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Abstract

Spiders were collected by pit-trapping in southeastern Arkansas in 1984. Collection areas included two pine silvicultural treatments, clear-cutting and selection cutting; and control stands, where no cutting occurred. Spider populations decreased with increased disturbance.

Introduction

A preliminary study of spiders collected by pit-traps in Drew and Bradley counties, Arkansas was published by Dorris (1986). Since that time many more species have been identified, and experience shows that as succession occurs in a forest stand, populations of organisms change with respect to numbers and species. Mounting evidence indicates that the population density, behavior, and population dynamics of spiders are such that these predators are collectively an important stabilizing agent of terrestrial arthropod population (Breymeyer, 1966; Moulder and Reichle, 1972; Enders, 1975; Coyle, 1981) and thus, spiders may be an important factor in total ecosystem stability. Tanner et. al., (1994) discussed species coexistence, keystone species, and succession. Numerous authors have noted changing predator-prey relationships as succession occurs in disturbed areas: Carlson (1994), Tallis (1994), Moore (1993). Spiders are among the dominant predators in many terrestrial communities (Gertsch, 1979).

Spiders were collected by pit-traps in Drew County in 1984 in a replicated experiment that included two silvicultural treatments and a control area. Nine different forestry stands were employed in an effort to determine how spider population decreases with increased disturbance.

Materials and Methods

This study was initiated in the West Gulf Coastal Plain in southeastern Arkansas, near Monticello in Drew County. One set of three stands was designated as the undisturbed control and the remaining six stands were managed using two pine silvicultural systems: selection cutting and clearcutting, each consisting of three stands.

In clear-cut stands all merchantable trees were harvested and the remaining vegetation and logging debris was sheared, raked and windrowed. Site preparation began in mid-September, 1981, and was completed within two weeks; windrows were burned approximately ten days after completion. The clear-cuts were planted in December, 1981, with genetically improved loblolly (*Pinus taeda*) pine seedlings in a 2.4m x 3.0m spacing.

Stands designated for selection management were prescribed burned and selectively harvested to remove some pines (including all pines with a diameter at breast height (d.b.h.) > 53cm) and all merchantable hardwoods; the remaining hardwoods (d.b.h.) > 2.5cm were injected with the herbicide 2,4-D + picloram. Harvesting began in July, 1981 and was completed by mid-August, 1982. The goal of selection management is to produce a stand with an overall structure grading from many seedlings and saplings to a few large trees; however, most of the stand basal area (a measure of stand density expressing the total cross-sectional area at d.b.h. of all trees in a unit of land) is in sawtimber-sized trees (d.b.h. > 25cm).

Generally, in clear-cut areas ground vegetation was dominated by blackberry (*Rubus spp.*) Japanese honeysuckle (*Lonicera japonica*), and hardwood vegetation. The many open areas in selection stands produced thickets of blackberry, Japanese honeysuckle, hardwood, and pine saplings. By contrast, the ground vegetation of the control stands was sparse because of its dense overstory.

Spiders were collected using pit-traps. Each trap consisted of a cylinder made from a tin 1-quart oil can with both ends removed. The cylinder was buried vertically (with one open end up) and level with the ground surface. A 16-ounce clear plastic drinking cup was placed in the cylinder and filled about one-third full with preserving fluid, a 1:1 mixture of anti-freeze (ethylene glycol) and water. To simplify content removal, a strainer (made from another plastic cup and aluminum window screen) was placed into the bottom of each drinking cup. A 1-ft.sq. plywood rain lid, held about two inches over the cup using three large nails as legs, reduced the amount of water entering each trap. Traps were serviced weekly, from May 5, 1984 to November 21, 1984.

Spiders were picked from the arthropods collected in each trap and stored in glass vials in 70% ethanol. Spiders were identified using the keys of Kaston (1948, 1978), Comstock (1965) and Heiss and Allen (1986).

Data collected were stored in a database system. The statistical program, SPSS (Norusis, 1990), was used for analysis. The three replicates for each treatment were pooled to produce the total for that treatment.

Results and Discussion

Pitfall trapping is not a good measure of absolute abundance because trap catches are influenced by the activity of each species and by differences in their susceptibility to trapping. Pitfall traps are typically used in ecological studies because they give reasonable estimates of spider relative abundance and are easy to use.

A total of 68 genera, more than 70 species and 10,856 total spiders was identified. The control stands produced 52%, selection stands 25% and clear-cuts 23% of the spiders (Fig. 1).

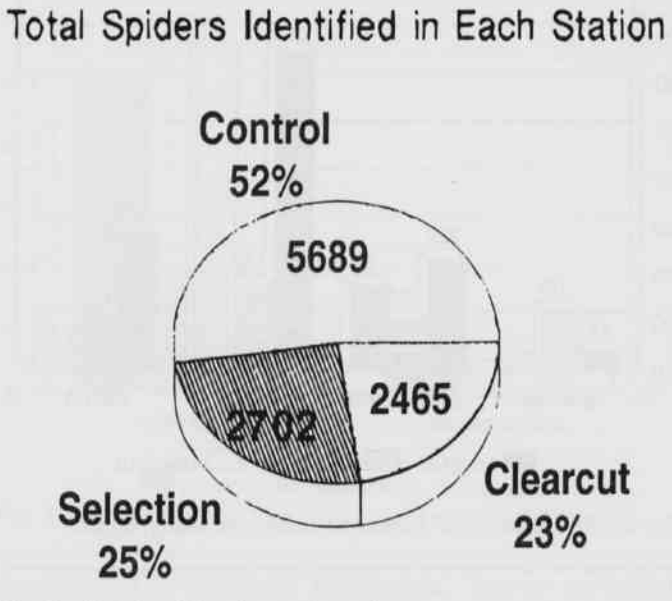


Fig. 1. Total spiders in each station.

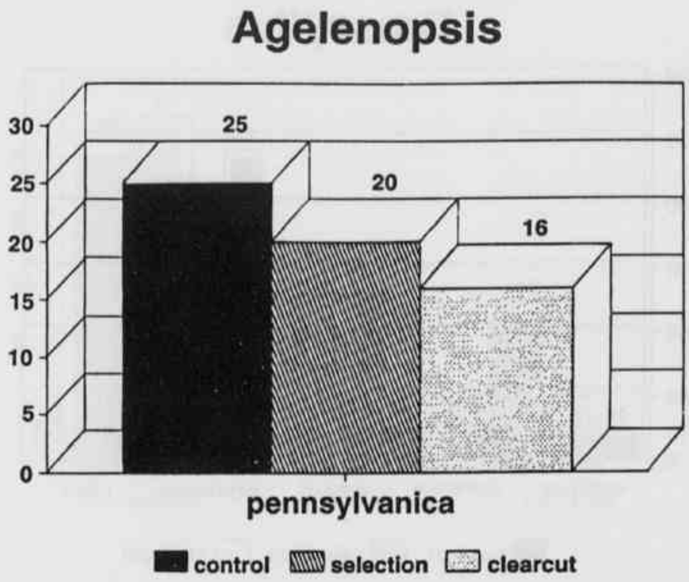


Fig. 2. Abundance of *Agelenopsis* in different study areas.

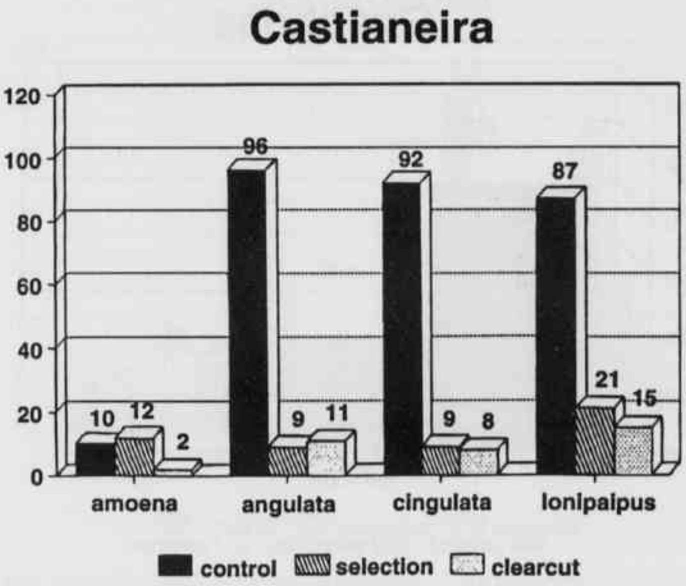


Fig. 3. Abundance of *Castianeira* in different study areas.

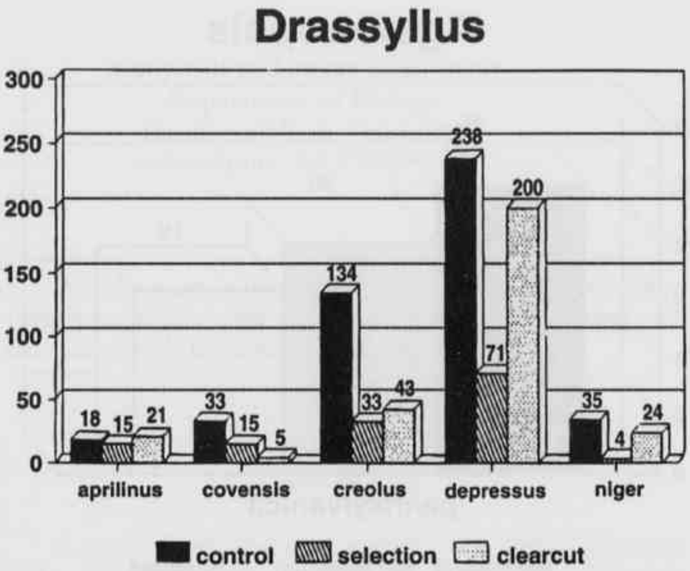


Fig. 4. Abundance of *Drassyllus* in different study areas.

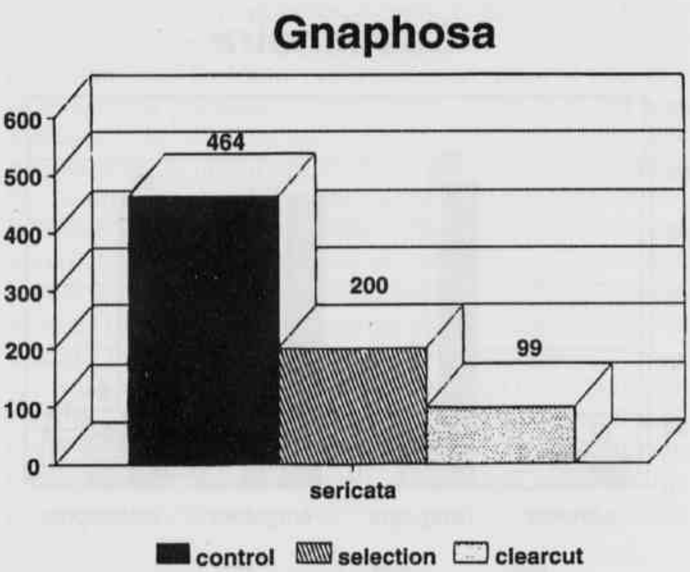
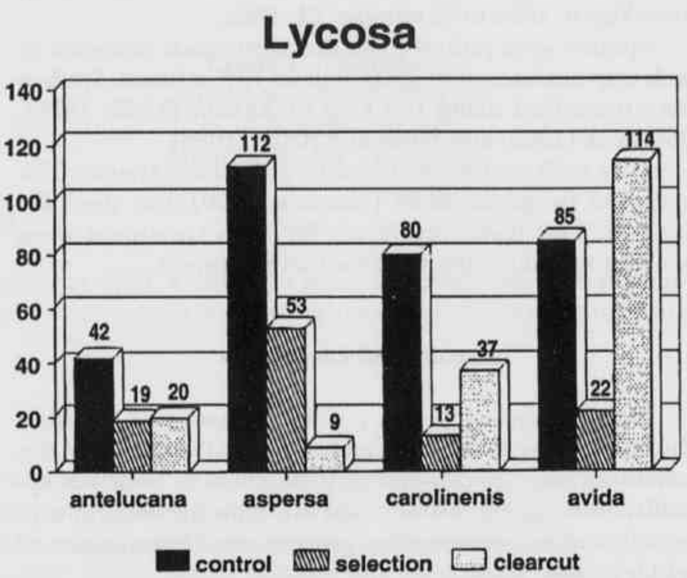


Fig. 5. Abundance of *Gnaphosa* in different study areas.



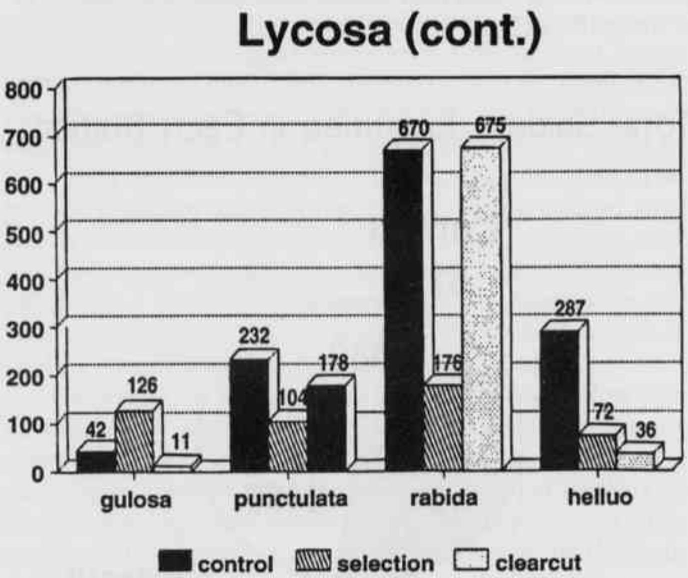


Fig. 6. Abundance of *Lycosa* in different study areas.

The following genera were most affected by clearcutting with a reduction in abundance: *Agelenopsis, Castianeira, Drassyllus, Gnaphosa, Lycosa, Misumemops, Oxyptila, Pirata, Rachodrassus, Schizocosa, Zelotes* (Figs. 2-12). Some genera did not occur in clear-cuts but occurred in the other stands.

The genera most affected by clearcutting were typically ground dwelling spiders. These spiders have high trap susceptibility and are more frequently collected in pit-traps than other spiders. Some species were extremely affected by disturbance such as *Rachodrassus exlieae* (Fig. 10), *Gnaphosa sericata* (Fig. 5) and *Misumemops asperatus* (Fig. 7). These species followed the writers' expected pattern of decreased numbers usually occurring with disturbance. A study done by Coyle (1981) on the effects of

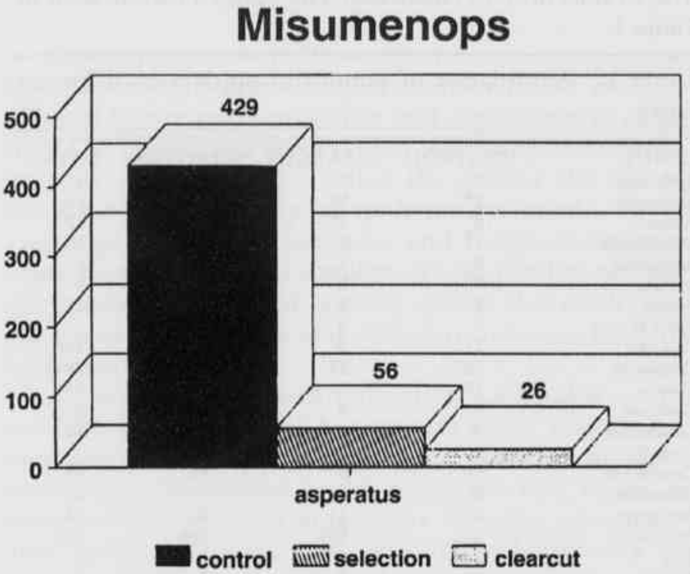


Fig. 7. Abundance of *Misumenops* in different study areas.

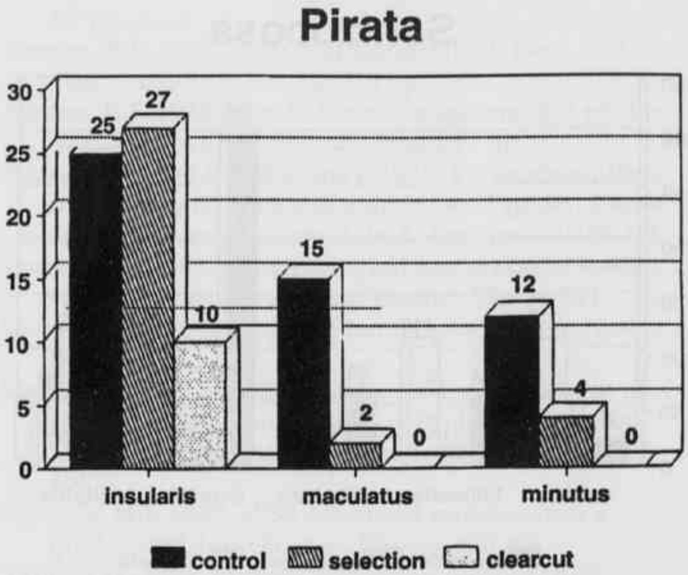


Fig. 9. Abundance of *Pirata* in different study areas.

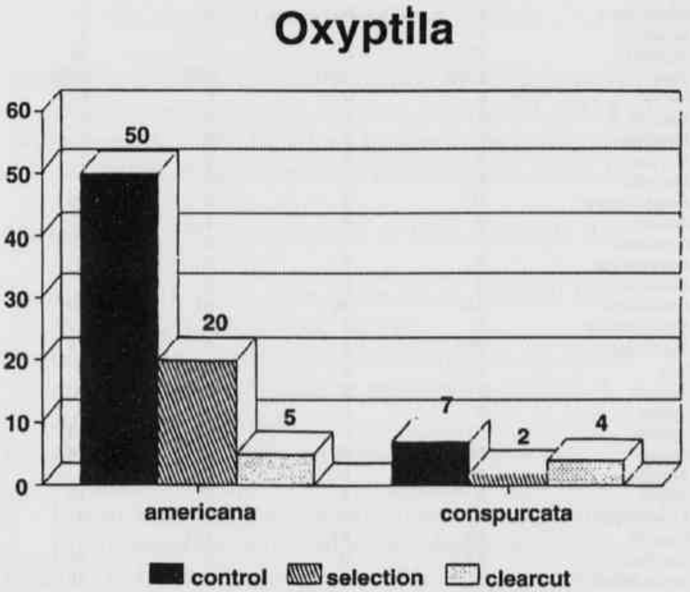


Fig. 8. Abundance of *Oxyptila* in different study areas.

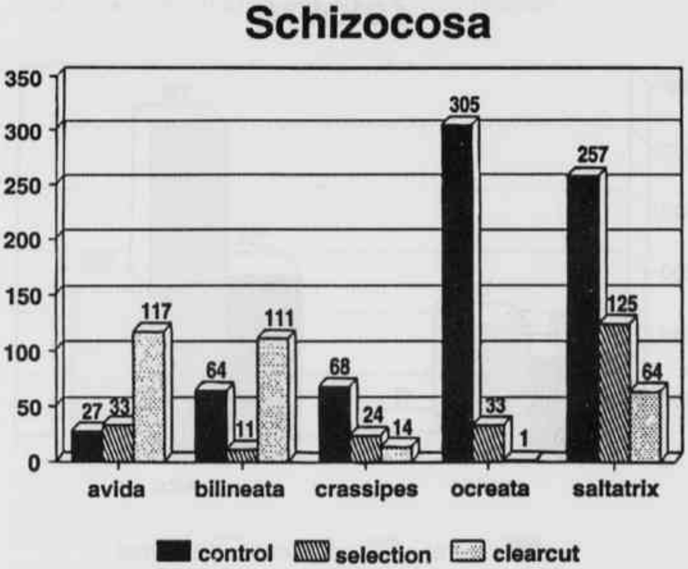


Fig. 10. Abundance of *Rachodrassus* in different study areas.

clearcutting in southern Appalachian forests indicated that clearcutting reduced the total spider population.

Not all species followed the predicted pattern. *Zelotes hentzi* (Fig. 12), *Zealotes duplex* (Fig. 12) and *Lycosa gulosa* (Fig. 6) occurred in greater numbers in the selection stands. These species may respond differently to disturbance and to different food supplies.

Schizocosa avida, Schizocosa billineata (Fig. 11), *Lycosa avida* (Fig. 6) and *Lycosa rabida* (Fig. 6) occurred in large numbers in the clear-cuts. The growth of ground vegetation in clear-cut areas attracts insects which in turn attracts spiders such as these wolf spiders that hunt prey rather than building webs. The ability of hunting spiders to successfully adjust to clearcutting is not surprising in view of the abundant evidence that many hunting spiders are remarkably well adapted to open and climactically harsh environments (Lowrie, 1948; Almquist, 1973; Gertsch and Riechert, 1976). Two factors contributed to the success of hunting spiders in such environments.

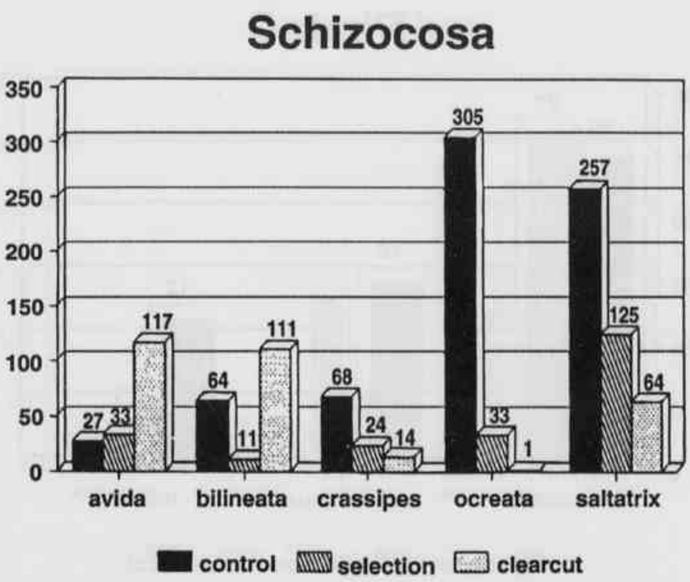


Fig. 11. Abundance of *Schizocosa* in different study areas.

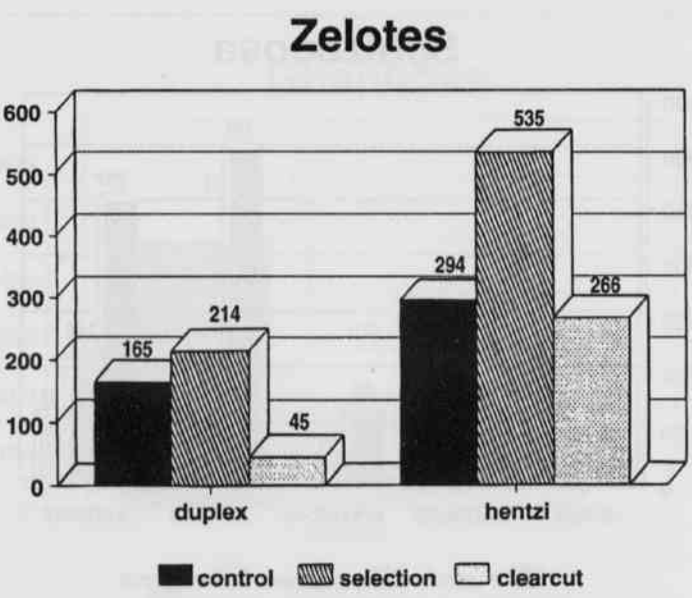


Fig. 12. Abundance of *Zelotes* in different study areas.

First, many hunting spiders live on or near to the ground where the climate is relatively stable (Geiger, 1950). Secondly, their ability to move readily to patches with more favorable climate and resource values (Almquist, 1973; Kronk and Riechert, 1979) may be especially important by allowing them to cope with the large amount of spatial and temporal variation in microclimate that exists in a clear-cut habitat.

The overall effect on spider populations followed the expected pattern with a decrease in numbers from control, to selection, to clear-cuts. The pattern can be seen in Table 1.

Table 1. Abundance of genera of spiders in different areas.

GENUS	CONTROL	CLEARCUT	SELECTION	TOTAL
Agelenidae	0	1	0	1
Agelenopis	27	17	24	68
Allocosa	5	10	17	32
Antrodiaetus	37	3	6	46
Anyphaena	0	2	0	2
Araneae	6	0	0	6
Arctosa	5	9	13	27
Aysha 3	0	0	3	
Callilepis	71	0	91	162
Castianeira	295	47	51	393
Cesonia	19	4	2	25
Clubionia	9	0	0	9
Cubionoides	0	8	2	10
Coras 0	2	0	2	
Corairachne	25	5	13	43
Dolomedes	5	0	0	5
Drassodes	37	11	10	58
Drassyllus	482	297	140	919
Eris	9	0	0	9
Eustala	0	0	2	2
Gnaphosa	471	101	209	781
Habrocestum	23	3	6	32
Habronattus	8	0	4	12
Haplodrassus	0	0	5	5
Herpyllus	0	4	0	4
Hobrocestrum	2	0	0	2
Latrodectus	2	1	0	3
Litopyllus	27	0	9	36
Lycosa	1580	1091	657	3328
Maevia	6	0	2	8
Mangora	0	0	4	4
Marcellina	0	2	0	2
Marpissa	2	0	0	2
Metacyrba	4	0	0	4
Metaphidippus	16	3	0	19
Micaria	8	0	4	12
Micrathena	7	1	4	12
Misumenoides	2	0	0	2
Misumena	0	0	2	2
Misumenops	441	26	67	534
Myrmeciophila	1	0	0	1
Neoantistea	22	2	0	24
Neon	0	2	0	2
Neoscona	0	2	0	2
Oxyopes	6	0	0	6
Oxyptila	57	9	22	88
Pardosa	60	58	29	147
Phidippus	4	0	0	4
Phlegra	9	4	0	13
Phrurotimpus	4	0	0	4
*Pirata*59	10	33	102	
Plexippus	15	0	0	15
Poecilochraoa	3	0	7	10
Puecetia	4	0	4	8
Rachodrassus	403	9	214	626
Schizocosa	721	307	226	1254
Sergiolus	3	0	2	5
Sosilaus	5	3	0	8
Sosippus	7	1	0	8
Strotrachus	5	5	2	12
Synaphos	29	35	24	88
Synema	2	2	0	4
Tarentula	10	13	2	23
Trabea	1	2	0	3
Trochosa	13	5	13	31
Xysticus	138	3	2	143
Zelotes	474	343	772	1589
Zora	0	2	8	10
TOTAL	5,689	2,468	2702	10,856

Conclusions

Pit-traps assess relative abundance of spiders. Numbers collected show highest density in the controls followed by the selection stands and slightly less in clear-cuts. The three stand types reflect increasing disturbance intensity. Data have shown that the greater the disturbance the more adversely the spiders are affected.

Large numbers of Lycosidae and Gnaphosidae were found than other spider families. These families are primarily ground spiders or hunting spiders that catch prey without the aid of a web and, therefore are more likely to fall into pit-traps.

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