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Ground-Dwelling Arachnids and Fire Disturbance: A Case Study in Northeastern Patagonia (Argentina)

Fernando Joaquín Martínez [1,2,*], Germán Horacio Cheli [1,2], Cristian José Grismado [3] and Alejandro Jorge Bisigato [1,2]

[1] Instituto Patagónico para el Estudio de los Ecosistemas Continentales, IPEEC-CONICET, Boulevard Brown 2915, Puerto Madryn U9120ACD, Argentina; cheli@cenpat-conicet.gob.ar (G.H.C.); bisigato@cenpat-conicet.gob.ar (A.J.B.)
[2] National Scientific and Technical Research Council, Universidad Nacional de la Patagonia San Juan Bosco, Boulevard Brown 3700, Puerto Madryn U9120ACD, Argentina
[3] División Aracnología, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" – CONICET, Av. Ángel Gallardo 470, Ciudad Autónoma de Buenos Aires C1405DJR, Argentina; grismado@macn.gov.ar
* Correspondence: fjmartinez@cenpat-conicet.gob.ar; Tel.: +54-280-4883184

Abstract: Fire is one of the main disturbances in northeastern Patagonia. Wildfires are becoming more frequent and severe, threatening the sustainability of local ecosystems. Arachnids respond markedly to environmental modifications and can regulate processes linked to lower trophic levels. Assessing changes in arachnid diversity is useful to understand the effect of fire on animal assemblages and ecosystem functionality. The aim of this study was to analyze the response of the ground-dwelling arachnid assemblage to fire disturbance. Eight sampling sites were selected: four burned and four unburned. Arachnids were sampled using pitfall traps. The taxonomic and functional structure of the assemblage was found to differ between burned and unburned areas. This change was related to major taxa turnover. On the other hand, the alpha diversity did not differ significantly according to fire disturbance. The abundance of specialist spiders decreased significantly in burned areas, possibly related to post-fire changes in the composition and structure of the plant community. In addition, significant species indicators of unburned and burned sites were found. The results of this study are useful for ecosystem management and the development of biodiversity conservation strategies in northeastern Patagonia, an area severely affected by fires.

Keywords: spiders; diversity; wildfire; dryland

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1. Introduction

Fire has shaped many ecosystems worldwide for hundreds of millions of years [1]. Fire disturbance is a major ecological and evolutionary force that promotes and maintains biodiversity at a local, regional and global scale [2]. However, as a consequence of significant shifts in human population growth, socioeconomic factors, and land use, fires have become more frequent and severe, affecting the sustainability of many ecosystems [2,3]. Moreover, as a result of rising global temperatures, projections predict that these changes in fire regime will accelerate [4,5]. In this context, understanding how fire affects ecosystem components is important for developing strategies for biodiversity conservation and proper management of natural resources in regions prone to this kind of disturbance [5,6].

The effects of fire on biological communities are diverse [6]. Although fire disturbance initially reduces plant biomass drastically [1], it favors the recovery and dominance of herbaceous species over woody vegetation, which can increase primary productivity [7]. Moreover, fire changes several soil characteristics such as litter cover and surface morphology, as well as hydrological processes [8]. Wildlife is affected by fire in different ways, mainly through the environmental modifications it causes [1]. There are taxa more resilient to fire disturbance and their populations recover quickly. Some species have a preference for certain post-fire stages, e.g., opportunists that predominate soon after the disturbance, or species that only colonize the burned area many years later [9,10]. Although there is knowledge about fire disturbance and animal assemblages (e.g., [9,11,12]), most studies have focused on the effect of fire on vegetation due to intrinsic differences between plants and animals [13].

Arachnids are among the most common animals in terrestrial environments [14]. They are key predators that structure their prey communities [15] and can modify lower-level processes and ecosystem functionality [16,17]. Given their marked responses to environmental alterations, arachnids show a very close relationship with vegetation features and habitat structure [18–20]. Additionally, they are useful for analyzing the effects of disturbance on animal assemblages [21]. Since not all spider species exploit resources in similar ways [22], they can be grouped into discrete guilds. Considering spider guilds is useful for studying the functional diversity of the arachnid community and to help understand how disturbances affect ecosystem processes [22,23].

Arachnids generally respond markedly to fire [24]. Direct effects are related to their ability to survive fire disturbance (e.g., escape behavior, burrows as shelters, etc.) [10]. However, long-term indirect effects are the most relevant and correspond to changes in habitat and microclimate conditions [25]. For example, changes in plant cover and litter characteristics, such as depth and complexity, have a significant influence on the recovery of arachnid assemblages after fire [19,26]. It is difficult to find a general pattern regarding the effects of fire on arachnids, mainly due to differences among fire regimes, ecosystem characteristics, and the biology of the species conforming each particular assemblage [13]. However, some general responses can be established. In the case of ground-hunter spiders (e.g., Lycosidae), habitat simplification by fire often facilitates prey capture and increases the abundance of this guild, which consequently dominates assemblages in burned areas [19,27]. On the other hand, fire produces extreme changes in plant structure, negatively affecting web-building spiders due to less availability of web anchor sites [21,27]. In addition, prey-specialized spiders, limited to habitats with sufficient food availability, may become less abundant in burned areas [24]. This type of response is usually associated with a decrease in overall arachnid diversity after fire [21].

Fire is one of the main disturbances in northeastern Patagonia [28]. There is evidence that fire has been a determinant of plant communities in the region [7,29]. Previous studies indicate that fire triggers the transition from steppes dominated by shrubs (stable community) to grass steppes [29]. The persistence of the grass-dominated state depends on the recovery rate of the shrub species [7]. In this sense, differences between burned and unburned plant communities have been observed for more than 10 years postfire [29]. The natural role of fire was greatly modified at the end of the 19th century, mainly due to the introduction of sheep and fire suppression [7,30]. Then, towards the end of the 20th century, grazing pressure began to decrease as a consequence of low wool prices and land degradation [29], leading to fuel accumulation, and favoring the occurrence of more severe and frequent fires [31]. This situation, added to the typical arid environmental characteristics of the region and global climate change, has made this area very prone to wildfires, especially during late spring and summer [30,31]. Finally, knowledge of the effects of fire on the invertebrate fauna of northeastern Patagonia is practically null. There is only one study on this issue in the region, but it focuses on the responses of the entire assemblage of ground-dwelling arthropods ten years after a fire [32]. There is no specific background information on the effect of fire on arachnid species in the arid Patagonia (Argentina).

The aim of this study was to analyze the response of the ground-dwelling arachnid assemblage to fire disturbance. Fire is expected to decrease the species diversity and change the taxonomic composition of the assemblage. A variation in the functional structure is predicted, with opportunistic groups (e.g., ground hunter spiders) being dominant in disturbed areas, while more sensitive groups (e.g., specialist spiders) being negatively affected by fire. In addition, this study seeks to identify taxa indicators of fire disturbance in northern arid Patagonia, enabling the improvement of future actions related to biodiversity management and conservation in the region.

2. Materials and Methods

2.1. Study Area

This study was conducted in La Esperanza ranch, located in northeastern Patagonia (Argentina), 75 km north of Puerto Madryn (42°09′23″ S; 64°59′40″ W). In 2008, all domestic herbivores were removed to establish a wildlife refuge [33]. The climate is arid, with a mean annual temperature of 13.4 °C and a mean annual precipitation of 236 mm [34]. The characteristic vegetation is shrubland with several strata. Vegetation covers 20% to 40% of the ground in a random, patchy structure formed by clumps of shrubs and perennial grasses. Generally, the areas between patches lack vegetation, although some isolated individuals can be found, mainly grasses. The upper canopy layer (1–2 m) is dominated by evergreen and deciduous shrubs of *Larrea divaricata*, accompanied by *Schinus johnstonii*, *Lycium chilense*, *Prosopis alpataco* and *Prosopidastrum striatum*. In the lower canopy layer (<1 m), *Chuquiraga avellanedae* is highly abundant with the co-occurrence of perennial grasses and dwarf shrubs [35].

In December 2016, the study area was affected by a three-day fire that burned more than 25,000 ha, including 60% of La Esperanza ranch. This wildfire occurred under conditions of high temperature, low humidity, and strong winds [36]. Taking into account the fire classification according to their severity for xeric shrublands [37], the event studied can be categorized as highly severe, where most or all vegetation was consumed (including small terminal branches). This study considered eight sites (four burned and four unburned) separated from each other by a minimum distance of 600 m (Figure 1). All sites were homogeneous in terms of topography. At the time of sampling (three years after the fire), the plant community in the burned sites was dominated by perennial grasses with a few resprouting shrubs. Since grazing was excluded from the area more than 10 years before sampling, it was ruled out as a disturbance influencing arachnid assemblages.

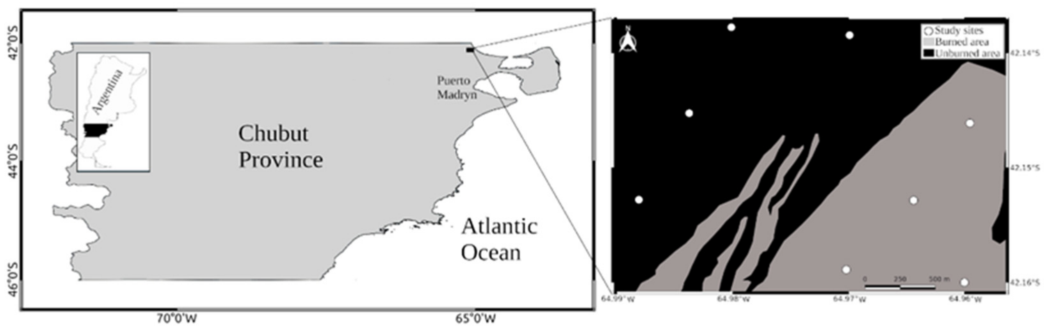


Figure 1. Study area with location of sampling sites.

2.2. Arachnid Sampling and Determination

Pitfall traps were used to collect ground-dwelling arachnids. Eight traps (12 cm diameter and 12 cm deep) were placed on bare ground between vegetation patches within each site along two transects, with 10 m distance between traps (8 traps × 4 sites × 2 areas = 64 traps) oriented in an east–west direction. This design is optimal for sampling the ground-dwelling arthropods in the region [38]. Each pitfall trap was filled with 300 mL of 30% propylene glycol and remained active for 15 days during late spring (November 2019). Only adult specimens of Araneae and Scorpiones were considered and identified at the lowest possible taxonomic level. These orders are representative of the arachnid assemblages in northeastern Patagonia [39,40]. In addition, mostly using the criteria proposed by Cardoso et al. [23], spiders were grouped according to their foraging strategy into the following guilds: sensing web weavers, sheet web weavers, space web weavers, orb web weavers, specialists, ambush hunters, ground hunters, and other hunters. Exceptionally, the gnaphosids of the genus *Eilica* were classified as specialists because there is evidence that they have a diet restricted to ants [41,42]. Unlike most philodromids, spiders of the genus *Petrichus* hunt at ground level [43] and were therefore listed as ground hunters. Finally, although Zodariidae is considered a family of specialist spiders, *Cybaeodamus enigmaticus* was classified as a ground hunter because members of this genus have a wide diet [44]. The collected material was deposited in the Entomological Collection of the Instituto Patagónico para el Estudio de los Ecosistemas Continentales (IPEEC-CONICET).

2.3. Statistical Analysis

To analyze the variation in the structure of arachnid assemblage due to fire, non-metric multidimensional scaling (NMDS) was performed to obtain an ordination of the study sites as a function of the arachnid taxa. The analysis was performed using a biological similarity matrix based on the Bray–Curtis index calculated from the taxa abundances (not transformed). Then, a permutational multivariate analysis of variance (PERMANOVA) was performed [45], considering the biological similarity matrix as a function of fire disturbance (fixed factor) and sampling sites as a random factor. Previously, the homogeneity of multivariate variance was tested. Spatial autocorrelation was evaluated by a Mantel test, and it was not significant (Pearson correlation coefficient: 0.42; p: 0.06). These analyses were carried out using the adonis, betadisper, and mantel functions of the vegan package [46]. To determine whether the differences in taxonomic composition were due to species turnover (βsim) or nestedness (βsne), a beta diversity analysis was performed using the Sørensen dissimilarity index and the beta.multi function of the betapart package [47]. Turnover occurs when existing species are replaced by different ones at new sites, whereas nestedness patterns occur when the species present at sites inhabited by fewer species are a subset of the richer assemblage [48]. Finally, to analyze the variation in the functional structure of the spider assemblage, a matrix of guild abundances by sampling site was created and analyzed using PERMANOVA and MDS, similarly to the previous analysis.

The variation in the total abundance of arachnids and the main groups (taxa and guilds) between burned and unburned areas was analyzed by generalized linear mixed models (GLMM). The models were performed with fire disturbance as a fixed factor, sampling sites as a random factor, and Poisson errors (link function = log), using the glmer function of the lme4 package [49]. Only the five most abundant species or guilds were considered. The comparison of the Akaike information criterion (AIC) concerning the null model was used to evaluate the significance of the models ($\Delta AIC > 2$) [50]. The model assumptions were checked through the diagnostic residual plots generated by the DHARMa package [51].

Diversity analysis was performed employing Hill numbers and rarefaction extrapolation curves [52]. The total arachnid abundance by site was considered for this analysis. Two indexes from Hill numbers were used: richness (coefficient $q = 0$) and the exponential of Shannon entropy (coefficient $q = 1$). The significance of the index comparisons among burned and unburned areas was made through rarefaction/extrapolation curves and the overlapping of their confidence intervals using the iNEXT package [53]. The sampling effort was evaluated by the sample coverage estimator [52].

An indicator species analysis (IndVal) was used to study the associations among arachnids and fire disturbance. The results of this analysis are indicator values between 0 and 1, where 1 represents a higher affinity with particular sites [54]. The significance of indicator values was assessed using a Monte Carlo procedure with 999 iterations. The IndVal analysis was performed with the multipatt function of the indicspecies package [55].

3. Results

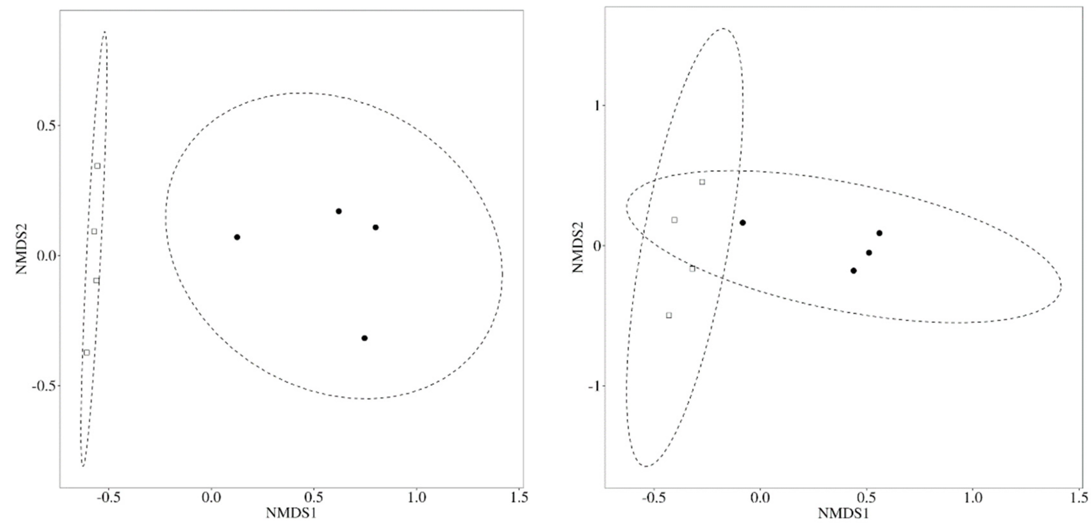
A total of 573 adult arachnid specimens were collected, belonging to 16 families and 32 species/morphospecies (Table 1). The main families were Philodromidae ($N = 192$, two species), Gnaphosidae ($N = 111$, five species), and Zodariidae ($N = 97$, two species). The most abundant taxa were *Petrichus anomalus* (Philodromidae, $N = 144$), *Leprolochus birabeni* (Zodariidae, $N = 89$), *Eilica* sp2 (Gnaphosidae, $N = 65$), and *Petrichus junior* (Philodromidae, $N = 48$). Spiders were classified into seven guilds, of which the ground hunters were the most abundant (*N* = 277), followed by the specialists (*N* = 162) and the space web weavers (*N* = 52). The ground hunters showed the highest species richness (12 species), while at the other extreme were the orb web weavers (1 species). No specimen belonging to the sheet web weavers was collected (Table 1).

Table 1. Abundance of arachnid species/morphospecies in burned and unburned areas. The total abundance of each taxon and the assignment of spiders to each guild are also indicated. Guild abbreviations: AH = ambush hunters, GH = ground hunters, OWW = orb web weavers, OH = other hunters, SWW = sensing web weavers, SPWW = space web weavers, S = specialists.

Order	Family	Taxa	Guild	Burned	Unburned	Total
Araneae	Anyphaenidae	*Sanogasta* sp. gr. *maculosa*	OH	8	0	8
	Araneidae	*Metepeira* sp.	OWW	0	1	1
	Dictynidae	Dictynidae sp1	SPWW	21	12	33
	Gnaphosidae	*Apodrassodes araucanius*	GH	1	1	2
		Apopyllus sp.	GH	1	1	2
		Camillina calel	GH	3	31	34
		Eilica sp1	S	0	8	8
		Eilica sp2	S	7	58	65
	Lycosidae	*Alopecosa restricta*	GH	7	1	8
		Lycosa sp. aff. *pampeana*	GH	7	4	11
		Lycosa sp. aff. *proletaroides*	GH	3	2	5
	Philodromidae	*Petrichus anomalus*	GH	64	80	144
		Petrichus junior	GH	48	0	48
	Pycnothelidae	*Acanthogonatus* sp.	SWW	1	0	1
		Lycinus sp.	SWW	1	0	1
	Salticidae	*Aillutticus pinquidor*	OH	1	12	13
		Trydarssus pantherinus	OH	0	1	1
	Sicariidae	*Sicarius rupestris*	AH	0	2	2
	Theridiidae	*Steatoda ancorata*	SPWW	3	0	3
		Theridion sp.	SPWW	0	1	1
	Thomisidae	*Misumenoides athleticus*	AH	0	4	4
		Misumenoides eximius	AH	3	1	4
		Misumenops sp.	AH	0	1	1
		Thomisidae sp. indet.	AH	1	0	1
	Titanoecidae	*Goeldia* sp.	SPWW	0	14	14
	Trachelidae	*Meriola setosa*	GH	1	0	1
	Xenoctenidae	*Odo bruchi*	GH	2	8	10
		Xenoctenus sp.	GH	0	4	4
	Zodariidae	*Cybaeodamus enigmaticus*	GH	0	8	8
		Leprolochus birabeni	S	13	76	89
Scorpiones	Bothriuridae	*Bothriurus burmeisteri*		0	7	7
		Brachistosternus angustimanus		32	7	39

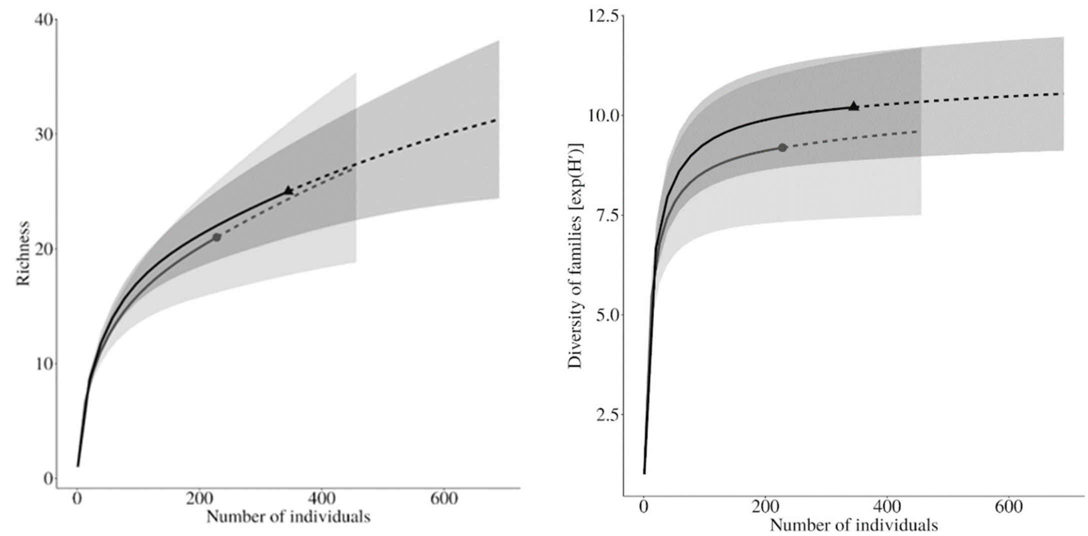
Graphically, the NMDS analysis suggested that fire disturbance modified the arachnid assemblage (Figure 2a, stress 0.01), a finding that was confirmed analytically by PERMANOVA results ($F_{(1,6)}$ = 8.03, p = 0.02, r^2 = 0.57). This change was mainly associated with the taxa turnover (βsim = 94%). Similarly, the disturbance was related with a modification in the functional structure of the spider assemblage ($F_{(1,6)}$ = 6.19, p = 0.02, r^2 = 0.51; Figure 2b, stress 0.02).

The sample coverage was 96%, indicating that the sampling was sufficient to capture a large part of the ground-dwelling arachnid assemblage. Although there was a trend towards greater richness and diversity of arachnids in the burned area, the differences were not significant (Figure 3).



(**a**) (**b**)

Figure 2. Non–metric multidimensional scaling ordination (NMDS) of the sampling sites (n = 8) based on the abundance of the arachnid taxa (**a**) and spider guilds (**b**). White squares represent unburned sites; black circles represent burned sites. Dotted lines indicate the 95% confidence ellipses.



(**a**) (**b**)

Figure 3. Sample-size-based rarefaction and extrapolation curves for the richness (**a**) and exponential of the Shannon entropy (**b**) of arachnid species in burned (grey circles) and unburned areas (black triangles). Symbols denote the observed values and shaded areas show the 95% confidence interval. Solid and dashed lines represent the interpolation and extrapolation component of the analysis, respectively.

The mean arachnid abundance per site did not vary significantly between burned and unburned areas. However, the abundance of *L. birabeni* and *Eilica* sp2 was higher in unburned sites, abundances of *P. junior* and *Brachistosternus angustimanus* (Scorpiones: Bothriuridae) evidenced the opposite pattern, and *P. anomalus* displayed similar abundance in both areas (Figure 4a). The analysis of guild abundances showed that specialists were more abundant in the unburned sites (Figure 4b).

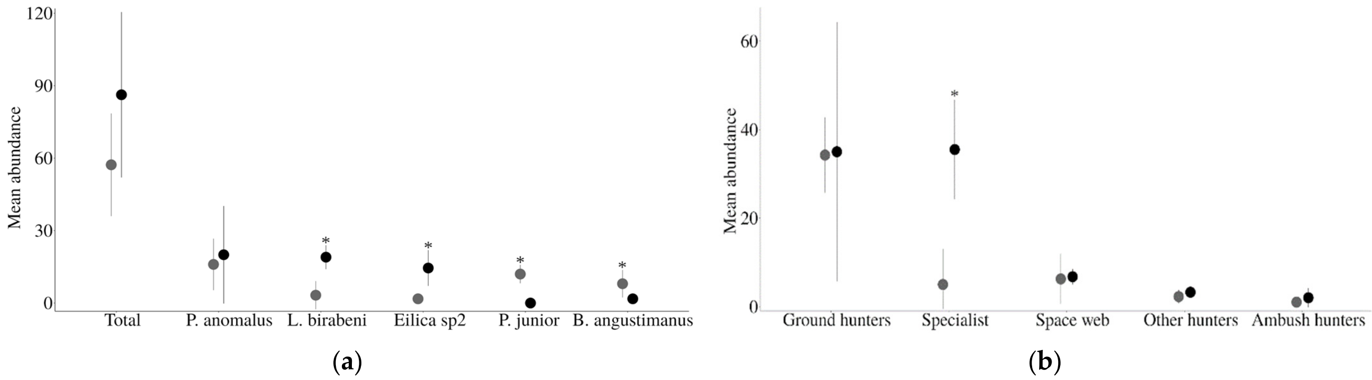


Figure 4. Mean abundance per site (±standard error) of the total arachnids and main taxa (**a**), and more abundant arachnid guilds (**b**). Asterisk symbol indicates significant differences in abundances. Black symbols represent unburned sites; grey symbols represent burned sites.

Finally, *Sanogasta* sp. gr. *maculosa* and *P. junior* were identified as indicators of burned sites. On the other hand, six taxa were indicators of unburned sites, where *Eilica* sp1, *Ailutticus pinquidor* (Salticidae), and *Goeldia* sp. (Titanoecidae) showed the highest values for the indval index (Table 2).

Table 2. Taxa indicators of burned or unburned sites. Only species/morphospecies with statistically significant values are shown ($p < 0.05$).

	Taxa	**Indval**
Burned	*Sanogasta* sp. gr. *maculosa*	1
	Petrichus junior	1
Unburned	*Eilica* sp1	1
	Goeldia sp.	1
	Ailutticus pinquidor	0.96
	Camillina calel	0.95
	Eilica sp2	0.94
	Leprolochus birabeni	0.92

4. Discussion

Although fire is one of the most common and relevant disturbances in the drylands of Argentina, it is practically unknown how it structures the invertebrate communities in the region [7]. The current study found, for the first time, that fire disturbance significantly modified the arachnid assemblage in northeastern Patagonia. In agreement with previous findings [19,56,57], this work found major taxa turnover and significant variation in functional structure. Therefore, as has been proposed for other regions [21,56], the current study suggests that arachnid assemblages are a useful tool for monitoring the effects of fire in arid Patagonia. In addition, changes in arachnid assemblage have repercussions on processes linked to lower trophic levels and ecosystem functionality [16,17]. Thus, the findings of this study may help to understand how fire disturbance affects processes that are relevant to the sustainability of local ecosystems.

In agreement with reports on other arid and semi-arid environments in Argentina, the arachnid assemblage in northeastern Patagonia was dominated by species of Philodromidae, Gnaphosidae, and Zodariidae [58–62]. Unlike other local studies that include arachnids as part of the ground-dwelling arthropod assemblages [40,63], this work found a low relative abundance of wolf spiders (Lycosidae). Most of the captured wolf spiders were juveniles and therefore not included in the analyses. This could explain the differences with the studies mentioned above, which focused on the family taxonomic level and considered juvenile spiders. In addition, seven of the eight guilds currently proposed on a global scale were recorded [23]. Like the taxonomic composition, the functional structure is similar to that found in other drylands of the region [58,59], with a predominance of species that are active hunters and non-web building. A particularity of the assemblage studied was the higher abundance of philodromids, represented by two species of the genus *Petrichus*. Since most of the specimens were males, the sampling probably coincided with the breeding season and higher male activity.

Contrary to expectation, the alpha diversity did not differ significantly between burned and unburned areas. This could be related to the high species turnover (similar richness but different species identity), and the little variation in total arachnid abundance. Moreover, it has been found that the arachnid diversity in burned areas recovers relatively quickly [56,57,64]. Many arachnids have high efficiency as colonizers of disturbed sites [65]. Spiders can disperse to nearby environments by ambulatory locomotion or reach higher distances through the air through silk threads ("ballooning") [14,66]. This could explain why the most evident changes in arachnid richness and diversity usually occur during the first year after the fire [19,57]. Therefore, considering that this work was carried out three years after the fire, future research that contemplates periods closer to the disturbance would be recommended to obtain more appropriate conclusions regarding the response of the alpha diversity of arachnids to fire in northeastern Patagonia.

On the other hand, changes at the level of assemblage structure were more evident. The analyses showed that the main modification was due to species turnover. In other words, the effect of fire in the medium term was associated with a high replacement of arachnid species at the burned sites. This indicates that the assemblage in the disturbed area is not a subset of the original assemblage, allowing processes such as the selective local extinction to be ruled out [48]. Conversely, the results may be more related to the colonization and establishment of arachnids that may take advantage of the new environmental conditions after the fire [19,27]. In northeastern Patagonia, fire alters the composition of the plant community, triggering the transition between shrub and grass steppes [29], and generating new habitats that could support particular arachnid assemblages. Moreover, this disturbance enhances environmental heterogeneity because it generates a mosaic of burned and unburned patches, increasing the beta diversity of arachnid assemblages [56].

In addition, the fire disturbance was associated with a variation in the functional structure of the spider assemblage, where the main changes occurred in the abundance of specialists. As expected, it was found that these spiders were less abundant in the burned sites. The specialist guild was represented by stenophagous ant-eating species: two gnaphosids of the genus *Eilica* and *L. birabeni* [41,42,67]. Although ant abundance was not estimated in this study, local background information shows that ants are more abundant in burned areas [32]. Therefore, the variation in the abundance of specialist spiders would not be a response to the low prey availability but is probably related to other factors. At the local level, some of the most important postfire changes in the plant communities are the quick recovery of the herbaceous strata and the slower increase in shrub cover [7]. This could alter, for example, the habitat structure and microclimate, negatively affecting specialist spiders [21]. The results of this study do not agree with Pompozzi et al. [61], who found that *L. birabeni*, a typical spider of the arid and semi-arid environments of Argentina [67–69], was more abundant in burned areas in a study carried out with prescribed fire (central region of Argentina). Fires that develop under controlled conditions allow the survival of many taxa in situ [56], affecting assemblages very differently from the way wildfires do [9]. This could explain the inconsistencies between the current study, based on a high-severity fire, and the results of Pompozzi et al. [61]. Finally, *L. birabeni* has been found to be sensitive to other anthropogenic disturbances such as grazing and agriculture in different areas in Argentina [58,69]. Thus, it could be a useful species for monitoring the response of local biological communities to different types of disturbances.

Ground-hunter spiders usually prefer bare ground or open habitats with low structural complexity [26,70]. In northeastern Patagonia, they are more abundant in plant communities dominated by grasses than in shrub steppes [40]. In this regard, it has been suggested that the pursuit style of hunting of ground hunters may benefit from the habitat simplification caused by fire, enabling them to be one of the first groups to colonize and dominate burned areas [26,27,71]. However, our results showed that the abundance of ground hunters did not vary significantly as a result of fire disturbance. This is probably because *P. anomalus*, the most representative species in this guild, displayed similar abundance in both burned and unburned areas. On the other hand, its congeneric *P. junior*, the second ground hunter in terms of number of individuals, showed a pattern consistent with the one expected for the guild. *P. junior* was significantly more abundant in burned sites and had high value as an indicator species of disturbed areas. Although more detailed studies are required, this first analysis suggests that the two *Petrichus* species respond differently to fire disturbance, which could reflect important ecological distinctions between them.

Finally, other interesting results were found. *Brachistosternus angustimanus*, the most abundant scorpion species, was recorded mainly from sites affected by fire. The only local antecedent [32] found that the order Scorpiones (dominated by species of *Brachistosternus*) is associated with burned sites and shows a positive relationship with grass cover and bare soil, which are characteristics of burned areas [7,29]. Additionally, the abundance of a congeneric scorpion increases in sites affected by deforestation or fire in other drylands of Argentina [72]. In addition to the gnaphosids and zodariids mentioned above, *Ailutticus pinquidor* (Salticidae) and *Goeldia* sp. (Titanoecidae) showed high values as indicators of undisturbed areas and could be taxa associated with late stages of postfire succession. The limitations of the current study (a single sampling three years after fire) did not allow us to analyze whether the changes in the assemblage are permanent or represent a transition towards, for example, a stable endpoint. Interestingly, a previous work on the drylands of Australia found that the spider assemblages tend to return to a single stable state prior to fire disturbance [56]. In this context, it would be necessary to develop studies that analyze the postfire trajectory of the arachnid assemblage in northeastern Patagonia. This would contribute to the knowledge of the dynamics of local biological communities after fire disturbance.

5. Conclusions

This first study on arachnid diversity and wildfire for northeastern Patagonia showed significant variation in the taxonomic and functional structure of the assemblage three years after the disturbance. Further studies with longer timeframes are needed to address topics such as the postfire recovery of the arachnid assemblages. This is important, since alterations in the fire regime could permanently change the assemblage structure, impacting on ecosystem processes. For example, the decline in abundance of specialist spiders in sites frequently affected by fires can modify ecosystem functionality, especially through the top-down regulation of the prey populations (mainly insects). The results of this study are useful for monitoring the effect of fire on local ecosystems, and for developing management strategies and biodiversity conservation. This is relevant given that northeastern Patagonia is a fire-prone area, where the fire regime is currently changing and will continue to do so in the future.

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