legend: End, endemic; I, introduced; N, native, Orn, ornamental, M, Macaronesia; NL, no location.

Plant Species	Common name	Origin	Type of interaction	Location	Known on Madeira and Selvagens arquipelagos	Source
AGAVACEAE						
<i>Agave attenuate</i>	Foxtail Agave	I		Garajau, Santa Cruz	Yes	Elvers 1977
AIZOACEAE						
<i>Carpobrotus edulis</i>	Hottentot Fig	I	Legitimate visit	Rua Nova da Igreja, Funchal	No	<b>This study</b>
<i>Mesembryanthemum crystallinum</i>	Crystalline Iceplant	I		Selvagem Grande	Yes	Ferreira <i>et al.</i> 2016
APIACEAE						
<i>Chrythimum maritimum</i> (Figure 3N)	Sea Fennel	N	Legitimate visit	Lido, Funchal	No	<b>This study</b>
<i>Foeniculum vulgare</i> (Figure 3F)	Fennel	N	Legitimate visit	Miradouro de S. Sebastião, Ribeira Brava	Yes	Sziemer 2010; <b>This study</b>
APOCYNACEAE						
<i>Alamanda cathartica</i> (Figure 3P)	Golden Trumpet Vine	Orn	Legitimate visit	Rua Nova da Igreja, Funchal	No	<b>This study</b>
ASTERACEAE						
<i>Cynara cardunculus</i>	Artichoke Thistle Cardoon	N		NL	Yes	Beyhl 1990
<i>Schizogyne sericea</i>	Salado Blanco	M		Selvagem Grande	Yes	Ferreira <i>et al.</i> 2016
BEGONIACEAE						
<i>Begonia</i> sp. (Figure 3A)		Orn	Legitimate visit	Rua Nova da Igreja, Funchal	No	<b>This study</b>
BORAGINACEAE						
<i>Echium candicans</i>	Pride of Madeira	End	Legitimate visit	Pico do Arieiro	Yes	Ricardo Costa 2019, Esposito <i>et al.</i> 2021
<i>Echium nervosum</i> (Figure 3L)	Coastal Pride of Madeira	End	Legitimate visit	Garajau, Santa Cruz and Caminho Real do Paul do Mar	Yes	Elvers 1977; <b>This study</b>
CACTACEAE						
<i>Opuntia</i> spp. (Figure 3J)	Cactus Pear	I	Legitimate visit	Miradouro de S. Sebastião, Ribeira Brava	No	<b>This study</b>

Table 1. Continued.

Plant Species	Common name	Origin	Type of interaction	Location	Known on Madeira and Selvagens arquipelagos	Source
CAMPANULACEAE						
<i>Musschia aurea</i>	Madeira Giant Bellflower	End		Garajau, Santa Cruz and São Gonçalo, Funchal	Yes	Elvers 1978, Olesen and Valido 2003, Olesen et al. 2012
<i>Musschia isambertoi</i>		End		Desertas islands	Yes	Sequeira et al. 2007
<i>Tracheoulium caeruleum</i>	Blue Throatwort	I		NL	Yes	Beyhl 1990
CRASSULACEAE						
<i>Aeonium glutinosum</i>	Viscid Houseleek	End	Legitimate visit	Miradouro de S. Sebastião, Ribeira Brava	No	<b>This study</b>
<i>Kalanchoe</i> spp.		Orn	Legitimate visit	Caminho da Ladeira	No	<b>This study</b>
<i>Echeveria atropurpurea</i>	Chapetona	Orn		Garajau, Santa Cruz	Yes	Elvers 1977
ERICACEAE						
<i>Rhododendron</i> spp. (Figure 3O)	Macranthum Azalea	Orn	Legitimate visit	Rua Nova da Igreja, Funchal	No	<b>This study</b>
EUPHORBIACEAE						
<i>Euphorbia milii</i>	Crowns of Thorns	Orn	Legitimate visit	Rua Nova da Igreja, Funchal	No	<b>This study</b>
<i>Euphorbia piscatoria</i> (Figure 3Q)	Fish-Stunning Spurge	End	Legitimate visit	Porto Novo, Santa Cruz	No	<b>This study</b>
<i>Euphorbia pulcherrina</i>	Poinsettia	Orn		Funchal	Yes	Beyhl, 1990
<i>Ricinus communis</i>	African Wonder Tree	I	Legitimate visit	Miradouro de S. Sebastião, Ribeira Brava	No	<b>This study</b>
FABACEAE						
<i>Bituminaria bituminosa</i>	Arabian Pea	N	Legitimate visit	Miradouro de S. Sebastião, Ribeira Brava	No	<b>This study</b>
<i>Lotus glaucus sub selvagensis</i>		End		Selvagem Grande	Yes	Ferreira et al. 2016
GERANIACEAE						
<i>Pelargonium</i> sp.		I		Funchal	Yes	Beyhl 1990

Table 1. Continued.

Plant Species	Common name	Origin	Type of interaction	Location	Known on Madeira and Selvagens archipelagos	Source
HYDRANGEACEAE <i>Hydrangea macrophylla</i> (Figure 3D)	Big Leaf Hydrangea	I	Legitimate visit	São Vicente and Igreja de Nossa Senhora das Neves, Calheta	Yes	Petrovan 2023; <b>This study</b>
IRIDIACEAE <i>Gladifolus</i> spp.		Orn	Legitimate visit	Rua Nova da Igreja, Funchal	No	<b>This study</b>
LAMIACEAE <i>Globularia salicina</i>	Globe Daisy Shrub	Mac	Legitimate visit	Ribeira do Natal, Caniçal	No	<b>This study</b>
<i>Leonotis leonurus</i>	Lion's Tail	Orn	Illegitimate visit	Lido, Funchal	No	<b>This study</b>
<i>Salvia rosmarinus</i> (Figure 3E)	Rosemary	Orn	Legitimate visit	Rua Nova da Igreja, Funchal	No	<b>This study</b>
<i>Salvia splendens</i>	Scarlet Sage	Orn		Garajau, Santa Cruz	Yes	Elders 1977
LILIACEAE <i>Aloe arborescens</i>	Krantz Aloe	I		Garajau, Santa Cruz	Yes	Elders 1977
MALVACEAE <i>Hibiscus rosa-sinensis</i> (Figure 3K)	Chinese Hibiscus	Orn	Legitimate visit	Rua Nova da Igreja, Funchal and R. Dr Fernando José Martins D'Almeida Couto	No	<b>This study</b>
MORACEAE <i>Ficus carica</i>	Common Fig	I	Legitimate visit	Rua do Lazareto, Funchal	No	<b>This study</b>
MYRTACEAE <i>Leptospermum scoparium</i>	Tea Tree	I	Legitimate visit	Rua Nova da Igreja, Funchal	No	<b>This study</b>
<i>Melaleuca regulosa</i> (Figure 3R)	Scarlet Bottlebrush	Orn	Legitimate visit	Parque de Santa Catarina	No	<b>This study</b>
<i>Psidium cattleianum</i>	Strawberry Guava	I	Legitimate visit	Rua Nova da Igreja, Funchal	No	<b>This study</b>

Table 1. Continued.

Plant Species	Common name	Origin	Type of interaction	Location	Known on Madeira and Selvagens archipelagos	Source
OLEACEAE						
<i>Ligustrum sinense</i> (Figure 3B)	Chinese Privet	Orn	Legitimate visit	Rua Nova da Igreja, Funchal	No	This study
ORCHIDACEAE						
<i>Phalaenopsis</i> spp. (Figure 3M)		Orn	Legitimate visit	Rua Nova da Igreja, Funchal	No	This study
POLYGONACEAE						
<i>Polygonum capitatum</i>	Pink Clover	I	Illegitimate	Jardim Botânico, Funchal	No	This study
ROSACEAE						
<i>Rosa</i> spp. (Figure 3C)		Orn	Legitimate visit	Rua Nova da Igreja, Funchal	No	This study
SAPINDACEAE						
<i>Cardiospermum grandiflorum</i> (Figure 3H)	Showy Balloovine	I	Illegitimate visit	Miradouro de S. Sebastião, Ribeira Brava	No	This study
SOLANACEAE						
<i>Capsicum annuum</i>	Red pepper	I	Legitimate visit	Caminho da Ladeira	No	This study
<i>Nicotiana glauca</i> (Figure 3G)	Tree Tobacco	I	Legitimate visit	Funchal, Miradouro de S. Sebastião, Ribeira Brava	Yes	Beyhl 1990; This study
STRELTIZIACEAE						
<i>Sreilizia reginae</i> (Figure 3I)	Bird of Paradise	Orn	Legitimate visit	Miradouro de S. Sebastião, Ribeira Brava	No	This study
URTICACEAE						
<i>Parietaria judaica</i>	Pellitory-of-the-Wall	N	Illegitimate visit	Rua Nova da Igreja, Funchal	No	This study
VERBENACEAE						
<i>Lantana camara</i>	Common Lantana	I	Illegitimate visit	Lido, Funchal	No	This study

**Table 2.** Flower visitation frequency by *Teira dugesii*.

Plant	Visits	Percentages
<i>Foeniculum vulgare</i>	101	46.54%
<i>Chrithum maritimum</i>	17	7.83%
<i>Hibiscus rosa-sinensis</i>	16	7.37%
<i>Rhododendron</i> spp.	13	5.99%
<i>Opuntia</i> spp.	8	3.69%
<i>Euphorbia milii</i>	7	3.23%
<i>Allamanda cathartica</i>	4	1.84%
<i>Echium nervosum</i>	4	1.84%
<i>Hydrangea macrophylla</i>	4	1.84%
<i>Ligustrum sinense</i>	4	1.84%
<i>Ficus carica</i>	3	1.38%
<i>Salvia rosmarinus</i>	3	1.38%
<i>Leptospermum scoparium</i>	3	1.38%
<i>Strelitzia reginae</i>	3	1.38%
<i>Melaleuca regulosa</i>	3	1.38%
<i>Begonia</i> sp.	2	0.92%
<i>Euphorbia piscatorial</i>	2	0.92%
<i>Globularia salicina</i>	2	0.92%
<i>Phalaenopsis</i> spp.	2	0.92%
<i>Rosa</i> spp.	2	0.92%
<i>Capsicum annum</i>	2	0.92%
<i>Carpobrotus edulis</i>	1	0.46%
<i>Ricinus communis</i>	1	0.46%
<i>Bituminaria bituminosa</i>	1	0.46%
<i>Gladiolus</i> spp.	1	0.46%
<i>Leonotis leonurus</i>	1	0.46%
<i>Aeonium glutinosum</i>	1	0.46%
<i>Psidium cattleianum</i>	1	0.46%
<i>Polygonum capitatum</i>	1	0.46%
<i>Cardiospermum grandiflorum</i>	1	0.46%
<i>Nicotiana glauca</i>	1	0.46%
<i>Parietaria judaica</i>	1	0.46%
<i>Kalanchoe</i> spp.	1	0.46%

Islands), *Globularia salicina* Lam. (Macaronesia), and *Euphorbia piscatoria* Aiton (Madeira Archipelago and Selvagens Islands). Additionally, three are native: *Crithmum maritimum*, *Bituminaria bituminosa* (L.) C. H. Stirt., and *Parietaria judaica* L. The remaining species are introduced or ornamental.

The plants most visited by *Teira dugesii* have flowers that appear close together or grouped in inflorescences. Therefore, the family with the most visits was the Apiaceae (*Foeniculum vulgare*, *Crithmum maritimum*). Romero-Egea *et al.* (2023) observed that the most visited plants were *Daucus* sp. and *Lobularia* sp. with these plants having inflorescences and close flowers. *Foeniculum vulgare* was the plant species with the highest number of recorded lizard visits. Notably, it was also where juvenile lizards were most frequently observed accessing the flowers. We cannot conclusively state that juveniles are the primary visitors because we did not estimate the relative densities of different age classes. Nonetheless, this observation aligns with findings by Sziemer (2010), who reported a similar pattern. We observed that approximately 95% of the visitors were juveniles and subadults. We observed intriguing behaviors, including repeated instances of aggressive interactions on three different days as individuals competed for access to inflorescences (Figures 2 and 3). Although juveniles and subadults were the most frequent floral visitors, we also recorded adult males on flowers, albeit less frequently. Adult males were observed visiting *Opuntia* sp. (twice), *Foeniculum vulgare* (three times), and *Hibiscus rosa-sinensis* (three times).

Of these 30 species, we recorded interactions with three endemic plants—*Euphorbia piscatoria*, *Globularia salicina*, and *Aeonium glutinosum*—highlighting the need for more detailed studies on the potential benefits of these endemic lizards for the survival of native flora in Madeira Island. We recorded several introduced plant species being visited by lizards, which may play a role in their dispersal. Among the 34 plant species observed, 26 (76.5%) were ornamental



**Figure 2.** Aggressive behavior between two *Teira dugesii* (Photo: JC).

and introduced, highlighting the potential influence of lizards in the spread of non-native flora in the ecosystem.

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**Figure 3.** *Teira dugesii* visiting the flower of *Begonia* sp. (A), foraging in the flowers of *Ligustrum sinense* (B), visiting the flower of *Rosa* spp. (C), visiting the inflorescence of *Hydrangea macrophylla* (D), licking the nectar of *Salvia rosmarinus* (E), licking the nectar of *Foeniculum vulgare* (F), licking the nectar of *Nicotiana glauca* (G), visiting the flower of *Cardiospermum grandiflorum* (H), visiting the flower of *Strelitzia reginae* (I), visiting the flower of *Opuntia* spp. (J), licking the nectar of *Hibiscus rosa-sinensis* (K), visiting *Echium nervosum* (L), visiting the flower of *Phalaenopsis* sp. (M), licking the nectar of *Chrythum maritimum* (N), licking the nectar of *Rhododendron* spp. (O), and visiting the flower of *Allamanda cathartica* (P), licking the nectar of *Euphorbia piscatoria* (Q), licking the nectar of *Melaleuca regulosa* (R). Photos: JC.

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