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COMPARISON OF THREE METHODS FOR ESTIMATING SOLPUGID (ARACHNIDA) POPULATIONS[1,2]

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ABSTRACT

This 2-year study of solpugids collected at 2-week intervals from Hurley and Lordsburg, New Mexico comparing 12 can traps with 40 trap boards and 40 pieces of natural ground-surface debris demonstrates that can traps are much more reliable in estimating both the mean number of individuals and the number of species in a given area than either of the other two methods tested. Additional methods studies are needed for species not consistently susceptible to can trap collections, and for attaining greater reliability for data on the relative densities of solpugid species.

INTRODUCTION

The present paper presents comparative population data for solpugids obtained during 1974-75 from collections in can traps, under trap boards, and under natural ground-surface debris.

Estimates of solpugid populations have been published by Muma (1963, 1974b, 1975a), Allred and Muma (1971), and Brookhart (1972). The data presented by Muma (1963), Allred and Muma (1971) and Brookhart (1972) were obtained using pit traps (large, dry cans) and were believed by Muma (1974b) to be questionable owing to the ability of solupgids to climb smooth vertical surfaces with their adhesive palpal organs. Some of the data presented by Muma (1974a) are similarly questionable, but that obtained with killing-preserving can traps, used by Muma (1975a), may be statistically valid within relatively broad limits, 30 percent of the mean, as indicated by Muma (1975b). Muma (1974b, 1975b) has inferred that even continuous can trap operation does not produce reliable population data for *Eremochelis bilobatus* (Muma). It is necessary, therefore, to develop and test other methods for estimating solpugid incidence and population density.

The term "population" is used here rather than "abundance" for the following reasons. In North America, solpugids are predominantly nocturnal arachnids. Only 5 or 6

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species are known to be diurnal. Most species are also subterranean, spending the daylight hours and many night time hours in burrows in the soil or under soil-surface debris. At least one species, *Ammotrechella stimpsoni* (Putnam), is known to inhabit termite and wood-boring insect burrows above the soil-surface. Excepting possibly adult males, solpugids do not emerge from their burrows nightly or even regularly. They remain in their burrows for extended periods of time to digest food, to molt, to deposit eggs and to escape extremes of temperature and humidity. Further, some solpugid species are long-legged, run rapidly, and range over large areas. Others are short-legged, with limited ranges. Still others are sedentary, capturing prey by ambush. Most males are longer-legged than females and range widely in search of their more sedentary mates. Therefore, all previous studies and the present study were conducted on the premise that solpugids actively running over the soil-surface or hiding under soil-surface debris are representative of the entire population, either active or inactive, and either subterranean, on the soil-surface or arboreal. As yet, no one has attempted to estimate or compare population sizes of solpugid species per square or cubic meter or per hectare.

METHODS

Muma (1974b) demonstrated that solpugid numbers tend to be larger in the arid grasslands than in the pinyon-juniper life zone of southwestern New Mexico. Therefore, his Hurley and Lordsburg study areas were used for this 2-year investigation in order to assure capture of significant numbers of indiviuals and species. The topography and plant associations of the 2 areas are described in that publication.

Muma (1975b) demonstrated reliability of the mean number of solpugids collected annually within 30% of the mean in 11 can traps per study area. In this study 12 can traps, those proposed by Muma (1970) and tested by Muma (1975b) were operated in each area. They were 3.79 liter cans with 15.3 cm openings, supported at ground level with a 35 cm square of plywood 6 mm thick, and roofed with a similar piece of plywood on 2 cm legs. These traps were set in 2 intersecting transect lines; 7 oriented north-south at 10 m intervals and 5 oriented east-west at similar intervals. Each trap was provided with 250 cc of a 1:1 mixture of 70% isopropyl alcohol and commercial ethylene glycol. Traps were visited every 2 weeks from 1 April to 1 December of each year, solpugids were screened from the killing-preserving medium and the medium reconstituted with a 3:1 mixture of alchol-glycol.

Trap boards were planed, pine lumber 4.2 cm thick, 14.3 cm wide and 32.4 cm long. Forty trap boards, arranged in 4 north-south rows of 10 each at 5 m intervals with 5 m between rows, were placed within the arms of the can trap transects in each study area. At each visit, between dawn and 10:00 AM, each trap board was turned over, and any observed solupgids were collected for identification and enumeration.

Natural ground-surface debris consisted of cow dung, yucca logs, and rocks. At each visit, between dawn and 10:00 AM, 40 randomly selected pieces of debris within the arms of the can trap transects were turned over, and any observed solupgids were collected for identification and enumeration.

Early instar immatures, those with 3 pairs of malleoli, were identified only to family. Middle and late instar immatures were identified only to genus. Only adults or easily recognized, and sexed penultimate immatures were identified to species.

Table 1.–Solpugids collected in can traps, under trap boards, and under natural soil-surface debris in 1974 and 1975 at Hurley and Lordsburg, New Mexico.

		Hurley			Lordsburg		
Solpugids	Years	Traps	Boards	Debris	Traps	Boards	Debris
Eremobatidae (Juv)	1974				10		
	1975				10		
Eremorhax (yg)	1974				1		
	1975				3		
Eremorhax species #1	1974	1			2		
	1975				1		
Eremobates (yg)	1974	59	5	4	32	5	2
	1975	14	1		60	14	7
Eremobates species #1	1974	1			12		
	1975				14		
Eremobates species #2	1974	5			17		
	1975	2			24		
Eremobates hessei (Roewer)	1974	5			8		
	1975				16		
Eremobates species #3	1974	11			8	1	
	1975	5			9	4	
Eremochelis (yg)	1974						
	1975				1		
Eremochelis bilobatus (Muma)	1974				1		
	1975				1		1
Ammotrechidae (Juv)	1974						
	1975						
Ammotrechula (yg)	1974						
	1975						
Ammotrechula peninsulana (Banks)	1974				1		
	1975				1	1	
Sub-Totals	1974	82	5	4	92	6	2
	1975	21	1		140	19	8
Totals		**103**	**6**	**4**	**232**	**25**	**10**

RESULTS

Table 1 presents the accumulated data summarized on plot, annual, and total bases.

Seasonal data, not tabulated, showed that the can traps captured about 10 times the total number of solpugids taken each season by either or both of the other 2 methods. However, in the spring of 1975 at Lordsburg only 5 times as many were taken in the can traps.

DISCUSSION

It is not necessary to apply statistical analyses to the data in Table 1 to determine that can traps, as used, collected a far larger sample of solpugid specimens and species than either or both of the other 2 methods, as tested. In fact, the data indicate that estimation

of solpugid populations by turning over natural or artificial ground-surface debris and counting or collecting the specimens would be highly erroneous unless either much larger or much more frequent samples were utilized. Two species were not taken under either natural or artificial ground-surface debris, and no juveniles were collected by either method. Further, since Muma (1975b) has demonstrated stability of the mean number of solpugids collected with 11 can traps at a site, within 30% of the mean, it can be assumed that *Eremobates* species #2 was more common at the Lordsburg plot than *Eremobates* species #3, but the trap board data indicate just the reverse. Using the same logic, *Eremobates* sp. #3 was more common at the Hurley plot than *Eremobates* sp. #2, but neither of the species was collected under natural or artificial ground-surface debris at that plot. The utilized number of can traps per plot was, therefore, much more reliable for estimating solpugid incidence and population density than searching under natural or artificial ground-surface debris. It should be emphasized, however, that although can traps have been validated within broad parameters for solpugid studies, searching under artificial or natural ground-surface debris has not been examined statistically. Furthermore, can traps are continuous sampling devices and to be numerically comparable, the turning over of ground-surface debris would have to include a greater number of pieces of debris or much more frequent sampling, as stated above. The present study merely indicates that beyond the setting of can traps and the placing of trap boards, can traps produce more reliable data per time expended than trap boards or natural ground-surface debris.

The collection data presented here for *Eremochelis bilobatus* (Muma) confirm the inference of Muma (1974b, 1975b), that can traps do not produce reliable data for this species. The same also may be true for *Eremorhax* species #1 and *Ammotrechula peninsulana* (Banks).

Additional methods of research studies are needed for more reliable estimation of both solpugid incidence and solpugid population density.

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