

BEE-COLLECTED POLLEN IN THE LOWER VALLEY OF THE CHUBUT RIVER (ARGENTINA)

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Summary: This paper reports the pollen sources that *Apis mellifera* L. selects in the lower valley of the Chubut river. It evaluates the relative biomass contribution and the protein content of the collected taxa. 56 morphological types were identified in pollen loads; 20% of them belong to plants endemic of South America. Twenty pollen types contributed over 1% of the total biomass obtained during the apicultural period; four of them, Brassicaceae (*Cardaria draba* type), *Grindelia* spp., *Prosopidastrum globosum* and *Trifolium* spp., contributed over 10%. The most represented families were Asteraceae, Brassicaceae, and Fabaceae. The incoming of anemophilous pollen was reported in periods with scarce entomophilous pollen. The crude protein content of the most collected entomophilous pollen ranged from 16.93% to 24.06%. The major contribution of native shrubland was recorded during springtime and came from *Prosopidastrum globosum* and *Schinus johnstonii*.

Key Words: bee plants, pollen loads, Patagonian Monte.

Resumen: Polen recolectado por las abejas en el valle inferior del río Chubut (Argentina). Se identificaron las fuentes de polen que *Apis mellifera* L. selecciona en el valle inferior del río Chubut. Se evaluó la contribución en biomasa y el contenido proteico de los taxa recolectados. Se identificaron 56 tipos morfológicos en las cargas corbiculares, 20% de ellos pertenecientes a plantas endémicas de América del Sur. Veinte tipos polínicos hicieron un aporte superior al 1% en la biomasa total obtenida, cuatro de ellos: Brassicaceae (Tipo *Cardaria draba*), *Grindelia* spp., *Prosopidastrum globosum* y *Trifolium* spp., contribuyeron en más del 10%. Las familias más representadas fueron Asteraceae, Brassicaceae y Fabaceae. La recolección de polen anemófilo fue registrada en períodos de escasez de polen entomófilo. El contenido proteico del polen entomófilo más recolectados varió entre 16,93% y 24,06%. La mayor contribución del arbustal nativo fue registrada durante la primavera y provino principalmente de *Prosopidastrum globosum* and *Schinus johnstonii*.

Palabras clave: Plantas melíferas, cargas polínicas, Monte patagónico.

INTRODUCTION

Pollen is the main source of proteins and amino acids for honeybees (*Apis mellifera* L.) (Haydak, 1970; Heinrich, 1975; Herbert *et al.*, 1977; Roulston & Cane, 2000). To collect and transport this reward, the domestic bees, as well as other Apidae, exhibit structural and behavioural adaptations (Thorp, 2000). In the corbiculae, specialized areas of hind legs, pollen is mixed with nectar or honey, packed into a pasty pellet, and transported to the colony.

The composition of pollen loads and the protein content are valuable tools to identify apicultural resources in a region. Pollen with less than 20% crude protein does not satisfy colony requirements for optimum production; whereas, pollen with between 23% and 30% crude protein enable bees to successfully rear brood (Herbert *et al.*, 1977; Shaw, 1990).

In Extra-Andean Patagonia, apiculture is still at

an incipient stage and confined to irrigated valleys. Melissopalynological analysis of honey from this region has been previously reported (Forcone & Tellería, 1998; Forcone & Tellería, 2000; Tellería & Forcone, 2000). The aim of the present research is to identify the pollen sources used by honeybees in the lower valley of the Chubut river and to evaluate the relative contribution in biomass and protein content of the pollen types collected.

MATERIALS AND METHODS

Botanical features of the study area:

The lower valley of Chubut river (43°-44°S and 65-66° W) lies within the Chubut province (Argentina) (Fig. 1). This is an irrigated area in the Patagonian Monte (Cabrera, 1971; Roig, 1998). The characteristic vegetation is shrubby steppe, consisting of *Larrea* spp., intermingled with some halophilous plants. *L. divaricata*; *L. nitida*,

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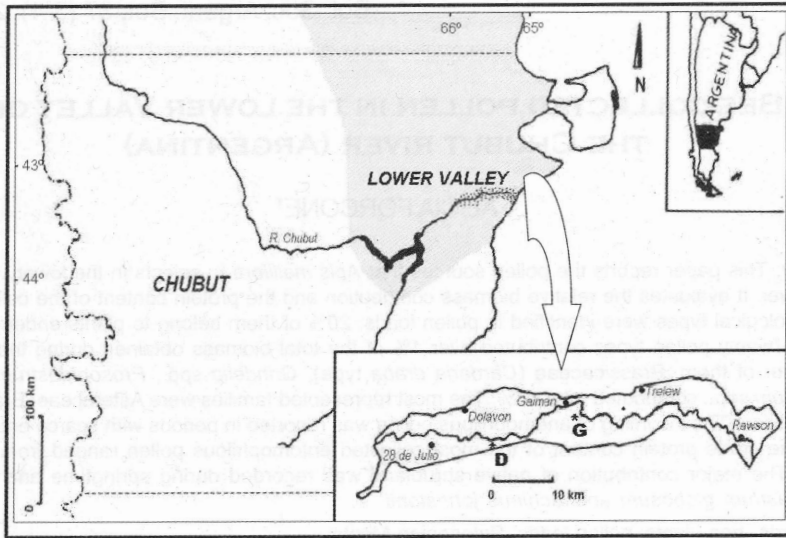


Fig. 1. Geographical location of the lower valley of Chubut river. G: Gaiman apiary, D: Dolavon apiary. Grey area: Monte Phytogeographical Province.

Prosopidastrum globosum, *Schinus johnstonii*, *Lycium* spp., *Chuquiraga* spp. are abundant. Some species, mainly the halophilous taxa extend down to the floodplain of the Chubut river valley, where *Lycium chilense*, *L. ameghinoi* and *Chenopodiaceae* are frequent (Soriano, 1950).

River valley farmlands consist of pastures, (mainly *Medicago sativa*), horticultural plants, cereals and fruit plantations. The most abundant tree species belong to *Salicaceae*, from which *Populus* spp., mainly *Populus nigra*, are cultivated for building windbreak curtains. Along the riverbanks, *Salix* spp., *Populus* spp., and *Tamarix gallica* are abundant. *Salix fragilis* L. and *T. gallica* are naturalized and widely distributed in Patagonia (Correa, 1988; Rossow, 1988).

Irrigation occurs from September to April. During these months there is a proliferation of weeds, such as *Brassica* spp., *Cardaria draba*, *Cichorium intybus*, *Convolvulus arvensis*, *Erysimum repandum*, *Rapistrum rugosum*. Extensive valley areas remain uncultivated due to the low profitability of farm products and to increased soil salinity. Different weeds predominate in these lands, some of which are introduced, and some are native halophytes such as *Malvella leprosa* and *Grindelia tehuelches*.

Site of sampled beehives

Surrounding vegetation to the apiaries surveyed (Fig. 1) shows differences. The Gaiman apiary is sur-

rounded by fodder crops, small fruit plantations, orchards, salty lowlands, and uncultivated fields. The Dolavon apiary is near native shrubland, although within foraging honeybee range there are also pasture lands and uncultivated fields.

Sampling and treatment of pollen loads

Twenty-two samples were obtained from pollen traps (Louveaux, 1968) that were placed at the entrance of the beehives. In both apiaries three beehives were sampled, between 08.00 and 18.00 hours, every 20 days, from September to March, during the apicultural periods 1997-1998 (Gaiman) and 1998-1999 (Dolavon).

Flowering plants, within a 1 Km radius of the beehives were recorded every 20 days during the sampling period at both sites.

An aliquot of 10 g of pollen per trap was taken, mixed with those of the other two hives and classified according to color and pollen morphology. Pollen types were determined by comparison with a pollen reference collection of the plants collected at the surveyed area. The reference pollen samples and collected bee pollen samples were acetolyzed (Erdtman, 1960). Classified pollen loads were dried in an oven at 50° C for 48 hours and weighed (Montenegro *et al.*, 1992). Total nitrogen content was determined by the micro-Kjeldahl method (Mitchell, 1972), and crude protein concentration was estimated using the most utilized conversion factor: 6.25 (Roulston & Cane, 2000). Nitrogen content analysis

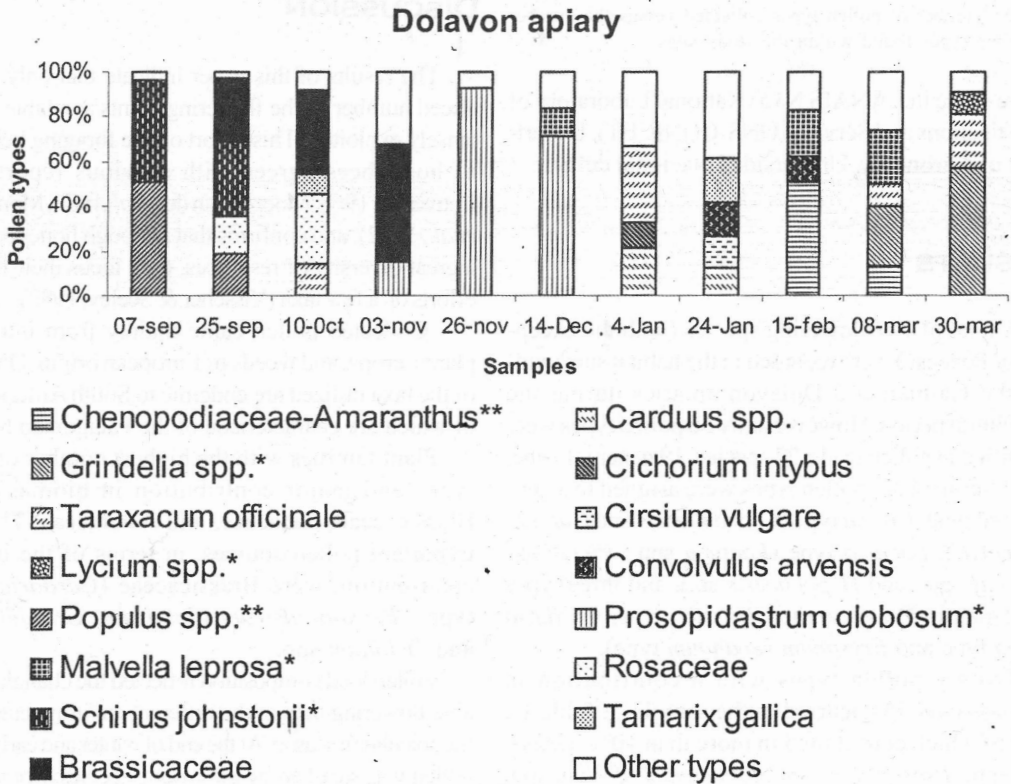
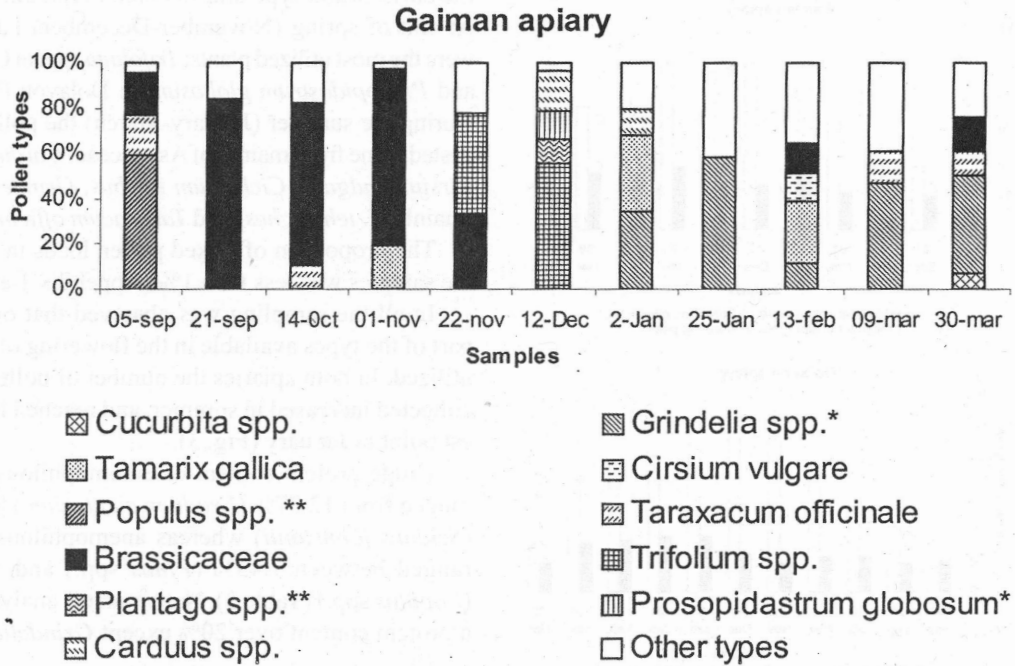


Fig. 2. Pollen taxa with biomass contribution greater than 10% in bee-collected pollen from lower valley of Chubut river. (*) Native plants, (**) anemophilous pollen

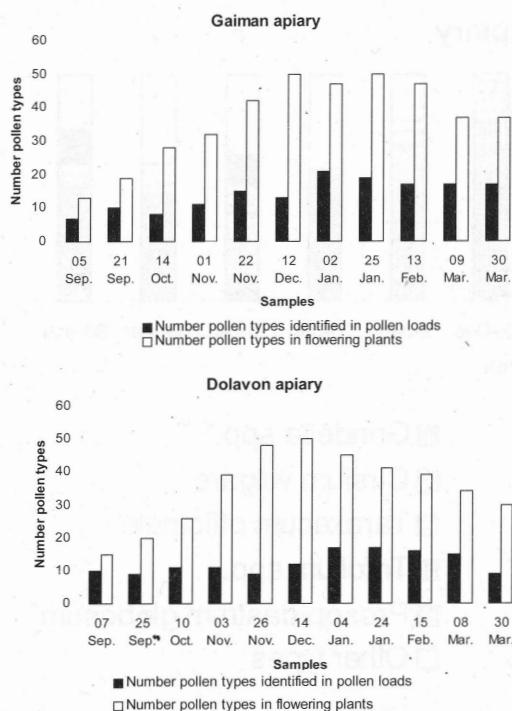


Fig. 3. Number of pollen types collected versus the number of pollen types found within the study sites.

Cardaria draba type and *Erysimum repandum* type. At end of spring (November-December) Fabaceae were the most utilized plants: *Trifolium* spp. in Gaiman, and *Prosopidastrum globosum* in Dolavon (Fig. 2). During the summer (January-March) the pollen harvested came from mainly of Asteraceae: *Carduus* spp., *Cirsium vulgare*, *Cichorium intybus*, *Grindelia* spp. (mainly *G. tehuelches*) and *Taraxacum officinale*.

The proportion of mixed pollen loads in total of the samples was less than 1% (Appendix 1 and 2).

In all the sampling was observed that only one part of the types available in the flowering offer was utilized. In both apiaries the number of pollen types collected increased in summer, and reached its highest point in January (Fig. 3).

Crude protein content of entomophilous pollen ranged from 12.37% (*Erodium cicutarium*) to 24.31 (*Schinus johnstonii*) whereas anemophilous pollen ranged between 7.43% (*Pinus* spp.) and 15.43% (*Populus* spp.) (Table 2). Native plants analyzed had a protein content over 20% except *Grindelia* spp.

DISCUSSION

The results of this paper indicate that only one reduced number of the flowering plants available was intensely exploited. This report on the foraging behaviour of honeybees agrees with previous reports (e.g. Louveaux, 1968; Moezel, van der *et al.*, 1987; Montenegro *et al.*, 1992), and confirms that although honeybees visit a great diversity of resources, they focus their foraging efforts on a few taxa (Visscher & Seeley, 1982).

Collected pollen came mainly from introduced plants, crops, and weeds of European origin. Only 20% of the taxa utilized are endemic to South America, nine of which are characteristic of the Patagonian Monte.

Plant families with the highest number of pollen types and major contribution in biomass were: Brassicaceae, Fabaceae, and Asteraceae. The most important pollen sources, in terms of the biomass contribution, were Brassicaceae (*Cardaria draba* type), *Prosopidastrum globosum*, *Grindelia* spp. and *Trifolium* spp.

Pollen load composition reflected the changing available flowering taxa of the different environments during the apicultural season. At the end of winter and early spring, pollen was supplied by the woody species: *Populus* spp. plantations, fruit trees, and some native shrubs such as *Schinus johnstonii*. Some weeds (Brassicaceae, *Taraxacum officinale*) were also intensely exploited.

f were made in LANAIS N15 (National Laboratory of Investigations and Services UNS-CONICET), Department of Agronomy, Universidad Nacional del Sur.

RESULTS

A total of 147 flowering species (with the exception of Poaceae) were recorded in the habitat surrounding the Gaiman and Dolavon apiaries during the apicultural period. However, only 56 pollen types were identified in pollen loads, 27 species, 19 genera, 1 tribe, and 4 family. Five pollen types were assigned to a generalized type: *Cressa* type (*C. truxillensis* and *Cuscuta indecora*), *Lactuca* type (*Lactuca* spp., *Picris* sp., *Sonchus* spp., and *Hypochoeris* sp.), and three types belonging to Brassicaceae (*Brassica* type, *Cardaria draba* type and *Erysimum repandum* type).

Twenty pollen types with a contribution in biomass over 1% occurred in the samples, (Table 1), four of which contributed in more than 10%, *Grindelia* spp., *Prosopidastrum globosum*, *Trifolium* spp. and the *Cardaria draba* type.

In both apiaries Brassicaceae were intensely collected in spring (September-November), mainly

A. Forcone, Bee-collected pollen in the lower valley of the Chubut river (Argentina)

Table 1. Pollen types found in 22 samples of pollen loads from lower valley of Chubut river. Geographical origin and biomass contribution of each taxon in the total of pollen collected per apiary is shown.

(*) Plants of Patagonian Monte. SA: South America. NA: North America. E: Europe. A: Asia. AU: Australia. C: cosmopolitan. Gaiman and Dolavon: apiaries

Family	Pollen type	Origin	Biomass contribution (%)	
			Gaiman	Dolavon
ANACARDIACEAE	<i>Schinus johnstonii</i> *	SA	<1	7.2
	<i>Schinus areira</i>	SA	<1	
APIACEAE	<i>Ammi</i> spp.	E	<1	
	<i>Pastinaca sativa</i>	E	<1	
ASTERACEAE	<i>Anthemis cotula</i> - <i>Matricaria</i> spp.	E	<1	<1
	<i>Artemisia absinthium</i>	E - A	<1	
	Astereae			<1
	<i>Carduus</i> spp.	E	4.5	4.0
	<i>Centaurea</i> spp.	E - A	<1	<1
	<i>Cichorium intybus</i>	E	1.7	4.1
	<i>Cirsium vulgare</i>	E	2.6	1.8
	<i>Grindelia</i> spp. *	SA	17.8	8.1
	<i>Onopordon acanthium</i>	E	<1	<1
	<i>Taraxacum officinale</i>	E	6.0	8.7
	<i>Lactuca</i> type		<1	
	<i>Xanthium</i> spp.	C		<1
BRASSICACEAE	<i>Cardaria draba</i> type		16.6	7.1
	<i>Erysimum repandum</i> type		3.7	4.4
	<i>Brassica</i> type		9.8	1.0
CONVOLVULACEAE	<i>Convolvulus arvensis</i>	E	<1	4.0
	<i>Cressa</i> type		<1	<1
CUCURBITACEAE	<i>Cucurbita</i> spp.	SA - NA		<1
CYPERACEAE			<1	
CHENOP-AMAR.			<1	5.9
ELAEAGNACEAE	<i>Elaeagnus angustifolia</i>	E - A	<1	
FABACEAE	<i>Medicago sativa</i>	A	<1	<1
	<i>Melilotus</i> spp.	E - A	1.1	1.0
	<i>Prosopis</i> spp. *	SA		<1
	<i>Prosopidastrum globosum</i> *	SA	1.3	16.5
	<i>Trifolium</i> spp.	E	10.7	<1
	<i>Trifolium pratense</i>	E	<1	<1
	<i>Robinia pseudoacacia</i>	NA	<1	
GERANIACEAE	<i>Erodium cicutarium</i>	C	<1	
JUGLANDACEAE	<i>Juglans regia</i>	E - A	<1	
LAMIACEAE	<i>Mentha</i> spp.	E		<1
MALVACEAE	<i>Malvella leprosa</i>	NA - SA	1.0	6.4
MYRTACEAE	<i>Eucalyptus</i> spp.	AU	<1	<1
	<i>Malva nicaensis</i>	E		<1
OLEACEAE	<i>Fraxinus</i> spp.	E - NA	<1	
	<i>Menodora robusta</i> *	SA	<1	
PINACEAE	<i>Pinus</i> spp.	E - NA - A	<1	
PLANTAGINACEAE	<i>Plantago</i> spp.	C	2.7	<1
PLUMBAGINACEAE	<i>Limonium brasiliense</i>	SA	<1	<1
POACEAE		C	<1	
	<i>Zea mays</i>	NA - SA	<1	
ROSACEAE	Rosaceae (Fruit trees)	C		4.5
	<i>Fragaria x ananassa</i>	C	<1	
SALICACEAE	<i>Populus</i> spp.	E - A	5.4	6.3
	<i>Salix</i> spp.	C		<1
SOLANACEAE	<i>Lycium</i> spp. *	SA	<1	1.8
TAMARICACEAE	<i>Tamarix gallica</i>	E	7.4	3.2
TYPHACEAE	<i>Typha</i> spp.	C	<1	
VERBENACEAE	<i>Acantholippia seriphioides</i> *	SA		<1
	<i>Junellia ligustrina</i> *	SA		<1
	<i>Phyla canescens</i>	E	<1	
ZYGOPHYLLACEAE	<i>Larrea</i> spp. *	SA		<1

Table 2. Nitrogen and protein content of bee-collected pollen from lower valley of the Chubut river. (*) native plants, (**) Anemophilous pollen.

Pollen type	Nitrogen content	Crude Protein (%)
	%	(N x 6.25)
<i>Anthemis cotula-Matricaria</i> spp.	2.74	17.12
<i>Brassica</i> type	3.47	21.68
<i>Cardaria draba</i> type	3.85	24.06
<i>Carduus</i> spp.	2.97	18.56
<i>Centaurea</i> spp.	3.57	22.31
Chenopodiaceae- <i>Amaranthus</i> **	1.83	11.4
<i>Cichorium intybus</i>	2.41	15.06
<i>Cirsium vulgare</i>	3.04	19
<i>Convolvulus arvensis</i>	3.22	20.12
<i>Cucurbita</i> spp.	3.54	22.12
<i>Erodium cicutarium</i>	1.98	12.37
<i>Erysimum repandum</i> type	3.58	22.37
<i>Eucalyptus</i> spp.	3.76	23.5
<i>Grindelia</i> spp.*	2.71	16.93
<i>Juglans regia</i> **	2.35	14.68
<i>Junellia ligustrina</i> *	3.38	21.12
<i>Larrea</i> spp.*	3.88	24.25
<i>Lycium</i> spp.*	3.60	22.5
<i>Malvella leprosa</i>	2.53	15.81
<i>Mellilotus</i> spp.	3.15	19.68
<i>Onopordon acanthium</i>	2.73	17.06
<i>Pinus</i> spp.**	1.19	7.43
<i>Plantago</i> spp.**	1.93	12.06
<i>Populus</i> spp.**	2.47	15.43
<i>Prosopidastrum globosum</i> *	3.49	21.81
<i>Prosopis</i> spp.*	3.53	22.06
Rosaceae	3.43	21.43
<i>Schinus johnstonii</i> *	3.89	24.31
<i>Tamarix gallica</i>	2.85	17.81
<i>Taraxacum officinale</i>	2.12	13.25
<i>Trifolium</i> spp.	3.82	23.87

Toward the end of spring (November-December), the most important contribution from native shrubland was observed when *Prosopidastrum globosum* was almost exclusively harvested in Dolavon. During that period, clover pastures, mainly *Trifolium repens*, were the most used resources in Gaiman.

In summer (January-March), the major pollen sources were from taxa in the pastures, riparian vegetation, uncultivated fields, and road sides. In the latter two environments, the most used plants were *Cichorieae*, *Cynareae*, *Convolvulus arvensis*, *Chenopodiaceae*, *Grindelia* spp. and *Malvella leprosa*. *Tamarix gallica* was the species with the major biomass contribution in riparian environments. *Medicago sativa* was intensely visited, but its pollen was scarcely found in the loads, probably because of explosive floral tripping (Small *et al.*, 1987).

After comparing the results of this work with the botanical origin of honey from the valley of Chubut river (Forcone & Tellería, 1998), it was observed that many taxa supplying pollen to honeybees were also nectariferous resources. The intense exploitation of some native shrubs by honeybees indicates the need for further researches to evaluate the impact of this bee on the plants-pollinators communities of the shrubby steppe.

Pollen from anemophilous taxa was reported in periods with scarce entomophilous pollen, end of winter (mainly from *Populus* spp.) and February (mainly from *Chenopodiaceae-Amaranthus*). Similar results were obtained by O'Neal & Waller (1984) in Arizona, where the anemophilous taxa, *Pinus* spp. and *Populus* spp., were the most collected pollen at the end of winter, and herbaceous *Chenopodiaceae-Amaranthus* at mid-summer.

A. Forcone, Bee-collected pollen in the lower valley of the Chubut river (Argentina)

The most collected entomophilous pollen had a protein content from moderate to high and ranged between 16.93% (*Grindelia* spp.) and 24.06% (*Cardaria draba* type). Anemophilous pollen has been considered to have low nutritional value (Roulston & Cane, 2000) and the results obtained in this research agree with this statement.

The pollen collection by honeybees in the Patagonian district studied had similar characteristics to those ones recorded in other Argentine areas: the Pampean plains (Tellería, 1993) and the Delta of Paraná river (Basilio, 2000). However, the pollen harvest in the lower valley of Chubut river differs from those areas because of scarcity of *Eucalyptus* spp., the abundance of *Populus* spp. and *Tamarix gallica*, and the important role played by the plant of native shrublands and edaphic communities.

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Appendix 1. Pollen types identified in corbicular loads in Gaiman apiary. Biomass contribution (mg) in 10 g of samples.

Pollen types	Samples												Total mg	%
	Sep. 05	Sep. 21	Oct. 14	Nov. 01	Nov. 22	Dec. 12	Jan. 02	Jan. 25	Feb. 13	Mar. 09	Mar. 30			
<i>Ammi</i> spp.								37					37	0.03
<i>Anthemis cotula</i> L. - <i>Matricaria</i> spp.						9	27						36	0.03
<i>Artemisia absinthium</i> L.								160					160	0.15
<i>Brassica</i> type: <i>Brassica</i> spp., <i>Rapistrum rugosum</i> (L.) All.				3449	3368			430	1300	726	1553	10825	18235	16.58
<i>Cardaria draba</i> type: <i>C. draba</i> (L.) Desv., <i>Rorippa</i> spp.		6597	7193	4439		111	1755	1147	712	179	667	377	4948	4.50
<i>Carduus</i> spp. (mainly <i>Carduus thoermeri</i> Weinm.)										902	15	100	1016	0.92
<i>Centaurea</i> spp.										22			41	0.04
Chenopodiaceae- <i>Amaranthus</i>	7	12												
<i>Cichorium intybus</i> L.						27	31	342	233	534	714		1881	1.71
<i>Cirsium vulgare</i> (Savi) Ten.								131	902	1281	444	74	2832	2.57
<i>Convolvulus arvensis</i> L.					7							7	14	0.01
<i>Cressa</i> type: <i>C. truxillensis</i> Kunth, <i>Cuscuta indecora</i> Choisy						14							14	0.01
<i>Cucurbita</i> spp.								8	12	194	122	696	1032	0.94
Cyperaceae								3					3	0.00
<i>Elaeagnus angustifolia</i> L.					28								28	0.03
<i>Erodium cicutarium</i> (L.) L'Her. Ex Aiton	16	271	243	11									540	0.49
<i>Erysimum repandum</i> type: <i>E. repandum</i> L., <i>Sysimbrium irio</i> L.	1818	1847	452										4117	3.74
<i>Eucalyptus</i> spp.						4				29	415	167	615	0.56
<i>Fragaria x ananassa</i> Duch.							2						2	0.00
<i>Fraxinus</i> spp.		16											16	0.01
<i>Grindelia</i> spp. (mainly <i>G. tehuelches</i> (Speg.) Cabrera)						75	3476	5813	1154	4690	4387	19595	19595	17.81
<i>Juglans regia</i> L.			320								9		320	0.29
<i>Lactuca</i> type													9	0.01
<i>Limonium brasiliense</i> (Boiss.) Kuntze								34	77				111	0.10
<i>Lycium</i> spp. (<i>L. chilense</i> Miers. ex Bertero, <i>L. ameghinoi</i> Speg.)		49	4	73						23	336		485	0.44
<i>Malvella leprosa</i> (Ortega) Krapov.				8		9	48	308	260	16	374	35	1049	0.95
<i>Medicago sativa</i> L.								11	25		12		56	0.05
<i>Melilotus</i> spp.						344	6	217	88	143	211	241	1250	1.14
<i>Menodora robusta</i> (Benth.) A. Gray			7										7	0.01
<i>Onopordon acanthium</i> L.								14	711				724	0.66
<i>Pastinaca sativa</i> L.								93	4				97	0.09
<i>Phyla canescens</i> (Kunth) Greene								9					9	0.01
<i>Pinus</i> spp.	129	189											318	0.29
<i>Plantago</i> spp.					765	1137	99	40	916	12	33		3002	2.73
Poaceae					4								4	0.00
<i>Populus</i> spp. (mainly <i>P. nigra</i> L.)	5954												5954	5.41
<i>Prosopidastrum globosum</i> (Gillies ex Hook & Arn.) Burkart					107	1216	9					57	1390	1.26
<i>Robinia pseudoacacia</i> L.				18									18	0.02
Rosaceae			28	643	8	522							1200	1.09
<i>Schinus areira</i> L.					28								28	0.03
<i>Schinus johnstonii</i> F. A. Barkley	289	492				8	123	3375		2722	8		782	0.71
<i>Tamarix gallica</i> L.				1917									8154	7.41
<i>Taraxacum officinale</i> Weber ex F. H. Wigg.	1788	442	1080	72	203	21	10		38	478	1399	1019	6550	5.95
<i>Trifolium pratense</i> L.					32				66				110	0.10
<i>Trifolium</i> spp. (mainly <i>T. repens</i> L.)				4	4463	5540	719	318	268	297	150		11760	10.69
<i>Typha</i> spp.							260						260	0.24
<i>Zea mays</i> L.									10	25			35	0.03
Mixed loads		58	52			26	42			61	42	42	324	0.29
Unidentified types			8										8	0.01
Total (mg)	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	110000	100.0

Appendix 2. Pollen types identified in corbicular loads in Dolavon apiary. Biomass contribution (mg) in 10 g of samples.

Pollen types	Samples											Total mg	%
	Sep. 7	Sep. 25	Oct. 10	Nov. 3	Nov. 26	Dec. 14	Jan. 04	Jan. 24	Feb. 15	Mar. 08	Mar. 30		
<i>Acantholippia seriphoides</i> (A. Gray) Moldenke					41							41	0.04
<i>Anthemis cotula</i> - <i>Matricaria</i> spp.					178	6						184	0.17
Astereae				16				10				10	0.01
<i>Brassica</i> type								396	127	507	61	1090	0.99
<i>Cardaria draba</i> type			2583	5265								7848	7.13
<i>Carduus</i> spp.				14	9	839	2153	1234	45	140	13	4446	4.04
<i>Centaurea</i> spp.								885				885	0.80
Chenopodiaceae- <i>Amaranthus</i>	51								5061	1354		6466	5.88
<i>Cichorium intybus</i>						164	1154	928	727	874	659	4507	4.10
<i>Cirsium vulgare</i>							269	1382	110	151	10	1922	1.75
<i>Convolvulus arvensis</i>					31	207	905	1529	1228	453		4352	3.96
<i>Cressa</i> type						50		14	9	55		129	0.12
<i>Cucurbita</i> spp.							5	6	70	16	13	111	0.10
<i>Erodium cicutarium</i>	30	249	63	512			6					860	0.78
<i>Erysimum repandum</i> type	104	2824	1179				779					4886	4.44
<i>Eucalyptus</i> spp.	6											6	0.01
<i>Grindelia</i> spp.								13	322	134		8930	8.12
<i>Junellia ligustrina</i> (Lag.) Moldenke	105									98	2670	5692	5.16
<i>Larrea</i> spp. (<i>L. divaricata</i> Cav., <i>L. nitida</i> Cav.)				371	134							505	0.46
<i>Lycium</i> spp.		12	684	301							975	1972	1.79
<i>Malva nicaensis</i> All.							6		7			13	0.01
<i>Malvella leprosa</i>					301	1212	343	601	2054	2368	183	7061	6.42
<i>Medicago sativa</i>							5					5	0.00
<i>Melilotus</i> spp.							140	561	124	294		1119	1.02
<i>Mentha</i> spp.									2			2	0.00
<i>Onopordon acanthium</i>							297					297	0.27
<i>Pinus</i> spp.		7										7	0.01
<i>Plantago</i> spp.						12		81				94	0.09
<i>Populus</i> spp.	5078	1849	8									6936	6.31
<i>Prosopidastrum globosum</i>				1490	9299	7158	133				17	18097	16.45
<i>Prosopis</i> spp.				744								744	0.68
Rosaceae	47	1743	3133									4923	4.48
<i>Salix</i> spp.	8											8	0.01
<i>Schinus johnstonii</i>	4568	3292	18									7878	7.16
<i>Tamarix gallica</i>			941	492	4	78	26	1930	20			3490	3.17
<i>Taraxacum officinale</i>	4	25	1391	789		195	3365	72	305	987	2393	9521	8.66
<i>Trifolium</i> spp.					5	60	46	215	11	107		443	0.40
<i>Xanthium</i> sp.								9				9	0.01
Mixed loads						5	47	13	2			68	0.06
Unidentified types				6						7		14	0.01
Total (mg)	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	110000	100.00

A. Forcone, Bee-collected pollen in the lower valley of the Chubut river (Argentina)