PLANT-POLLINATOR INTERACTIONS IN LEGUMINOSAE FROM ARGENTINA

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INTRODUCTION

There is a body of evidence showing that the spatial distribution of plants affects various aspects of plant-pollinator, such as insect behavior while visiting flowers and pollination rates. It was tested the effect of density on floral visitation rates, the relationship between the duration of visits and the type of reward and pollination mechanism.

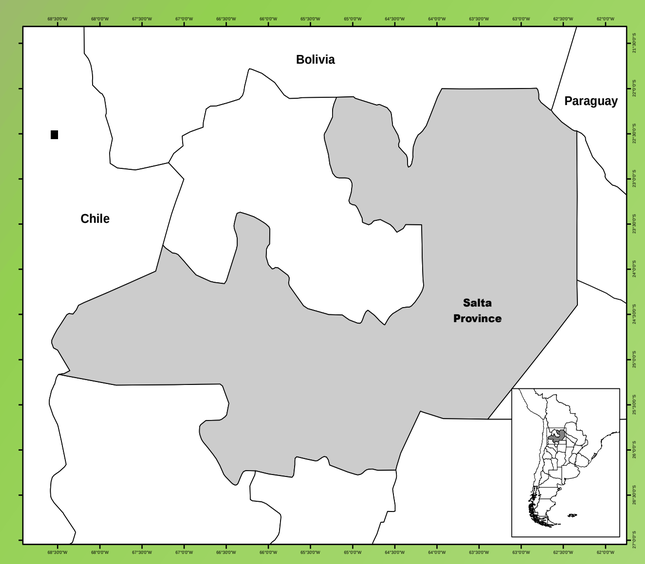
OBJECTIVES

Determine:

1. Floral length of 17 species of Papilionoideae from Valle de Lerma in Salta Province, Argentina.
2. Floral visitors, and their average body size.
3. Relative abundance of the major taxa of pollinators (proportion of individuals of each species in total).
4. Flowers visited per bout and duration of visits.
5. Relationships between floral density and floral visitation rates.
6. Relationships betwen visit duration , type of reward and pollination mechanisms.

Study site: Lerma Valley, Salta Province, Argentina (Fig. 1). Corresponds to a transition zone between Yungas seasonal rain forest and Chaco dry forest (24.34.53º-25.31.38º S and 65.22.30º-65.39.70º W). **Study period**: 2008-2012. **Studied species**: belong to five tribes of to the Papilionoideae subfamily (Leguminosae) (See Table 1).

Fig. 1 - Map of the study site



RESULTS AND DISCUSSION

Pollinator size

We found significant differences between pollinators size (H=75.38; P<0.0001).

Our results indicate that there is an association between floral length and pollinator size (r=0.85; P=2.90E-04). This could represent a better plant-pollinator fit: increased contact and greater removal and deposition of pollen.

The average number of pollinators per plant for the entire group was 6 ± 3 (range: 2-12). Floral visitors visited flowers average 3 ± 3 plant species of Papilionoideae (range: 1-13).

Table 1 - Pollination mechanism*, rewards*, floral length (mean±SD) and pollinator's body length (mean±SD) of the species found visiting each Papilionoideae. For pollinators body length, different letters indicate significative differences (p≤ 0.05).*Etcheverry et al, 2012.

Plant species	*Pollination mechanism	*Reward	Floral length (mm) (n=10)	Pollinators body length (mm) (n)
Indigofera parodiana	Explosive	Nectar + Pollen	5.24±0.39	9.48±0.33 (6) [a]
Indigofera sufruticosa	Explosive	Nectar + Pollen	5.56±0.31	10.92±1.09 (4) [ab]
Rhynchosia minima	Valvular	Nectar + Pollen	6.45±0.55	10.96±2.19 (11) [ab]
Desmodium incanum	Explosive	Pollen	7.63±0.57	10.66±1.76 (14) [ab]
Crotalaria pumila	Pump	Nectar + Pollen	7.97±0.56	9.69±3.14 (16) [a]
Macroptilium fraternum	Brush	Nectar	10.03±1.09	10.88±1.88 (18) [ab]
Crotalaria stipularia	Pump	Nectar + Pollen	10.06±1.19	11.36±1.93 (11) [ab]
Galactia latisiliqua	Valvular	Nectar + Pollen	10.46±1.09	12.53±0.30 (3) [abc]
Rhynchosia edulis	Valvular	Nectar + Pollen	11.31±1.35	10.74±1.61 (5) [ab]
Zornia contorta	Pump	Pollen	12.72±0.50	13.74±3.59 (18) [bc]
Desmodium uncinatum	Explosive	Pollen	15.39±0.26	14.61±2.97 (4) [bc]
Crotalaria incana	Pump	Nectar + Pollen	15.70±0.80	11.86±1.54 (7) [ab]
Macroptilium erythroloma	Brush	Nectar	16.70±1.34	15.43±5.50 (5) [bc]
Phaseolus vulgaris	Brush	Nectar	19.30±1.71	14.71±2.72 (3) [bc]
Crotalaria micans	Pump	Nectar + Pollen	22.72±2.01	16.73±3.19 (8) [c]
Cologania broussonetii	Valvular	Nectar + Pollen	24.76±1.76	17.02±3.71 (4) [c]
Centrosema virginianum	Valvular-Secondary	Nectar + Pollen	27.86±2.20	14.70±3.24 (11) [bc]

Fig. 3 – Relative pollinator abundance

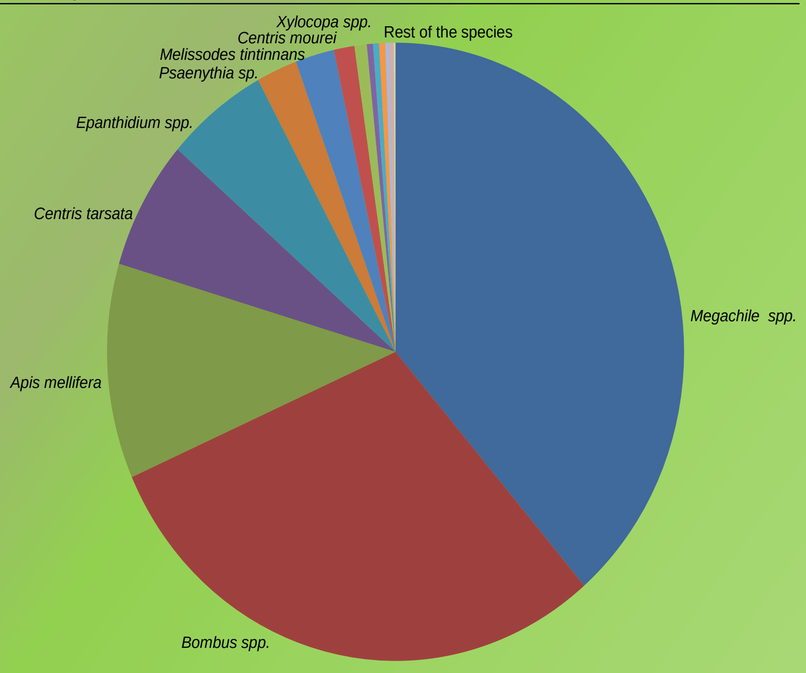


Fig. 2 - Some of the species of pollinators registered visiting flowers of Papilionoideae in Salta, Argentina. a) *Apis mellifera* pollinating a flower of *G. latisiliqua*; b) *Apis mellifera in Macroptilium fraternum;* c) *Bombus sp. in Centrosema virginianum;* d) *Bombus sp. In Desmodium subsericeum;* e) *Centris tarsata* in *Centrosema virginanum;* f) *Arhysoceble dichroopoda* in *Zornia contorta;* g) *Megachile* sp. in *Crotalaria stipularia*; h) *Epanthidium nigrescens* in *Crotalaria stipularia;* i) *Xylocopa eximia* in *Crotalaria micans*; j) *Xylocopa* sp. in *Macroptilium erythroloma.*

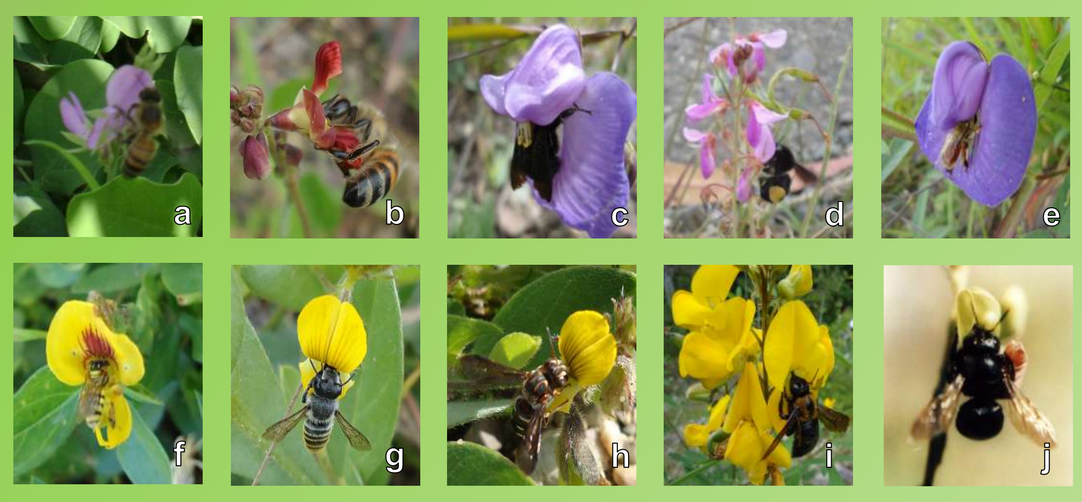
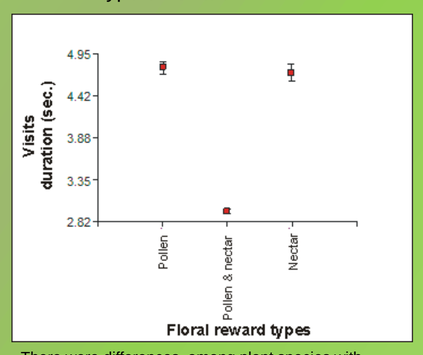


Table 2 - Duration of visit and flowers visited per bout by groups of pollinator species Papilionoideae (Leguminosae) native of Salta. (Me) median value. Different letters indicate statistically significant differences (p ≤ 0.05).

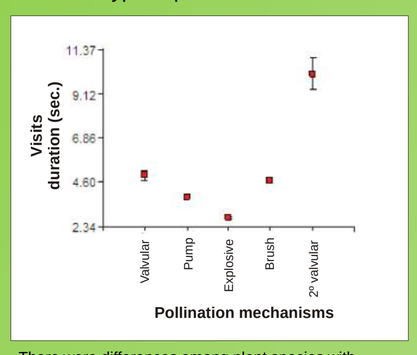
GROUP	POLLINATOR	VISITS DURATION (sec.) mean±SD (n)	VISITED FLOWERS/BOUT mean±SD (n) (Me)
Eusocial native bees			
	Bombus spp.	3.50±2.48 (3224)	11.13±17.46 (287) (5)[a]
Solitary native bees		3.88±3.42 (5548)	9.70±13.73 (571) (5)[a]
	Megachile spp.	3.39±2.83 (4250)[a]	11.58±15.18 (367) (6)[ab]
	Centris mourei	3.12±0.79 (170) [ab]	17.00±16.75 (11) (11)[ab]
	Xylocopa sp.	3.16 ± 0.98 (50)[ab]	8.33±7.26 (6) (6.5)[ab]
	Melissodes tintinnans	3.62±2.46 (353) [ab]	17.65±21.69 (20)(8.5)[ab]
	Arhysoceble picta	3.97±2.28 (29) [ab]	14.50±0.71 (2) (14.5)[b]
	Psaenythia sp.	4.01±3.03 (148)[b]	7.05±5.54 (21) (6)[ab]
	Arhysoceble dichroopoda	3.86±1.62 (21)[b]	7.00±7.00 (3) (4)[a]
	Epanthidium sp.	6.77±4.16 (223)[c]	3.78±3.48 (59) (3)[a]
	Exomalopsis trifasciata	7.89±4.74 (44)[cd]	11.00±12.73 (4) (5.5)[ab]
	Melissoptila pubescens	8.61±6.27 (23) [cd]	11.50±10.61 (2)(11.5)[ab]
	Coelioxys sp.	10.18±5.64 (17) [cd]	5.67±3.51 (3) (6)[ab]
	Thygater sp.	7.07±3.7 (41) [cd]	6.83±2.93 (6) (7.5)[ab]
	Centris tarsata	10.97±6.64 (156)[d]	2.44±1.87 (64) (2)[a]
No native bees			
	Apis mellifera	4.33±2.79 (1311)	12.37±15.12 (106) (8)[b]

Fig. 4a - Mean visit duration for each type of reward



There were differences among plant species with different reward offered to pollinators (H = 1370.31; P = 0016) **Fig. 4a**

Fig. 4b - Mean visit duration for each type of pollination mechanism



There were differences among plant species with different pollination mechanism (H = 1422.05, P = 0.0094) **Fig. 4b**.

Visited flowers per bout : **native bees and eusocial solitary bees visited less flowers** than no native bees (H = 13.99, P = 0.0028) **which would mean a smaller effect on the geitonogamy.**

Among the solitary native bees *Arhysoceble picta* and *Centris tarsata* bees visited the highest and lowest number of flowers inside the patch.

Visits duration: visits duration of native eusocial bees and native solitary bees were similar to those of non-native bees . Among the solitary native bees, ***Megachile*** **made shorter visits** (approx 3 seconds) and ***Centris tarsata*** **longer visits** (> 10 seconds) (H = 747.34; P <0.0001).

Rate of visits per area: patches with more flowers/area received more visits (r= 0.52; P=0.00).

Rate of visits per capita: individual flowers of the densest patches compete for visitors because received fewer visits than flowers in lower densed patches (r= -0.14; P=0.02).

CONCLUSIONS

Solitary native bees were the most abundant pollinators of Papilionoideae. The bees of the genera *Megachile* (approx 13 sps.) and *Bombus* (2 sps.) had the highest relative abundance. Differences in body length between pollinators of different species of plants were observed. The coincidence in size between flowers and pollinators prove important in the pollination process allowing a better fit between the two. The flowers that offered pollen and nectar received longer visits, followed by those who offered only nectar, while that offered only pollen received shorter visits (Fig. 4a).

Most bees are polylectic, which would suggest that there is an indirect competition of plants for their pollinators. Our results suggest that the studied species are phenotypically specialist, with a complex floral morphology associated with complex mechanisms of pollination. Besides, all species are functionally specialists, i.e., all pollinators were bees belonging to the Superfamily Apoideae (except one wasp species that behaves as an occasional pollinator in *Crotalaria pumila*). However, some species may be considered ecologically generalist and others could be more specialized, although none is a strict specialist.