

SOLPUGID POPULATIONS IN  
SOUTHWESTERN NEW MEXICO<sup>1,2</sup>MARTIN H. MUMA<sup>3</sup>

Silver City, New Mexico

## ABSTRACT

Solpugid populations in southwestern New Mexico, were evaluated by can traps and miscellaneous collecting. Present data indicate that populations are 2 to 4 times larger in the arid-grassland than in the pinyon-juniper life zone. Within the 2 life zones, they vary in size from year to year and locality to locality. Flooding and over grazing appear to be 2 factors involved in such variation. *Eremobates* spp. predominately inhabit the arid-grassland but can and do invade and live in the pinyon-juniper life zone and may also invade the montane zone. Ten species occur in the region. Three, *Eremobates hessei* (Roewer), *E. n. sp. (palpisetulosus-group)*, and *E. pallipes* (Say), are common; 1, *Eremorhax n. sp. (magnus-group)*, is relatively common; 2, *Hemerotrecha fruitana* Muma and *Ammotrechula peninsulana* (Banks), are uncommon; and 3, *Eremochelis sp. (imperialis-group)*, *Hemerotrecha sp. (banksi-group)*, and *Hemerotrecha marathoni* Muma, are rare. *Eremochelis bilobatus* (Muma) also occurs in the area but its population cannot be evaluated with present methods.

This investigation of solpugid populations in southwestern New Mexico was conducted utilizing can-traps provided with a liquid killing-preserving agent. Most other attempts to evaluate populations in North America (Muma 1963, Allred and Muma 1971, Brookhart 1972) have relied principally on dry can-traps, a questionable method owing to the ability of solpugids to climb smooth vertical surfaces with their adhesive palpal organs. Muma (in press A) reported on solpugids collected by selective searching and incandescent night-lighting in the San Simon valley of southeastern Arizona and southwestern New Mexico. These latter data are reasonably credible and are utilized herein for comparative and supplementary purposes.

A review of the world-wide literature on these arachnids indicates that no effort has been made, to date, to numerically describe solpugid populations on other continents. C. F. R. Roewer (1934), R. F. Lawrence (1936), C. de Mello-Leitao (1938) and J. L. Cloudsley-Thompson (1961) have reported casually on the abundance and relative abundance of solpugids. Their observations indicate that solpugids are abundant aridland arachnids in certain areas and at certain times. This condition has been quantitatively verified in North America by Muma (1963) and Brookhart (1972), even though the sampling

<sup>1</sup>Contribution No. 298, Bureau of Entomology, Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville, Florida 32601.

<sup>2</sup>Western New Mexico University Research Contribution No. 327.

<sup>3</sup>Entomologist Emeritus, University of Florida, Gainesville, Florida. Research Associate, Florida State Collection of Arthropods, Bureau of Entomology, Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville, Florida and Western New Mexico University, Silver City, New Mexico.

technique used by these authors can be demonstrated to be inconsistent and inadequate.

It should be pointed out here that I am aware of the numerous objections that have been raised against the use of can-traps for the accumulation of quantitative data. Most such objections have been directed toward the short term use of dry can-traps, and many of the objections are themselves untested for validity; these objections are summarized by Southwood (1966) and Turnbull (1973). Results of an investigation into the validity of killing-preserving can-traps, operated throughout the year are presently being evaluated statistically on per-trap, per-sample, and per-year bases for stability in the mean number of cursorial arachnids collected. When this study is completed it is possible that some of the results presented and discussed below will become suspect, but it is believed that any suspicion will be only relative to minor comparisons.

The studies reported here were initiated April 1972 and terminated December 1973 to determine the level and specific make-up of solpugid populations in the pinyon-juniper and arid-grassland life zones of southern Grant County and northern Luna and Hidalgo Counties in southwestern New Mexico.

#### METHODS

Two study-areas were set up in each of the 2 life-zones under investigation. The Silver City, New Mexico study-area was located about 1½ miles north of the town in the foothills of the Pinos Altos Mountains. Topographically the area was situated in a narrow valley between 2 stony-ridges at 6200 ft elevation; the soil was predominately a sandy-clay alluvium containing numerous rocks deposited by 2 intermittent streams. At one time the area was used as cattle pasturage but during the past 5 years was protected from grazing. The plant association was dominated by junipers, *Juniperus monosperma* (Engelm.) Sarg. and *J. deppeana* Steud., and pinyon, *Pinus edulis* Engelm., with a scattering of soapweed, *Yucca elata* Engelm., squaw bush, *Rhus trilobata* Nutt., scrub live oak, *Quercus turbinella* Greene, cacti, *Opuntia phaeacantha* Engelm. and *O. spinosior* (Engelm. and Bigel) Toumey, and along the margins of the streams box elder, *Acer negundo* L. Seasonally, the abundant herbs were *Astragalus* spp., *Lepidium* spp., *Aster* spp., *Senecio* spp., *Evolvulus* spp. and prickly-poppy *Argemone platyceras* Link and Otto. Dominant grasses included blue grama, *Bouteloua gracilis* (H. B. K.) Lag., side oats grama, *Bouteloua curtipendula* (Michx.) Torr., vine-mesquite, *Panicum obtusum* H. B. K., and ring-grass, *Muhlenbergia torreyi* (Kunth.) Hitchc.

The Burro Mountain companion study-area was located about 20 miles southwest of Silver City along U. S. highway 90. Topographically the area was a cup-shaped valley bordered on the north, east, and west by stony ridges; the soil was a sandy-clay to clayey-sand alluvium containing many rocks deposited by numerous small dry-washes at 6300 ft elevation. The area has been heavily grazed by commercial cattle. The plant association was dominated by junipers, *J. monosperma* and *J. deppeana*, pinyon, *P. edulis*, Gambels oak, *Q. gambelii* Nutt., and bear grass, *Nolina microcarpa* Wats., with a scattering of soapweed, *Y. elata* and *Y. schotti* Engelm., and cacti, *O. phaeacantha* and *O. spinosior*. Abundant herbs included *Astragalus* spp., *Evolvulus* spp., *Senecio* spp., and *A. platyceras*. Dominant grasses were blue grama and side oats grama.

The Lordsburg study-area was located on the Burro Mountain bajada between the Burro and Peloncillo Mountains about 10 miles north of Lordsburg, New Mexico and about 1 mile west of U. S. highway 90. Topographically the area involved a low-rounded, northeast to southwest ridge between dry-washes at 4300 ft elevation; the soil was a sandy-clay alluvium containing a few gravelly rocks. The area has been heavily grazed by commercial cattle. The plant association is dominated by soapweed, *Y. elata*, and joint-fir, *Ephedra trifurca* Torr., with a scattering of cacti, *O. phaeacantha* and *O. spinosior*, and *Ceanothus Greggii* Gray. *Gutierrezia* spp. were the most abundant herbs although *Lepidium* spp. and *Evolvulus* spp. were common during the late spring and early summer. Dominant grasses were fluff-grass, *Tridens pulchellus* (H. B. K.) Hitchc., and 2 species of 3-awn grass, *Aristida*.

The Hurley, New Mexico companion study-area was located about 14 miles southeast of the town on the southeast corner of the intersection of U. S. highway 180 and N. M. highway 61. Topographically the area involved the gently-southwesterly-sloping bajada of the foothills of the Cook Mountains at 4800 ft elevation; the soil was a sandy-clay alluvium containing many small gravelly rocks. The area has been heavily grazed by commercial cattle and apparently is sporadically flooded by late summer rains. Although the area has been cleared recently of thorny-shrubs and large herbs by bulldozing, the association was still dominated by *Y. elata*, all-thorn, *Koerberlinia spinosa* Zucc., mesquite, *Prosopis juliflora* (Swartz) D. C., and joint-fir. By far the most abundant herbs in the area were *Gutierrezia* spp. Dominant grasses were tobosa, *Hilaria mutica* (Buckl.) Benth., and burro grass, *Scleropogon brevifolius* Phil.

Can-traps provided with a killing-preserving medium comprised of a 50-50 mixture of 70% iso-propyl alcohol and commercial ethylene glycol were the principal collecting devices utilized during the study. These traps were proposed by Muma (1970) and reported on by Muma (in press A, B).

Ten traps were set in each study area; 5 in a north-south transect at about 10 m intervals and 5 in an east-west transect at similar intervals. Traps were visited every 2 weeks from 1 April 1972 to 1 December 1973, the specimens screened from the medium, and the medium reconstituted with a 75-25 mixture of alcohol-glycol. Specimens were sorted, counted, and identified in the laboratory.

Early instar immatures, primarily those with 3 pairs of malleoli, were identified only to family. Middle instar immatures were identified to genus. Late instar immatures also were identified only to genus but if the genus proved to be represented in the area by a single species they were later relegated to that species.

At each sample time, in each study-area and prior to 10:00 AM ground surface debris such as boards, rocks, yucca-logs, and cow-pies was turned and examined for solpugids. Collected specimens were not included in quantitative data but were utilized either to validate trap catches or to supplement known recorded species. At the Silver City study-area, solpugids collected at night lights, in buildings, and in supplemental traps were utilized in the same manner.

## RESULTS

All of the primary quantitative results are summarized in Table 1. Pertinent primary information contained in the table include the gross magni-

TABLE 1. SOLPUGIDS COLLECTED ON 4 STUDY-AREAS IN KILLING-PRESERVING CAN-TRAPS, 10 PER AREA, DURING 1972 AND 1973 IN SOUTHWESTERN NEW MEXICO.

Life Zones Study-areas Years	Eremobatidae (early instars)	<i>Eremobates</i> sp. (mid and late instars)	<i>Eremochelis</i> sp. (mid and late instars)	<i>Eremorhax</i> n.sp. (magnus-group)	<i>Eremobates hesseli</i> (Roewer)	<i>Eremobates</i> n.sp. (palmisetusus-group)	<i>Eremobates pallipes</i> (Say)	<i>Eremochelis bilobatus</i> (Muma)	<i>Eremochelis</i> sp. ( <i>imperiatis</i> -group)	<i>Hemerotrecha fruitana</i> Muma	<i>Ammotrechula</i> <i>peninsulana</i> (Banks)	Total
<b>PINYON-JUNIPER</b>												
Burro Mountains												
1972	2	20	1	4	13	1	1	0		0		41
1973	4	8	0	0	3	5	5	4		4		24
Subtotals	6	28	1	4	16	6	6	4		4		65
Silver City												
1972	9	5	0		1	3	3	1	1	1	1	21
1973	1	3	1		1	8	8	1	0	1	1	16
Subtotals	10	8	1		2	11	11	2	1	2	2	37
Life-Zone Totals	16	36	2	4	18	17	17	6	1	6	2	102
<b>ARID GRASSLAND</b>												
Hurley												
1972	2	74			17	5	13	1				112
1973	1	29			0	2	2	1				35
Subtotals	3	103			17	7	15	2				147
Lordsburg												
1972	2	40	1	7	9	13	6					78
1973	5	32	0	2	12	0	2					53
Subtotals	7	72	1	9	21	13	8					135
Life-Zone Totals	10	175	1	9	38	20	23	2				278
1972 Totals	15	139	2	11	26	32	23	1	1	1	1	252
1973 Totals	11	72	1	2	12	6	17	1		5	1	128
Grand Totals	26	211	3	13	38	38	40	2	1	6	2	380

tude of solpugid populations on each study-area, during each year and in each life zone. With certain reservations, the specific make-up and gross populations of common species on each study-area, during each year and in each life zone may also be considered pertinent.

Secondary or supplemental data obtained during the investigation are contained in the following statements.

No rainfall recording equipment was available during the study, and rainfall data available from the U. S. Weather Bureau has not yet been published for 1973. Despite this lack, it is known from local observations and records, that 1970, 1971, and 1972 were below normal to dry years and 1973 was an above normal wet year. This rainfall pattern was evident in normal to sparse plant growth in the late summer and fall of 1972 and in abundant verdant plant growth in the spring and summer of 1973 on all study-areas. Unseasonal, unusually heavy rains caused occasional trap-flooding on all study-areas but on the Hurley area filled about half of the traps with water during 2 sample periods, 1 in the fall of 1972 and 1 in the spring of 1973. This water apparently was flood-water, since all traps were provided with a rain shield.

Supplemental solpugid specimens collected under ground surface debris in most instances confirmed trap records as to species incidence, species abundance, and seasonal occurrence of species in each of the study-areas. The only exceptions occurred on the Silver City study-area where 2 females of *Eremochelis bilobatus* (Muma) and 1 female of *Eremobates hessei* (Roewer) were recorded under debris, but these species were not taken in the study traps.

Specimens collected at night-lights, in buildings and in supplemental traps on the Silver City study-area in most cases validated trap records. However, 3 males of *E. bilobatus* were taken at lights and in buildings, and 1 female of *Hemerotrecha* sp. (*banksi*-group) was collected in a supplemental trap.

The following are additional species records. Specimens of *Eremorhax* n. sp. (*magnus*-group), and *Ammotrechula peninsulana* (Banks) were collected at 5000 ft altitude in a mesquite thicket on the western slope of the Burro Mountains north of Lordsburg; specimens of *Eremorhax* n. sp. (*magnus*-group), *Eremobates* n. sp. (*palpisetulosus*-group), *Eremobates hessei*, *Eremochelis bilobatus*, and 1 female of *Hemerotrecha marathoni* Muma were collected at 4700 ft altitude in a creosote bush, *Larrea tridentata* (D. C.) Caville, thicket on the western slope of the Cook Mountains southeast of Hurley.

#### DISCUSSION

The results obtained during this investigation indicate that solpugid populations in southwestern New Mexico are much larger in the arid-grassland between 3000 and 5000 ft altitude. Gross population levels in the grassland were recorded at 2 to 4 times the magnitude of those in the pinyon-juniper life zone. This supports the questionable findings of Muma (1963) and Brookhart (1972) in Nevada and Colorado respectively. There is also some indication of a locale to locale and year to year variation. Lowest populations occurred in the Silver City study-area. Since this area was the only area not recently heavily grazed, it is possible that Brookhart (1972) was correct in relating high populations of *Eremobates pallipes* (Say) to over-grazed pasturage. The markedly lower solpugid populations recorded in 1973 in the present study could have been caused by the excessive rainfall experienced in

late 1972 and early 1973. There are no experimental data to corroborate this suspicion, but the Hurley study-area supported the largest solpugid population in 1972, following 2 dry years, and suffered the greatest (73.2%) decrease in population following intermittent flooding. This is indicative that rainfall was an important, if not the controlling factor.

The quantitative and supplemental data also indicate that the genus *Eremobates* Banks in southwestern New Mexico predominately inhabits the arid-grassland with certain species capable of living in the higher elevations of the pinyon-juniper life zone. Adults of *E. n. sp. (palpisetulosus-group)* and *E. pallipes* were equally as abundant in the pinyon-juniper zone (35 specimens) as in the arid grassland (43 specimens) but immatures of the genus, unquestionably those of the 2 species, barely equalled the adults in numbers at the higher elevation (36 specimens), whereas immature *Eremobates* were twice as abundant (175 specimens) as the adults of the 3 species collected in the arid grassland (81 specimens). *E. hessei* was recorded exclusively from the arid-grassland by the quantitative data but 2 females recorded by supplementary data indicate that the species does occasionally move out of the grassland.

Other genera of solpugids recorded during the study were not sufficiently common to evaluate on a population basis. They are, however, by inference, evaluated in the following paragraphs dealing with individual species.

*Eremorhax n. sp. (magnus-group)*: This relatively common species apparently matures during May and June. A total of 13 mature specimens was taken, 4 in May, 7 in June, and 2 in July; 7 immatures were also collected. The optimal habitat of the species cannot be deduced from collected specimens; 4 were taken in the pinyon-juniper zone, 7 from brush-land, and 9 from arid-grassland. J. O. Brookhart plans to describe the species in a projected review of the species-group.

*Eremobates hessei* (Roewer): This common species matures during July and August according to specimens recorded here, those recorded by Muma (in press A) and previously unrecorded specimens from western Texas. Biological and behavioral notes on this species have been recorded by Muma (1966 A, B, C, D; 1967) under the junior synonym, *E. nodularis* Muma. The species appears to be more restricted to an arid-grassland habitat than other ecologically studied species of the genus.

*Eremobates pallipes* (Say): According to specimens recorded in the present study and those recorded by Brookhart (1972) and Muma (in press A) this common species matures in July and August. Muma (1966E, in press A) recorded the same maturity time for the closely related *Eremobates durangonus* Roewer. Although the optimal habitat of *E. pallipes* apparently is heavily grazed arid-grassland pasturage, present data and Brookhart (1972), the species can survive and live in the pinyon-juniper life zone and Brookhart (1972) recorded specimens to 8,200 ft in the Wet Mountains of Colorado. Further, it is apparently as mobile or as versatile as *E. durangonus* which has been collected at 7,900 ft altitude in the Chiricahua Mountains of Arizona.

*Eremobates n. sp. (palpisetulosus-group)*: This common, pale species is morphologically closely related to *E. palpisetulosus* Fichter. It apparently matures during April and May (present study, and Muma in press A), 1 to 2 months earlier than the latter species (Brookhart 1972, Muma in press A). The optimal habitat probably is heavily grazed arid-grassland but since mature specimens were equally as abundant in the pinyon-juniper life zone, and have been collected in brush-land, further study is needed to verify this supposition. The species will be described in an early taxonomic paper.

*Eremochelis bilobatus* (Muma): Although insufficient adult specimens (9) of this species were collected during the present study to permit population analyses, previously published data are adequate. Brookhart (1972) stated that 17 Colorado specimens almost always were trapped in areas of small shrubs, and Muma (in press A) on the basis of 131 specimens reported that the species inhabited thorn-thickets in the foot-hills of the Chiricahua Mountains of Arizona. The quantitative data of these 2 authors indicate that the species matures in June and July. During the present study all adult specimens were collected in June, July, and August, and 7 of 9 were taken in pinyon-juniper or brush-land. An aberration in the known ecological data for this species should be mentioned and discussed here. Most of the recorded specimens are males, 12 of 17 from Colorado, 123 of 131 from Arizona, and 7 of 9 from New Mexico. This preponderance of collected males over females suggests that the species may not be a typical cursorial arachnid; it may be arboreal, an ambush-form or subterranean with males leaving the normal habitat only to find females. Biological notes on the species are cited by Muma (1966 A, C, D, and 1967).

*Eremochelis* sp. (*imperialis*-group): A single female collected in November may be the female of *E. rothi* (Muma) which was described from Arizona. Additional specimens and males will have to be collected before an evaluation can be made.

*Hemerotrecha fruitana* Muma: All 6 adult specimens, 4 males and 2 females, of this distinctive uncommon species were collected in March, April, and May in the pinyon-juniper life zone. This indicates that the species is either a mountain or a pinyon-juniper life zone inhabitant. Further population study is needed. Brookhart (1972) states that the species is montane.

*Hemerotrecha marathoni* Muma: This species, recorded here from a single female collected in June, was described from Texas. It is apparently rare in southwestern New Mexico.

*Hemerotrecha* sp. (*banksi*-group): A single female collected in April in the pinyon-juniper life zone has all of the characteristics of this group of the genus. Most species of this unusual, diurnal group of solpugids mature in the spring but the entire group is known only from the west coast, California, Oregon, Washington, Nevada, and Idaho. This unique specimen will not be additionally evaluated until more material has been collected.

*Ammotrechula peninsulana* (Banks): The 6 specimens, 3 males, 2 females and 1 young of this uncommon recorded species are not adequate for population analysis. However, Muma (in press A) recorded 17 males and 11 females collected in June and July in the thorn-thickets of the Chiricahua Mountains of Arizona. Combination of the 2 sets of data indicate that the species inhabits the brush-land and pinyon-juniper life zone in the foot-hills of mountains. Biological notes on the species are recorded by Muma (1966 C, 1966 D, 1967).

#### SUMMARY

A 2-year study of solpugid populations in the arid-grassland and pinyon-juniper life zones of southwestern New Mexico utilizing killing-preserving can-traps for primary quantitative data and miscellaneous collecting for supplemental data has produced results that permit the following conclusions.

1. In this study, arid-grassland solpugid populations appear to be 2 to 4 times the magnitude of those in the pinyon-juniper life zone.

2. Solpugid populations vary in size from year to year and locality to locality within the 2 life zones. Rainfall and heavy grazing appear to be 2 of the factors involved in such variation.

3. *Eremobates* spp. predominately inhabit the arid-grassland but can and do invade and live in the pinyon-juniper life zone and may also invade the montane zone.

4. Three common, 1 relatively common, 2 uncommon and 3 rare species occur in the region. *Eremochelis bilobatus* (Muma) also occurs in the region but its population cannot presently be evaluated.

#### LITERATURE CITED

- Allred, Donald M., and Martin H. Muma. 1971. Solpugids of the National Reactor Testing Station, Idaho. Great Basin Naturalist 31(3):164-168.
- Brookhart, John O. 1972. Solpugids (Arachnida) in Colorado. Southwestern Naturalist 17(1):31-41.
- Cloudsley-Thompson, J. L. 1961. Observations on the Natural History of the "Camel-Spider", *Galeodes arabs* C. L. Koch (Solifugae: Galeodidae) in the Sudan. The Ent. Monthly Mag. 97:145-152.
- Lawrence, R. F. 1963. The Solifugae of South West Africa. Cimbebasia (8):1028.
- Mello-Leitao, C. de. 1938. Solifugos de Argentina. Anales Museo Argentino de Ciencias Naturales 40:1-32.
- Muma, Martin H. 1963. Solpugida of the Nevada Test Site. Brigham Young Univ. Sci. Bull. Biol. Ser. 3(2):1-13.
- Muma, Martin H. 1966. A. Egg deposition and incubation for *Eremobates durangonus* with notes on the eggs of other species of Eremobatidae (Arachnida: Solpugida) Fla. Ent. 49:23-31.
- Muma, Martin H. 1966B. Mating behavior in the solpugid genus *Eremobates* Banks. Anim. Behav. 14(2-3):346-350.
- Muma, Martin H. 1966C. Feeding behavior of North American Solpugida (Arachnida). Fla. Ent. 49:199-216.
- Muma, Martin H. 1966D. Burrowing habits of North American Solpugida (Arachnida). Psyche 73(4):251-260.
- Muma, Martin H. 1966E. The life cycle of *Eremobates durangonus* (Arachnida: Solpugida). Fla. Ent. 49:233-242.
- Muma, Martin H. 1967. Basic behavior of North American Solpugids. Fla. Ent. 50:115-123.
- Muma, Martin H. 1970. An improved can-trap. Notes Arachnologists of the Southwest. 1:16-18.
- Muma, Martin H. in press A. Maturity and reproductive isolation of common solpugids in North American deserts. J. Arachnology.
- Muma, Martin H. in press B. Two vernal ground-surface arachnid populations in Tularosa Basin, New Mexico. Southwestern Naturalist.
- Roewer, C. F. R. 1934. Solifugae, Palpigradi, In Bronn, H. G., Klassen und Ordnungen des Tierreichs 5, div. 4, book 4:1-723.
- Southwood, T. R. E. 1966. Ecological Methods with Particular Reference to the Study of Insect Populations. London, Methuen 391 p.
- Turnbull, A. L. 1973. Ecology of the True Spiders (Araneomorphae). Annu. Rev. Ent. 18:305-348.