Grassland and shrubland grasshopper community composition in northern La Pampa province, Argentina

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Abstract

Grasshopper species composition, diversity and abundance on five grasslands and shrublands in northern La Pampa province were determined. Plant species composition, richness and a diversity index are reported for the different sites. A total of 24 grasshopper species were collected. The subfamily Melanoplinae was dominant, followed by Gomphocerinae and Acridinae. The highest abundance of grasshoppers was registered in shrubland communities in 1992. *Dichroplus pratensis* and *Neopedies brunneri* were the most abundant species in grasslands, while *D. vittatus* and *D. pratensis* were in shrublands. *D. pratensis* and *Euplectrotettix ferrugineus* were broadly distributed in both community types. *N. brunneri* was broadly distributed in grasslands and *Scyllina signatipennis* in shrublands. A total of 16 species were uncommon or rare, being collected only in certain years, in low numbers, and only in some locations. Species richness and diversity indices ranged from 11-4, and from 1.68-0.42, respectively. Although species richness in grasslands and shrublands was similar, diversity was, in general, lower in the latter.

Key words

Acrididae, grasshoppers, grasslands, shrublands diversity.

Introduction

Grasshoppers are the most conspicuous insect group in natural arid grasslands (Joern 1979). Studies of these insects have mainly focused on population dynamics and ecology (Richards & Waloff 1954, Sánchez & Liljesthröm 1986, Lockwood & Kemp 1988, Lockwood & Lockwood 1991, Lockwood & Shell 1995, Lockwood 1997), on the evaluation of forage losses (Nerney 1960, Anderson 1961, Putnam 1962, Mitchell & Pfadt 1974, Hewitt 1978, Sánchez & de Wysiecki 1990), and control (Hewitt & Onsager 1983; Lockwood 1993 a, b; Lockwood *et al.* 1988). More recently, emphasis has been placed on the study of grasshopper communities through analyzing the variation in abundance, species richness and diversity in relation to environmental gradients and grazing history (Kemp *et al.* 1990, Quinn & Walgenbach 1990) and habitat variation (Joern 1979, Pfadt 1982, 1984; Kemp *et al.* 1989, Kemp *et al.* 1990, Kemp 1992, Quinn *et al.* 1991, Bergmann & Chaplin 1992, Sánchez & de Wysiecki 1993, Fielding & Brusven 1995).

In Argentina the economic importance of grasshoppers has been recognized since the 19 th century . These insects may cause, in some years, forage and crop losses of considerable magnitude (Sánchez & de Wysiecki 1990, de Wysiecki & Sánchez 1992). Recently, a significant increase of populations of different species in the pampas (Cigliano & Lange 1998) was observed. Despite the fact that grasshoppers may cause important forage losses in some years, little is known of grasshopper assemblages that inhabit these plant communities.

In northern La Pampa province, there are different grassland and shrubland communities that are used for raising cattle in the east and goats and horses in the west. Although there are some recent studies on grasshopper grassland communities in the pampas (Sánchez & de Wysiecki 1993, Cigliano *et al.* 1999), no studies have been conducted on shrubland communities since Otte's work in the Monte of Argentina (1977).

In the present study, we report grasshopper species composition, richness, diversity and abundance on grassland and shrubland communities in northern La Pampa province.

Materials and Methods

Five study sites were established in northern La Pampa province (Victorica, La Pastoril, Santa Isabel, Algarrobo del Aguila and La Humada), representing different natural plant communities of the region (Fig. 1). Victorica, La Pastoril and Santa Isabel are situated in Espinal Province and Algarrobo del Aguila and La Humada in Monte Province, all in the Chaqueño Domain of the Neotropical Region as defined by Cabrera & Willink (1973). The coordinates, precipitation, and temperature of the sites are summarized in Table 1.

To determine plant species composition, herbaceous vegetation was sampled during January 1992. At each site, 20 plots (20x50 cm) were sampled along a randomly-selected transect. In each plot, percentages of basal area covered by grasses, forbs, shrubs and bare ground were determined following Daubenmire's procedure (1959). Species not identified in the field were taken to the laboratory and identified with a stereoscopic microscope.

At each site, two hundred net sweeps were made along vegetation transects during 1992 and through 1995. Samplings were made in January and February of 1992 and

1994, in February of 1993, and in January of 1995: samples taken in these two months adequately reflect the grasshopper communities of these habitats. Although many authors have shown that sweep netting generally provides accurate estimates of grasshopper diversity on grasslands (Evans *et al.* 1983, Larson *et al.* 1999), we are aware of possible biases of estimates on shrublands, considering the differences in plant architecture. However, taking into account that shrublands were open habitats of low shrubs which were satisfactorily swept, it is assumed that numbers and grasshopper species collected in these sites were not significantly affected. Individuals collected were examined in the laboratory to determine species composition and developmental stages in the population for each sampling date.

Grasshopper species abundance was calculated as the total number of individuals/200 net-sweeps, of each species, at each site, in each year. Species richness of plant and grasshopper communities was quantified as the total number of species present in a community. Species diversity in each site each year, was determined using the Shannon-Weaver index (McNaughton & Wolf 1984):

$$H' = -\Sigma pi.\ ln\ pi$$

where : pi is the relative abundance of each species.

The relationship between population abundance and diversity, and annual precipitation at the different sites was analyzed by linear regression.

Species distribution hierarchy was determined as the proportion of ocurrence of each species across the sites (grasslands and shrublands) and years. Species at each site-year were distributed narrowly (present at ≤ 25 % of the 19 total site-years), intermediately (present at > 25 and < 75 % of the total 19 site-years) and broadly (present at ≥ 75 % of the 19 total site-years) (Kemp 1992).

Results and Discussion

Plant species composition, richness and diversity indices in the different sites are given in Tables 2 and 3. Victorica is a dense grassland dominated by *Piptochaetium napostaense, Poa ligularis* and *Bothriochloa springfieldii*, with dispersed trees of *Prosopis caldenia*. La Pastoril is a grassland dominated by *Elyonurus muticus* and *Hyalis argentea*. Santa Isabel is an open shrubland dominated by *Psila spartioides* and *Senecio subulatus*. Algarrobo del Aguila and La Humada are shrublands dominated by *Larrea divaricata*, the understory dominated by the grass *Aristida mendocina*, and by the dicotyledonous shrubs *Verbena seriphioides* and *Acantholipia seriphioides*. Coverage of grasses and forbs was higher at Victorica and La Pastoril. Coverage of shrubs was higher than that of grasses in the sites belonging to the Monte (Santa Isabel and La Humada), with the exception of Algarrobo del Aguila. The percentage of bare ground was higher at Algarrobo del Aguila and La Humada. Coverage of grasses in relation to forbs was higher in Victorica and lower in La Humada (Table 3).

A total of 24 grasshopper species were collected at the five sites, grouped into three families, Acrididae, Romaleidae and Ommexechidae. Nine species were present only in grasslands, 5 only in shrublands, and 10 species were collected at both communities. Acrididae had the highest relative abundance in all sites. The subfamily Melanoplinae was dominant, followed by Gomphocerinae and Acridinae (Tables 4, 5).

The highest abundance of grasshoppers was registered in shrubland communities in 1992. In all sites, populations varied among years with some experiencing a drastic decrease from one year to the next (i.e. *Dichroplus vittatus* from 1992-1993 in shrublands). A pattern of decreasing abundance was observed in the Monte sites from 1992-1995, while in grasslands, mainly in Victorica, an opposite tendency was registered (Table 5). Regression analysis found that population abundance was not significantly related to annual precipitation ($b = 0.144$; $SE_b = 0.104$; $P = 0.185$). In grasslands, *D. pratensis* and *Neopedies brunneri* were the most abundant species accounting for 65% of the grasshopper assemblage, while *D. vittatus* and *D. pratensis* were in shrublands and there constituted 66% of the assemblage.

In relation to species distribution, grasslands had 3 broadly, 7 intermediately and 9 narrowly distributed species (Table 6) and shrublands, 3 broadly, 7 intermediately and 5 narrowly distributed species (Table 7). *D. pratensis* and *Euplectrotettix ferrugineus* were broadly distributed in both community types, although *E. ferrugineus* exhibited very low population abundance. *N. brunneri* was broadly distributed in grasslands and intermediately distributed in shrublands. *Scyllina signatipennis* exhibited an opposite pattern to *N. brunneri*. A total of 16 species were uncommon or rare; that is, they were collected in certain years, in low numbers, and only in some locations (Tables 6, 7).

The pattern of species distribution of the present study is in concordance with that registered by Cigliano *et al.* (1999) in the pampas: just a few species were common and most of them were uncommon. Of the broadly distributed species, only *D. pratensis* was registered in both studies. *D. elongatus, Beacris punctulatus* and *Aleuas linneatus*, broadly distributed in the pampas sites, were rare or absent in the present study.

Species richness and diversity indices ranged from 11-4, and from 1.68-0.42 respectively. Although there was not an important difference in richness among grasslands and shrublands, diversity was, in general, lower in the latter (Table 5). Victorica had the highest diversity of grasshoppers, which may be linked to its high diversity of plants and high coverage of grasses and forbs. In spite of the fact that this site had the highest level of precipitation, there was not a significant relationship between diversity and annual precipitation ($b = 0.005$; $SE_b = 0.005$; $P = 0.32$).

Otte (1977), analyzing North and South American scrub regions, found that as the number of plant species increased, the number of grasshopper species also increased. Evans (1988) also found significant correlations between species richness of grasshoppers and number of plant species in a tallgrass prairie community. In the present study, the lower diversity registered in shrublands could be related to the lower number of plant species and lesser vegetal diversity in these communities.

Vegetation composition and structure may influence habitat selection among grasshoppers. *D. pratensis*, *D. vittatus* and *N. brunneri* are polyphagous (de Wysiecki & Sánchez

1992, Otte & Joern 1977, de Wysiecki pers. com.) and were present in both community types; however, *D. pratensis* and *N. brunneri* were more abundant in the most humid grassland and *D. vittatus* in shrublands. *E. ferrugineus*, *S. signatipennis* and *Sinipta dalmani* are grass-feeders (Otte & Joern 1977, de Wysiecki pers. com., Ronderos *et al.* 1981) and were present at most sites.

In *L. divaricata* shrubland (La Humada) where was very low grass coverage (Table 3), populations of *E. ferrugineus* and *S. signatipennis* were extremely low while those of *S. dalmani*, were absent (Table 5). Habitat perturbation through grazing can alter plant community composition and reduce plant biomass, and thus influence grasshopper community structure (Quinn & Walgenbach 1990). Though grazing was not measured in this study, goat and horse grazing, presence of shrub indicators of overgrazing and lower plant and grasshopper species richness and diversity, would suggest higher grazing intensity at this site. Indeed, different histories of disturbance could be at least in part responsible for different levels of species richness (Robinson *et al.* 2000).

Species richness of grasshoppers from *L. divaricata* communities analysed in this study is higher (13 species) than that registered by Otte (1977) (8 species) in a much larger area, the Bolson of Pipanaco. These two studies had 5 species in common (*E. ferrugineus*, *Rhammatocerus pictus*, *Staurorhectus longicornis*, *D.vittatus* and *Diponthus argentinus*). *Schistocerca cancellata* registered by Otte was not found in the present study. Moreover, he reported that Monte and South American Pampas sites contained significantly fewer numbers of grasshopper species than Sonoran desert and North American prairie sites, respectively. Our results and previous data of natural grasslands from eastern La Pampa and western Buenos Aires provinces (Sánchez & de Wysiecki 1993, Cigliano *et al.* 1999) seem to support Otte's observations. Indeed, mean richness of species inhabiting grasslands of this region of the pampas ranged from ≅ 6-10, and was lower than that reported by Kemp (1992) at the habitat type level in the steppe region of the western United States(≅ 10-17).

Although spatial differences in grasshopper community structure analysed in this study could be related to some habitat characteristics, such as plant species composition, percent of bare ground, environmental conditions, and management, a variety of processes incorporating biogeographical and historical factors may play an important role in determining species community structure (Ricklefs & Schluter 1993; Farrell & Mitter 1993).

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Table 1. Characteristics of the different sites studied.

	Grassland		Shrublands		
	Victoria	La Pastoril	Santa Isabel	A. del Aguila	La Humada
Geographical location	36°12'S 65°27'W	36°26'S 66°28'W	36°16'S 66°55'W	At 40 km W of A. del Aguila 36°33'S 67°05'W	At 3 km E of La Humada 36°30'S 67°40'SW
Mean annual precipitation	512 mm (with a minimum of 11 mm in July and a maximum of 68 mm in December)	388 mm (with a minimum of 10 mm in July and a maximum of 56 mm in March)	340 mm (with a minimum of 4 mm in August and a maximum of 56 mm in October)	311 mm (with a minimum of 4,8 mm in July and maximum of 54 mm in March)	200 mm (with a minimum of 5 mm in July and a maximum of 25 mm in January)
Monthly mean temperature ranges	between 7.5°C in July and 24.2°C in January	between 7.2°C in July and 24.4°C in January	between 6.9°C in July and 24.6°C in January	between 6.5°C in July and 24°C in January	Ranges between 6°C in June and 23°C in January

Table 2. Percent canopy cover of plant species (Mean ± SE) expressed in % in the different sites in 1992. Biological types registered S=shrubs, F=forbs and G=grasses.

		GRASSLANDS		SHRUBLANDS		
		Victorica	La Pastoril	Sta Isabel	A del Aguila	La Humada
ANACARDIACEAE						
Schinus joantoni	S				3.6 ± 3.0	
CARYOPHYLLACEAE						
Silene antirrhina L.	F		0.3 ± 0.1			
CHENOPODIACEAE						
Salscla kali L	F		0.1 ± 0.1			
Allenrolfea vaginata (Gris) Kuntze	S			1.7 ± 1.1		
Atriplex lampa Gill. ex Moquin	S			0.5 ± 0.5		
Chenopodium sp L	S					0.1 ± 0.1
COMPOSITAE						
Baccharis ulicina Hook. et Arn.	F		1.2 ± 0.5			
B. gilliessi A. Gray	F		3.5 ± 2.0			
Conyza bonariensis (L.) Cronquist	F		0.6 ± 0.1	0.9 ± 0.6		
Gaillardia megapotamica Barker	F		0.5 ± 0.4			
Gnaphalium sp. L.	F	0.1 ± 0.1				
Hyalis argentea Don	F		13.4 ±4.1			
Hysterionica jasionoides Willdenow	F		0.1 ± 0.1			
Thelesperma megapotamicum Kuntze	F		0.4 ± 0.2			
Chuquiraga erinaceae Don	S					0.8 ± 0.8
Gutierritzia gilliesii Grisebach	S					0.2 ± 0.2
Psila spartioides	S			18.2 ± 4.6		
Senecio subulatus Don ex H. et Arn.	S			3.5 ± 1.8		
CRUCIFERAE						
Lepidium sp. L.	F		0.1 ± 0.1			
EPHEDRACEAE						
Ephedra ochreata Miers	S					2.7 ± 2.7
LEGUMINOSAE						
Geoffroea decorticans Schn. et Covas				0.1 ± 0.1		
Prosopis alpataco Philippi				0.9 ± 0.6		
Prosopis stombulifera (Lam) Benthan					1.6 ± 1.6	
Rynchosia senna Gill ex H.et Arn		7 ± 1.1				
MALVACEAE						
Lecanophora heterophylla Cav	S			0.1 ± 0.1		
NYCTAGINACEAE						
Bougainvillea spinosa (Cav.) Heimerl	S					0.1 ± 0.1
PLANTAGINACEAE						
Plantago patagonica Jacquin	F	0.6 ± 0.1	0.8 ± 0.4			
POACEA						
Aristida mendocina Phil	G		8.1 ± 2.8		15.6 ± 4.7	2.3 ± 0.9

		GRASSLANDS			SHRUBLANDS	
		Victorica	La Pastoril	Sta Isabel	A del Aguila	La Humada
Aristida subulata Henrard	G	1.6 ± 1.0				
Aristida sp L.	G		1 ± 0.6			
Bothriochloa springfieldii Parodi	G	11.5 ± 2.5	3 ± 1.4			
Bromus brevis Nees	G	0.5 ± 0.2				
Digitaria californica (Benth) Henrard	G				0.1 ± 0.1	
Elyonurus muticus (Spreng.) Kuntze	G		17.8 ± 5.6			
Eragrostis sp von Wolf	G				0.7 ± 0.4	2.7 ± 0.5
Panicum urvilleanum Kunth	G		0.3 ± 0.1		5 ± 1.5	
Piptochaetium napostaense Hackel	G	18.0 ± 3.0				
Poa lanuginosa Poiret	G		0.8 ± 0.2	0.1 ± 0.1	0.4 ± 0.1	0.1 ± 0.1
Poa ligularis Nees ex Steudel	G	5 ± 1.1				
Schedonnardus paniculatus Trel	G	0.1 ± 0.1				
Setaria leucopila Schumann	G			0.7 ± 0.6	3.6 ± 3.2	
Sporobolus cryptandrus (Torr) A. Gray	G	5 ± 1.4	1.3 ± 0.5		0.1 ± 0.1	
Stipa longiglumis Phil.	G	0.5 ± 0.3				
Stipa tenuis Phil.	G				0.1 ± 0.1	
Trichloris crinita (Lag.) Parodi	G			2.6 ± 1.2		
RHAMNACEAE						
Condalia microphylla Cavanilles	S				0.1 ± 0.1	
SCROPHULARIACEAE						
Linaria texana Scheele.	F		0.1 ± 0.1			
SOLANACEAE						
Nierembergia aristata Sweet	F	0.3 ± 0.2				
Fabiana pecki Nied	S					0.1 ± 0.1
Lycium chilense Miers	S					0.1 ± 0.1
Lycium gillesianum Miers	S				0.1 ± 0.1	
Lycium tenuispinosum Miers	S			1.5 ± 1.5		
UMBELLIFERAE						
Daucus pusillus Michx	F	0.4 ± 0.1				
VERBENACEAE						
Acantholipia seriphioides (A. Gray)	S				5.4 ± 2.8	12.5 ± 4.4
Verbena seriphioides Gill. et Hook	S			1.3 ± 1.3	6.9 ± 3.8	15.2 ± 4.1

Table 3. Percent canopy cover of grasses, forbs, shrubs, litter and bare ground expressed in %, diversity index and species richness of the different sites sampled in 1992.

	GRASSLANDS			SHRUBLANDS	
	Victorica	La Pastoril	Sta.Isabel	A del Aguila	LaHumada
Grasses	42.2	32.3	3.4	25.6	5.1
Forbs	13.1	16.5	0.9	--	--
Shrubs	--	--	27.8	16.1	29.1
Litter	38.6	32.8	30	6.2	5.1
Bare ground	6	20	30	50	50
Diversity index	2	1.7	1.6	1.8	1.4
Species richness	15	17	14	15	10

Table 4. Relative average abundance, expressed in percent, of grasshopper families and subfamilies record in each site.

	GRASSLANDS		SHRUBLANDS		
	Victorica	**La Pastoril**	**Sta Isabel**	**A.delAguila**	**La Humada**
ACRIDIDAE	93.5	98.5	96	100	99.7
Acridinae	0.5 ± 0.3	6.5 ± 3.4	3 ± 2.8	1 ± 0.4	--
Melanoplinae	78 ± 0.9	63 ± 7	68 ± 7.5	57 ± 16.5	89.5 ± 3
Gomphocerinae	15 ± 2.3	29 ± 5.4	25 ± 6.5	42 ± 16.5	10.2 ± 2.9
ROMALEIDAE	6.5 ± 2.2	--	2 ± 1.6	--	0.2 ± 0.2

Table 5. Mean relative abundance (individuals/200 sweeps) of grasshopper species collected and diversity index in the different sites in La Pampa province, Argentina, 1992-1995. Grasslands.

Family/Subfamily/Species	GRASSLANDS							
	Victorica				**La Pastoril**			
	1992	1993	1994	1995	1992	1993	1994	1995
ACRIDIDAE								
Acridinae								
Allotruxalis strigata (Bruner)	2			2			1	2
Parorphula graminea Bruner	1	1						
Cocytotettix intermedia (Bruner)						2		
Melanoplinae								
Baeacris punctulatus (Thumberg)				1				
Dichroplus alejomesai Liebermann								
D. bergii (Stål)		1						
D. elongatus Giglio-Tos								5
D. pratensis Bruner	35	20	46	36	16	3	5	10
D. vittatus Bruner	5	7	1					
Neopedies brunneri (Giglio-Tos)	33	16	83	84	2	3	3	2
Gomphocerinae								
Amblytropidia australis Bruner			2					
Borellia brunneri (Rehn)			1	1				
Euplectrotettix ferrugineus Bruner	2	1	16		2	1	2	2
Scyllina signatipennis (Blanchard)	8				1			
Sinipta dalmani Stål	2				4	4		4
Staurorhectus longicornis G.Tos		2	10	19			2	
Rhammatocerus pictus Bruner								
ROMALEIDAE								
Chromacris speciosa (Thumberg)								
Diponthus argentinus Picket&Saus.								
Xyleus laevipes (Stål)		1	1	1				
Zoniopoda omnicolor Bruner	2		1	7				
Z. tarsata (Blanchard)	4	6	5					
OMMEXECHIDAE								
Clarazella patagona Picket&Saus.								
Graea horrida Bruner					2			
Diversity Index	1.54	1.68	1.58	1.17	1.21	1.52	1.45	1.40
Total indi/ 200 net sweeps	94	55	166	151	27	13	13	25

Table 5. (contin.) Shrublands.

Family/Subfamily/Species	SHRUBLANDS										
	Santa Isabel			Algarrobo del Aguila				La Humada			
	1992	1993	1994	1992	1993	1994	1995	1992	1993	1994	1995
ACRIDIDAE											
Acridinae											
Allotruxalis strigata (Bruner)			2			4					
Parorphula graminea Bruner								1			
Cocytotettix intermedia (Bruner)											
Melanoplinae											
Baeacris punctulatus (Thunberg)											
Dichroplus alejomesai Liebermann	2	2			5			10			
D. bergii (Stål)											
D. elongatus Giglio-Tos											
D. pratensis Bruner	50	34	7	8	29	37	5	1	4	21	64
D. vittatus Bruner	33			277	59	18		261	59	63	1
Neopedies brunneri (Giglio-Tos)	2	2	4					2			
Gomphocerinae											
Amblytropidia australis Bruner											
Borellia brunneri (Rehn)						3	7			1	5
Euplectrotettix ferrugineus Bruner	3	10	1	21	14	4	2	1	5	1	
Scyllina signatipennis (Blanchard)	2			11	17	13	14	4	7	7	4
Sinipta dalmani Stål	10	2		6	4	1	9				
Staurorhectus longicornis G. Tos	1		6			12				4	
Rhammatocerus pictus Bruner	5	3			5						
ROMALEIDAE											
Chromacris speciosa (Thunberg)	7										
Diponthus argentinus Pictet & Saus.											1
Xyleus laevipes (Stål)											
Zoniopoda omnicolor Bruner											
Z. tarsata (Blanchard)											
OMMEXECHIDAE											
Clarazella patagona Pictet & Saus.	2		1								
Graea horrida Bruner											
Diversity Index	1.61	1.15	1.54	0.58	1.54	1.65	1.44	0.42	0.76	1.01	0.59
Total indi/ 200 net sweeps	117	53	21	323	133	92	37	281	75	97	75

Table 6. Grassland grasshopper species based on their frequency distribution across the two sites sampled in La Pampa province, Argentina, 1992-1995.

	GRASSLANDS GRASSHOPPERS		
	Broadly distributed (≥ 75-100 % of all sites)	Intermediately distributed (> 25 < 75 % of all sites)	Narrowly distributed (0 ≤ 25 % of all sites)
ACRIDIDAE			
Acridinae			
Allotruxalis strigata		50	
Parorphula graminea			25
Cocytotettix intermedia			12.5
Melanoplinae			
Baeacris punctulatus			12.5
D. bergii			12.5
D. elongatus			12.5
D. pratensis	100		
D. vittatus		37.5	
Neopedies brunneri	100		
Gomphocerinae			
Amblytropidia australis			12.5
Borellia brunneri			25
Euplectrotettix ferrugineus	87.5		
Scyllina signatipennis			25
Sinipta dalmani		50	
Staurorhectus longicornis		50	
ROMALEIDAE			
Xyleus laevipes		37.5	
Zoniopoda omnicolor		37.5	
Z. tarsata		37.5	
OMMEXECHIDAE			
Graea horrida			12.5

Table 7. Shrubland grasshopper species based on their frequency distribution across the three sites sampled in La Pampa province, Argentina, 1992-1995.

	GRASSHOPPERS SHRUBLANDS		
	Broadly distributed (≥ 75-100 % of all sites)	Intermediately distributed (> 25 < 75 % of all sites)	Narrowly distributed (0 ≤ 25 % of all sites)
ACRIDIDAE			
Acridinae			
Allotruxalis strigata			18
Parorphula graminea			9
Melanoplinae			
Dichroplus alejomesai		36	
D. pratensis	100		
D. vittatus		72	
Neopedies brunneri		36	
Gomphocerinae			
Borellia brunneri		36	
Euplectrotettix ferrugineus	90		
Scyllina signatipennis	82		
Sinipta dalmani		55	
Staurorhectus longicornis		36	
Rhammatocerus pictus		27	
ROMALEIDAE			
Chromacris speciosa			9
Diponthus argentinus			9
OMMEXECHIDAE			
Clarazella patagona			18

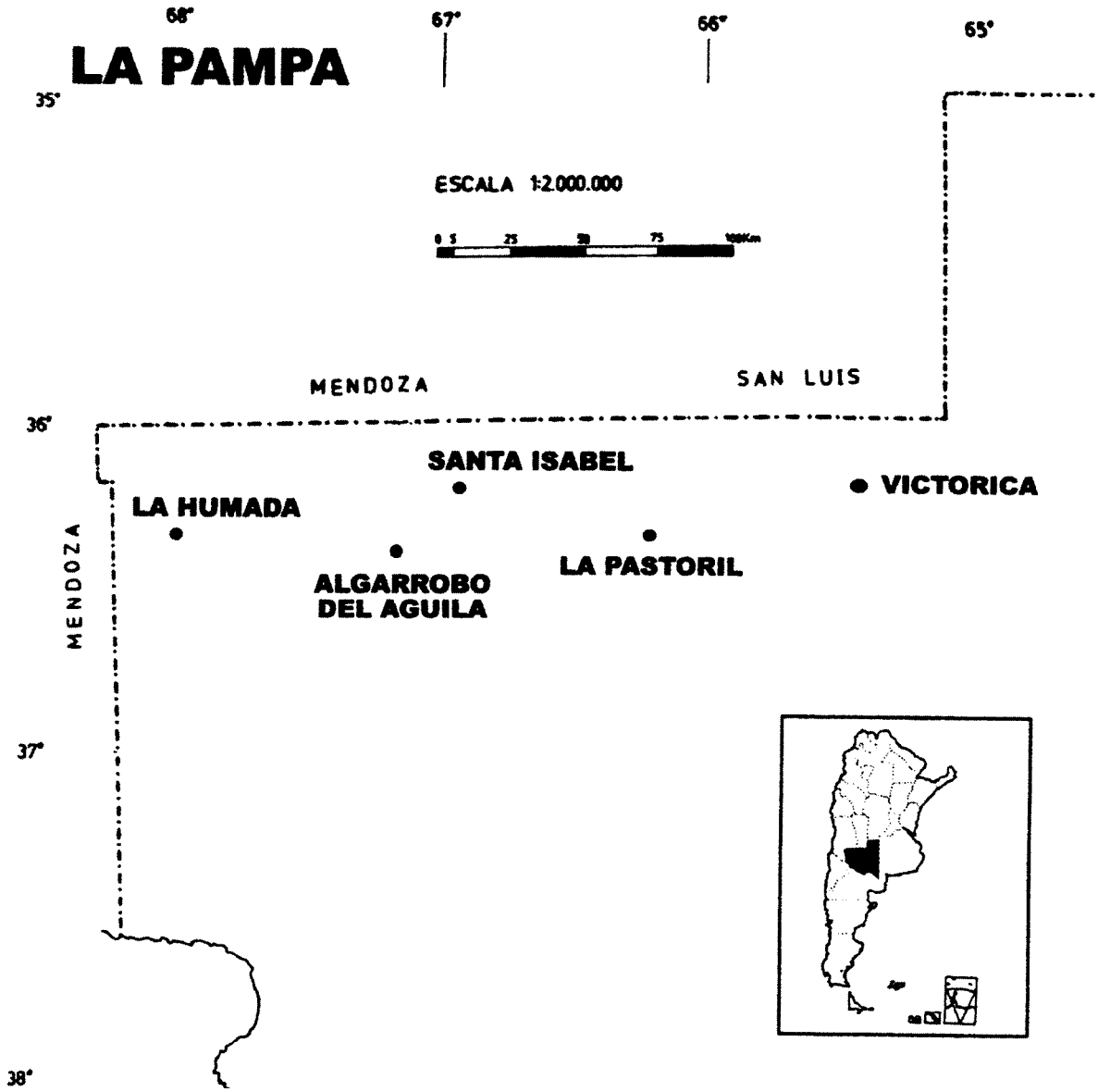

Figure 1. Map showing collection sites of grasshopper data 1992-1995 in northern La Pampa province.