PSOCOPTERA FROM THE CALAKMUL BIOSPHERE RESERVE, AND NEIGHBORING AREAS (CAMPECHE, MEXICO)

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ABSTRACT

A survey of the Psocoptera of the Calakmul Biosphere Reserve, Campeche, Mexico, was conducted in 1997 and early 1998. The collecting effort was 260 man-hours, excluding the operation of light and Malaise traps. A total of 1675 specimens was taken, representing 96 species, in 48 genera and 23 families. The ∝ Diversity Index for this collection was 22.12. Fifteen species constituted 66.7% of the total number of specimens, and 40 species constituted 3.9% of the same total. Only 18 of the 96 species present in the area are widely distributed locally, whereas 72 of the 96 species in the area showed restricted local distribution. The level of endemism is high (19.79% of the total number of species).

Key Words: Calakmul Biosphere Reserve, Campeche, Mexico, Psocoptera

RESUMEN

Durante 1997 y principios de 1998 se condujo un censo de Psocoptera en la Reserva de la Biósfera de Calakmul, Campeche, en el que el esfuerzo de colecta fue de 260 horas-hombre, sin contar el tiempo de operación de trampas de luz y trampas Malaise. Fueron capturados un total de 1675 ejemplares, que representan a 96 especies, en 48 géneros y 23 familias. El Indice de Diversidad ∝, calculado para ésta colección, fue de

22.12. Quince especies constituyeron el 66.7% del total de ejemplares recolectados, mientras que 40 especies constituyeron 3.9% del mismo total. Sólo 18 de las 96 especies registradas en la área tienen una amplia distribución local, y 72 del total de 96 especies tienen una distribución local muy restringida. El nivel de endemismo es alto (19.76% del total de especies).

The Calakmul Biosphere Reserve, in the Mexican state of Campeche, was created on 22 May, 1989, by decree of the then President of Mexico, Carlos Salinas de Gortari. The reserve is located at the base of the Yucatan Peninsula, in the southwestern corner of Campeche, between 17°49' and 19°11'N and between 89°08' and 90°08'W, bordering on the south with the Guatemalan Peten and partially to the east with the state of Quintana Roo. It covers approximately 7000 square kilometers, or about 14% of the total area of Campeche. It has a peculiar shape (Fig. 1), with two large areas, one to the north and one to the south of the highway Escarcega-Chetumal, separated by a pronounced narrowing that crosses the highway some 15 kilometers west of X'puhil. The defects in the design of the reserve have been widely pointed out and discussed by Galindo Leal (1997). All in all, it constitutes the largest humid forest reserve area in the country, with representation, in order of importance of area covered, of medium subperennifolious forest, low subperennifolious forest, secondary vegetation, perennifolius-subperennifolious evergreen forest, and aquatic vegetation (Gomez Pompa & Dirzo 1995). The area is inhabited by many species of wild animals, threatened or in danger of extinction, such as jaguar, ocelot, jaguarundi, spider and howler monkeys, curassow, harpy eagle and tapir. The area is also rich in Mayan archaeological zones of the Classic period, in architectural styles Peten, Chenes and Rio Bec (e.g. Calakmul, Hormiguero, Chicanna, Becan and Balamkum).

With respect to the Psocoptera fauna, the only notable reference is the record, by Mockford & Garcia Aldrete (1996), of 26 species in Campeche, which were the result of isolated, not systematic insect collecting in several localities in the state, none of these in the reserve area, with only some records from the vicinities of X'puhil. Most of the species recorded were neotropical or pantropical, widely distributed and also occurring in the Caribbean.

The purpose of this work was to survey the fauna of psocids in the reserve area and surroundings, to estimate the relative abundance and local distribution of the species present, and to determine the specific richness of the different sites sampled. The specimens collected are deposited in the National Collection of Insects (Departamento de Zoologia, Instituto de Biologia, UNAM, Apartado Postal 70-153, 04510, Mexico, D.F.)

Materials and Methods

In May and September, 1997, and in February, 1998, psocid collecting was conducted in the reserve area and some neighbouring places. The insects were taken by beating the vegetation, sifting litter, directly examining tree trunks and rock faces, and by using light and Malaise traps. During the first collecting event (1-9.V.1997), the effort was of 135 man-hours, then 70 man-hours during the second collecting event (19-25.IX.1997), and 55 man-hours during the third collecting event (15-19.II.1998). The specimens collected were preserved directly in 80% ethanol. Table 1 presents a list of the collecting localities and their geographic coordinates, and they are also indicated in Figure 1. It is pertinent to point out that no collecting was done in the northern segment of the reserve, nor in the nuclear zones.

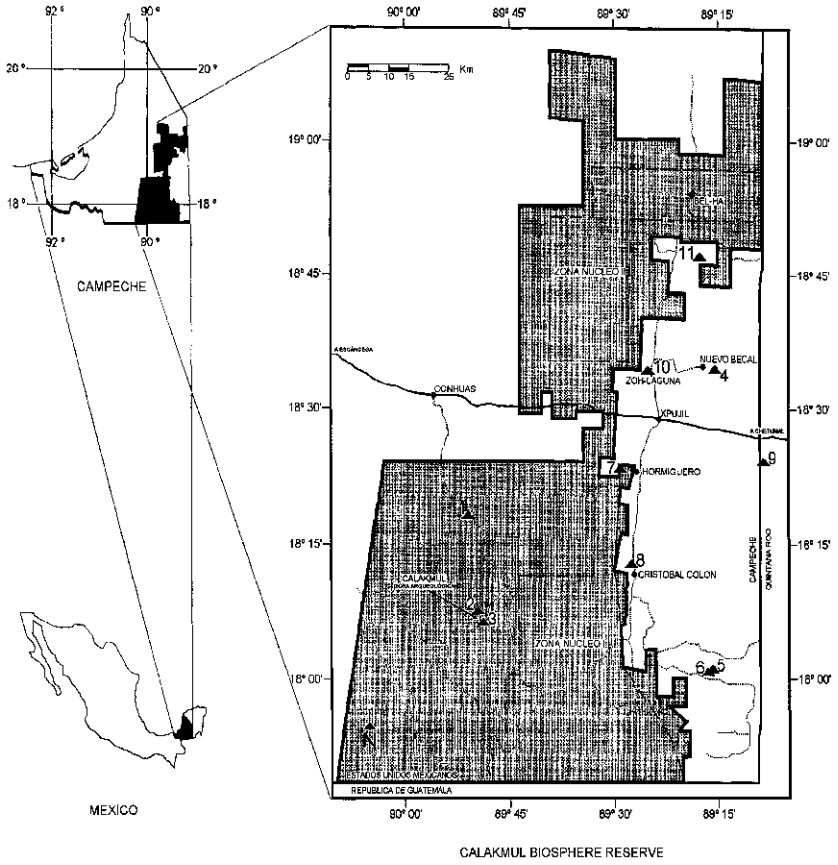

Fig. 1. Location of the Calakmul Biosphere Reserve, Campeche, and Psocoptera collecting localities in the area.

RESULTS

During the first collecting event, 708 psocid specimens were taken, with 58 species being represented. During the second collecting event, 449 specimens were taken, representing 41 species, 16 of which had not been taken during the first event, and during the third collecting event, 518 specimens were taken, representing 66 species, 22 of which had not been previously collected. A total of 1675 specimens was collected, representing 96 psocid species, in 48 genera and 23 families (Table 2).

Figure 2 shows the species accumulation curve for the collecting period. The slope of the line indicates that a fourth collecting episode would have been needed to determine if the curve was or was not in the asymptotic phase. With the evidence that in the third collecting event 22.9% of the total number of species were new additions, it is likely that more unrecorded psocid species could still be found in the area.

Table 2 lists the species of psocids collected in the area, the species and number of specimens taken in each collecting event, the relative abundance of each species, the

TABLE 1. COLLECTING LOCALITIES IN THE CALAKMUL BIOSPHERE RESERVE AND VICINITY.

1.	25 km N of Calakmul archaeological zone, 230 m.	18°17'49"N, 89°50'36"W
2.	Calakmul archaeological zone, ca. large "aguada", 265 m.	18°07'26"N, 89°48'56"W
3.	Calakmul archaeological zone, 265 m.	18°06'35"N, 89°48'17"W
4.	El Chorro, ejido Nuevo Becal, 130 m.	18°35'25"N, 89°15'28"W
5.	Laguna de Alvarado, 316 m.	18°01'54"N, 89°15'45"W
6.	Laguna de Alvarado, 322 m.	18°00'55"N, 89°16'10"W
7.	Hormiguero archaeological zone, 295m.	18°24'10"N, 89°29'13"W
8.	Arroyo Colon, ejido C. Colon, 420 m.	18°12'59"N, 89°27'23"W
9.	San Antonio Soda, ejido Diaz Ordaz, 200 m.	18°24'54"N, 89°08'19"W
10.	Zoh Laguna, ca. "aguada", 327 m.	18°35'21"N, 89°25'07"W
11.	La Mancolona, ejido 20 de Junio, 232 m.	18°48'38"N, 89°17'29"W

amplitude of distribution in the area sampled (A = number of localities in which each species was found), and the hierarchic order of each species (HOS), an ordering in which the species are placed in hierarchy, according to their importance values; in this case, the number of specimens/species was taken as importance value.

The 96 species found represent 48 genera in 23 families. The genus most diverse is *Lachesilla*, with 13 species, followed by *Tapinella, Caecilius* and *Archipsocus*, each with five species; then follow *Echmepteryx, Lithoseopsis* and *Peripsocus,* with four species each, and *Psyllipsocus, Liposcelis, Ectopsocus, Archipsocopsis, Blastopsocus* and *Ptycta,* with three species each. The genera *Cladiopsocus, Hemipsocus* and *Trichadenotecnum* are represented by two species each, and there is a large group of 32 genera represented by only one species each.

In terms of relative abundance, the 96 species are distributed in 38 ranks of hierarchic importance (Fig. 3). The species numerically most important is *Archipsocopsis* sp. 1, with 209 specimens, followed by *Ectopsocus titschacki* Jentsch, with 108 specimens, *Echmepteryx alpha* Garcia Aldrete, with 92 specimens, *Hemipsocus africanus* Enderlein, with 86 specimens, and *Caecilius totonacus* Mockford, with 78 specimens. Together, the 15 most abundant species constitute 66.7% of the total number of individuals, and, on the opposite end, 19 species are represented by one specimen, 16 species are represented by two specimens, and five species are represented by three specimens, so that 40 species constitute only 3.9% of the total of specimens collected.

The $\propto$ Diversity Index [$S = \propto \log (1 + N/\propto)$, cf. Taylor, Kempton & Woiwod (1976)], calculated for the Calakmul psocid collection, resulted in a value of 22.12, one of the highest recorded in the literature, surpassed only by the diversity indices for the Psocoptera of Chamela, Jalisco, Mexico ($\propto = 24.01$, N = 2863, S = 115), Panama Lowlands ($\propto = 24.5$, N = 10092, S = 148), and Los Tuxtlas, Veracruz, Mexico ($\propto = 32.45$, N = 4194, S = 158) (Broadhead & Wolda 1985; Garcia Aldrete 1988; Garcia Aldrete, Mockford & Garcia Figueroa 1997).

Table 3 presents the species and number of specimens of each species collected in each locality during this study; it also includes the habitats in which the species were collected. Since the collecting effort was not the same in each locality, the results are biased; however, the comparatively high species richness of localities 3, 7 and 10 probably reflect also intrinsic differences among the localities sampled. The richer ones are sites physically complex, varied, with several habitats sampled, such as the Calakmul archaeological zone, the Hormiguero archaeological zone or Laguna de Alvarado.

TABLE 2. PSOCOPTERA FROM THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE AND VICINITY (N = NUMBER OF SPECIMENS, %T = PERCENTAGE OF THE TOTAL, A = NUMBER OF LOCALITIES IN WHICH EACH SPECIES WAS COLLECTED, HOS = HIERARCHIC ORDER OF SPECIES).

		1-9. V. 1997 (135 man hours)			19-25. IX. 1997 (70 man hours)			15-19. II. 1998 (55 man hours)						
		males	females	nymphs	males	females	nymphs	males	females	nymphs	N	%T	A	HOS
	TROGIOMORPHA													
	Lepidopsocidae													
1	*Thylacella cubana* (Banks), 1941			2		2				1	5	0,30	4	34
2	*Nepticulomima* Enderlein, 1906					7	14				21	1,25	2	19
3	*Proentomum personatum* Badonnel, 1949		7	12		5	10		3	6	43	2,57	10	12
4	*Soa flaviterminata* Enderlein, 1906		1	7					1		9	0,54	3	30
5	*Echmepteryx alpha Garcia Aldrete, 1984*		38	30		1	4		13	6	92	5,49	7	3
6	*E. falco* Badonnel,1949		4	8							12	0,72	2	27
7	*E. madagascariensis* (Kolbe), 1885		22	9		3	3		5	24	66	3,94	3	7
8	*E. intermedia* Mockford, 1974		5	4		1	2		2	3	17	1,01	4	23
9	*Neolepolepis caribensis* (Turner), 1975					3					3	0,18	1	36
	Psoquillidae													
10	*Rhyopsocus sp.*		1								1	0,06	1	38

TABLE 2. (CONTINUED) PSOCOPTERA FROM THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE AND VICINITY (N = NUMBER OF SPECIMENS, %T = PERCENTAGE OF THE TOTAL, A = NUMBER OF LOCALITIES IN WHICH EACH SPECIES WAS COLLECTED, HOS = HIERARCHIC ORDER OF SPECIES).

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		males	females	nymphs	males	females	nymphs	males	females	nymphs	N	%T	A	HOS
	Psyllipsocidae													
11	*Psyllipsocus* Selys-Longchamps, 1872. sp. 1	12	14		1			5	3	1	36	2,15	3	13
12	*P.* sp. 2	8		1				4		5	18	1,07	3	22
13	*P.* sp. 3								1		1	0,06	1	38
	TROCTOMORPHA													
	Amphientomidae													
14	*Lithoseopsis* Mockford, 1993. sp. 1		3	9		2	1		1	4	20	1,19	5	20
15	*L.* sp. 2					1	1				2	0,12	1	37
16	*L.* sp. 3					8	4				12	0,72	1	27
17	*L.* sp. 4								1		1	0,06	1	38
	Compsocidae													
18	*Electrentomopsis variegatus* Mockford, 1967								1	1	2	0,12	1	37
	Liposcelididae													
19	*Belaphopsocus badonneli* New, 1971								2		2	0,12	1	37
20	*Embidopsocus cubanus* Mockford, 1987		1	1							2	0,12	1	37

TABLE 2. (CONTINUED) PSOCOPTERA FROM THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE AND VICINITY (N = NUMBER OF SPECIMENS, %T = PERCENTAGE OF THE TOTAL, A = NUMBER OF LOCALITIES IN WHICH EACH SPECIES WAS COLLECTED, HOS = HIERARCHIC ORDER OF SPECIES).

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21	*Liposcelis bostrychopila* Badonnel, 1931								2		2	0,12	2	37
22	*L. ornata* Mockford, 1978		2						1		3	0,18	2	36
23	*Liposcelis* Motschulsky, 1852		1								1	0,06	1	38
24	*Nanopsocus oceanicus* Pearman, 1928		13			2			6		21	1,25	3	19
25	*Tapinella maculata* Mockford & Gurney, 1926	2	6	2	2	3					15	0,90	7	24
26	*T. olmeca* Mockford, 1975	4	25	5	1	6	1		2		44	2,63	6	10
27	*T. vittata* Garcia Aldrete, 1993	2	17	3		4		2	23	2	53	3,16	6	10
28	*Tapinella* Enderlein, 1908. sp. 1		15						4		19	1,13	6	21
29	*T.* sp. 2		8						3		11	0,66	3	28
30	*Pachytroctes ixtapaensis* Garcia Aldrete, 1986								1	3	4	0,24	1	35
	PSOCOMORPHA													
	Epipsocidae													
31	*Epipsocus* Hagen, 1866		2	3					1		6	0,36	2	33
	Dolabellopsocidae													
32	*Dolabellopsocus roseus* Eertmoed, 1973		1								1	0,06	1	38

TABLE 2. (CONTINUED) PSOCOPTERA FROM THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE AND VICINITY (N = NUMBER OF SPECIMENS, %T = PERCENTAGE OF THE TOTAL, A = NUMBER OF LOCALITIES IN WHICH EACH SPECIES WAS COLLECTED, HOS = HIERARCHIC ORDER OF SPECIES).

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	Cladiopsocidae													
33	*Cladiopsocus garciai* Eertmoed, 1986							1	4	3	8	0,48	2	31
34	*C. ocotensis* Garcia Aldrete, 1996	1	4	3				1	1	3	13	0,78	2	26
	Ptiloneuridae													
35	*Loneura leonilae* Garcia Aldrete, 1995	1		1							2	0,12	1	37
36	*Triplocania spinosa* Mockford, 1957							3	5	7	15	0,90	2	24
	Asiopsocidae													
37	*Notiopsocus* Banks, 1913					1			3	7	11	0,66	2	28
	Caeciliidae													
38	*Caecilius casarum* Badonnel, 1931		2								2	0,12	1	37
39	*C. totonacus* Mockford, 1966	1	51	27							79	4,72	3	5
40	*Caecilius* Curtis, 1837. Sp. 1							1	4	4	9	0,54	3	30
41	*C.* sp. 2								1		1	0,06	1	38
42	*Xanthocaecilius* Mockford, 1989				1						1	0,06	1	38
	Amphipsocidae													
43	*Dasypsocus roesleri* (New & Thornton), 1975	1	1	7					3	13	25	1,49	4	18

TABLE 2. (CONTINUED) PSOCOPTERA FROM THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE AND VICINITY (N = NUMBER OF SPECIMENS, %T = PERCENTAGE OF THE TOTAL, A = NUMBER OF LOCALITIES IN WHICH EACH SPECIES WAS COLLECTED, HOS = HIERARCHIC ORDER OF SPECIES).

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	Lachesillidae													
44	*Anomopsocus* Roesler, 1940							1			1	0,06	1	38
45	*Nanolachesilla* Mockford & Sullivan, 1986								1		1	0,06	1	38
46	*Lachesilla bottimeri* Mockford & Gurney, 1956					1					1	0,06	1	38
47	*L. bifurcata* Garcia Aldrete, 1986								1		1	0,06	1	38
48	*L.* sp. (*forcepeta* group)	2	5	3	2	3	1		3	13	32	1,91	6	14
49	*L. cuala* Garcia Aldrete, 1988								2		2	0,12	1	37
50	*L. denticulata* Garcia Aldrete, 1988	3	2					5	18	35	63	3,76	5	8
51	*L. disjuncta* Garcia Aldrete, 1988	1	7	16				1	1	1	27	1,61	4	16
52	*L. nuptialis* Badonnel & Garcia Aldrete, 1980		5	1		7	5		10		28	1,67	8	15
53	*L. penta* Sommerman, 1946	1	3	17	2	8	1	3	9		44	2,63	7	11
54	*L. riegeli* Sommerman, 1946	1	1			1					3	0,18	2	36
55	*L. tropica* Garcia Aldrete, 1982	3	1			3	1				8	0,48	6	31
56	*L. yanomamioides* Garcia Aldrete, 1996	2	2	9	4	7	7	6	15	26	78	4,66	6	6
57	*Lachesilla* Westwood, 1840. sp. F9 B							2	2	7	11	0,66	1	28
58	*L.* sp. (*pedicularia* group)	1	2		3	1			4		11	0,66	7	28

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	Ectopsocidae													
59	*Ectopsocus mexicanus* Garcia Aldrete, 1991							1			1	0,06	1	38
60	*E. titschacki* Jentsch, 1929	17	45	12	10	16	2	2	3	1	108	6,45	7	2
61	*E. vilhenai* Badonnel, 1955	4	6								10	0,60	3	29
	Peripsocidae													
62	*Peripsocus potosi* Mockford, 1971		1			3			1		5	0,30	3	34
63	*P. chamelanus* Badonnel, 1986					1			1		2	0,12	2	37
64	*P. ca. stagnivagus* Chapman, 1930		1						1		2	0,12	2	37
65	*P.* sp. 1		1						2		3	0,18	2	36
	Archipsocidae													
66	*Archipsocopsis* Badonnel, 1966. sp. 1	1	54	2	8	101	42		1		209	12,48	7	1
67	*A.* sp. 2		5			1	1				7	0,42	2	32
68	*A.* sp. 3	1	1								2	0,12	1	37
69	*Archipsocus* Hagen, 1882 sp. 1		2								2	0,12	1	37
70	*A.* sp. 2		7	1		4	1		33	11	57	3,40	9	9
71	*A.* sp. 3	1	1								2	0,12	1	37
72	*A.* sp. 4		2								2	0,12	2	37
73	*A.* sp. 5		1								1	0,06	1	38

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		males	females	nymphs	males	females	nymphs	males	females	nymphs	N	%T	A	HOS
74	*Pseudarchipsocus guajiro* Mockford, 1974				1	2					3	0,18	1	36
	Pseudocaeciliidae													
75	*Pseudocaecilius citricola* (Ashmead), 1879		1	1					3	2	7	0,42	4	32
76	*Heterocaecilius badonneli* Garcia Aldrete, 1989				4	6	4				14	0,84	1	25
77	*Scytopsocus* Roesler, 1940 (ca. coriaceous Roesler, 1940)					2	1		1	3	7	0,42	3	32
	Philotarsidae													
78	*Haplophallus* Thornton, 1959							2	1	3	6	0,36	3	33
79	*Aaroniella* Mockford, 1951								1	1	2	0,12	1	37
	Elipsocidae													
80	*Palmicola* Mockford, 1955		1	1							2	0,12	2	37
81	*Nepiomorpha brasiliana* Badonnel, 1973							1	14		15	0,90	2	24
	Hemipsocidae													
82	*Hemipsocus africanus* Enderlein, 1907	6	13	7	12	28	14	2	4		86	5,13	5	4
83	*H. pretiosus* Banks, 1930		2	5					1		8	0,48	1	31

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		males	females	nymphs	males	females	nymphs	males	females	nymphs	N	%T	A	HOS
	Psocidae													
84	*Blastopsocus* Roesler, 1943. Sp.1		1					2	2		5	0,30	3	34
85	*B.* sp. 2						1		1	16	18	1,07	2	22
86	*B.* sp. 3							1			1	0,06	1	38
87	*Cerastipsocus trifasciatus* (Provancher), 1876		1		1	1				14	17	1,01	3	23
88	*Metylophorus* Pearman, 1932								1		1	0,06	1	38
89	*Steleops* Enderlein, 1910			1							1	0,06	1	38
90	*Ptycta* Enderlein, 1925. sp. 1			1							1	0,06	1	38
91	*P.* sp. 2							1			1	0,06	1	38
92	*P. tikala* (Mockford), 1957				1						1	0,06	1	38
93	*Trichadenotecnum* Enderlein, 1909. sp. 1					1		1	1	2	5	0,30	2	34
94	*T.* sp. 2					1		1	2		4	0,24	2	35
	Myopsocidae													
95	*Lichenomima varia* (Navas), 1927				15	9	1	1			26	1,55	2	17
96	*Myopsocus* Hagen, 1866		5	1					3		9	0,54	4	30
TOTAL		76	423	212	68	256	122	50	240	228				
TOTAL			711			446			518		1675			
α DIVERSITY INDEX (S = α log (1+N/α)) =			22,12											

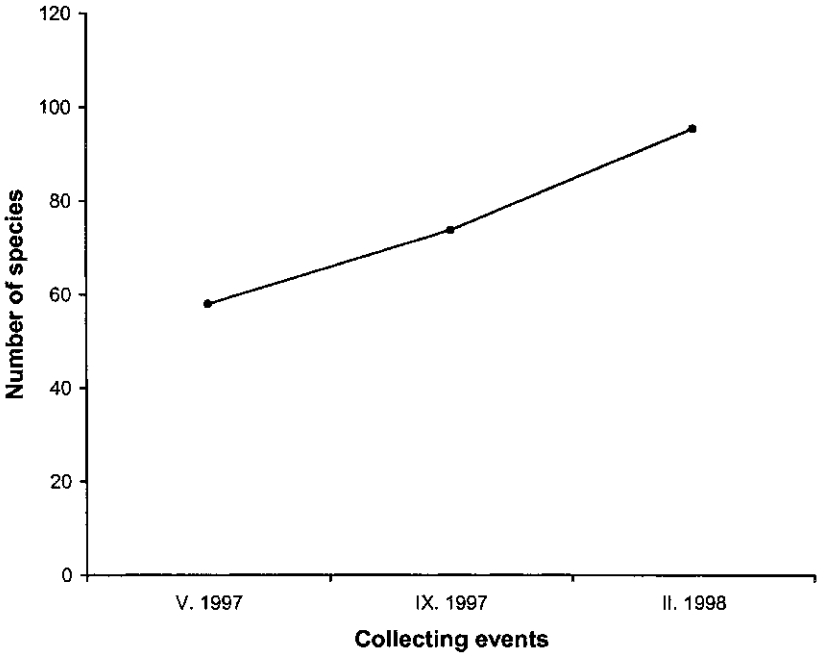

Fig. 2. Species accumulation curve for the Psocoptera of the Calakmul area. May 1997-February 1998.

The species of psocids collected in the Calakmul area, can be assigned to the following biogeographic categories:

I. Endemics and presumed endemics (19 species).

Nepticulomima sp., *Rhyopsocus* sp., *Psyllipsocus* sp. 2, *Lithoseopsis* sp. 4, *Liposcelis* sp., *Tapinella* sp. 1, *Xanthocaecilius* sp., *Nanolachesilla* sp., *Peripsocus* sp. 4, *Archipsocopsis* sp. 3, *Palmicola* sp., *Blastopsocus* spp.1, 2, and 3, *Metylophorus* sp., *Steleops* sp., *Ptycta* sp.1, and *Trichadenotecnum* spp. 1 and 2.

II. Tropical waifs (9 species).

Proentomum personatum Badonnel, *Soa flaviterminata* Enderlein, *Echmepteryx falco* Badonnel, *E. madagascariensis* (Kolbe), *Nanopsocus oceanicus* Pearman, *Ectopsocus titschacki* Jentsch, *E. vilhenai* Badonnel, *Pseudocaecilius citricola* (Ashmead) and *Hemipsocus africanus* Enderlein.

III. Cosmopolitan species (2 species).

Liposcelis bostrychophila Badonnel, *Caecilius casarum* Badonnel.

IV. Species widespread in tropical and subtropical America (9 species).

Thylacella cubana (Banks), *Belaphopsocus badonneli* New, *Liposcelis ornata* Mockford, *Tapinella maculata* Mockford & Gurney, *Dasypsocus*

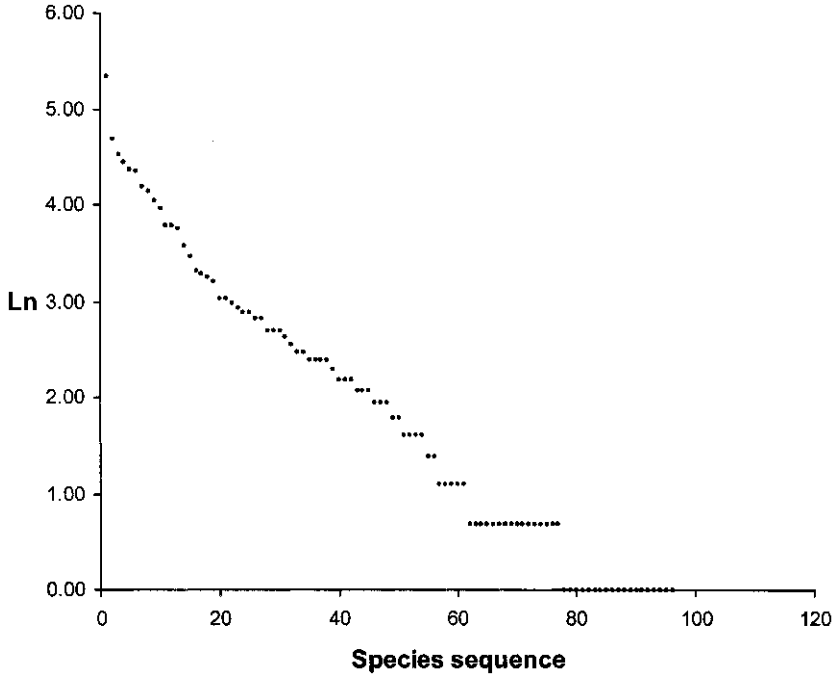

Fig. 3. Species abundance distribution of the collection of Psocoptera from the Calakmul Biosphere Reserve and surrounding areas. Log. of abundance ranked against species. $\propto = 22.12$.

roesleri (New & Thornton), *Lachesilla cuala* Garcia Aldrete, *Peripsocus potosi* Mockford, *Nepiomorpha brasiliana* Badonnel, and *Cerastipsocus trifasciatus* (Provancher).

V. Species occurring in Mexico and southeastern USA (2 species).

Lachesilla bottimeri Mockford & Gurney, *L. penta* Sommerman.

VI. Species occurring in tropical Mexico and Guatemala or Belize, not extending to Central America and the Caribbean (7 species).

Echmepteryx alpha Garcia Aldrete, *Cladiopsocus garciai* Eertmoed, *Triplocania spinosa* Mockford, *Anomopsocus* sp. *a, Lachesilla disjuncta* Garcia Aldrete, *L. nuptialis* Badonnel & Garcia Aldrete, *Ptycta tikala* Mockford.

VII. Species occurring in tropical Mexico, Central America and the Caribbean (2 species).

Lachesilla denticulata Garcia Aldrete, *L. riegeli* Sommerman.

VIII. Species occurring in tropical Mexico and the Caribbean (5 species).

Echmepteryx intermedia Mockford, *Neolepolepis caribensis* (Turner), *Tapinella olmeca* Mockford, *Lachesilla yanomamioides* Garcia Aldrete, *Hemipsocus pretiosus* Banks.

TABLE 3. PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats										
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
	TROGIOMORPHA																						
	Lepidopsocidae																						
1	*Thylacella cubana* (Banks), 1941	2		1		1							*	*								*	
2	*Nepticulomima* Enderlein, 1906										17	4	*								*	*	*
3	*Proentomum personatum* Badonnel, 1949		2	11	1	1	12	2	1	1	5	7	*	*			*	*	*		*	*	
4	*Soa flaviterminata* Enderlein, 1906			5			1	3						*				*					
5	*Echmepteryx alpha* Garcia Aldrete, 1984		12	23		10	5	29	6		7		*	*	*	*	*	*	*	*	*	*	*
6	*E. falco* Badonnel, 1949					6	6						*	*	*	*				*			
7	*E. madagascariensis* (Kolbe), 1885				14			45	7						*								
8	*E. intermedia* Mockford, 1974		3	5				5			4		*					*					

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats										
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
9	*Neolepolepis caribensis* (Turner), 1975		3										*										
	Psoquillidae																						
10	*Rhyopsocus* sp.								1													*	
	Psyllipsocidae																						
11	*Psyllipsocus* Selys-Longchamps, 1872. sp. 1			12			11	13												*		*	
12	*P.* sp. 2			7			9	2												*			
13	*P.* sp. 3			1																*			
	TROCTOMORPHA																						
	Amphientomidae																						
14	*Lithoseopsis* Mockford, 1993. sp. 1	2	1	13			2	2					*		*					*			
15	*L.* sp. 2			2																*			
16	*L.* sp. 3			12																*			
17	*L.* sp. 4										1				*								

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats										
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
	Compsocidae																						
18	*Electrentomopsis variegatus* Mockford, 1967			2											*								
	Liposcelididae																						
19	*Belaphopsocus badonneli* New, 1971							2							*								
20	*Embidopsocus cubanus* Mockford, 1987							2					*										
21	*Liposcelis bostrychopila* Badonnel, 1931			1				1									*						
22	*L. ornata* Mockford, 1978					2					1				*	*							
23	*Liposcelis* Motschulsky, 1852							1					*										
24	*Nanopsocus oceanicus* Pearman, 1928			18			1				2		*				*						
25	*Tapinella maculata* Mockford & Gurney, 1926	1			5	1		5	1	1		1	*				*		*				

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats										
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
26	*T. olmeca* Mockford, 1975		16	18	2			6		1	1		*				*		*				
27	*T. vittata* Garcia Aldrete, 1993		4	27	1	8		9			4		*	*	*		*	*		*			
28	*Tapinella* Enderlein, 1908. sp. 1		2	1		1	2	10			3		*							*			
29	*T.* sp. 2			7		1		3					*				*	*					
30	*Pachytroctes ixtapaensis* Garcia Aldrete, 1986			4									*										
	PSOCOMORPHA																						
	Epipsocidae																						
31	*Epipsocus* Hagen, 1866			1				5						*								*	
	Dolabellopsocidae																						
32	*Dolabellopsocus roseus* Eertmoed, 1973							1					*										
	Cladiopsocidae																						
33	*Cladiopsocus garciai* Eertmoed, 1986			7				1					*	*	*			*					

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats									
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
34	*C. ocotensis* Garcia Aldrete, 1996			5		8											*	*					
	Ptiloneuridae																						
35	*Loneura leonilae* Garcia Aldrete, 1995					2														*		*	
36	*Triplocania spinosa* Mockford, 1957			14				1							*					*			
	Asiopsocidae																						
37	*Notiopsocus* Banks, 1913			9							2		*					*				*	
	Caeciliidae																						
38	*Caecilius casarum* Badonnel, 1931				2												*						
39	*C. totonacus* Mockford, 1966					1	69	9					*	*									
40	*Caecilius* Curtis, 1837. sp. 1			6				1			2		*									*	
41	*C.* sp. 2			1									*										
42	*Xanthocaecilius* Mockford, 1989										1											*	

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats										
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
	Amphipsocidae																						
43	*Dasypsocus roesleri* (New & Thornton), 1975		2	18			2	3					*	*				*		*			
	Lachesillidae																						
44	*Anomopsocus* Roesler, 1940							1					*										
45	*Nanolachesilla* Mockford & Sullivan, 1986							1					*									*	
46	*Lachesilla bottimeri* Mockford & Gurney, 1956				1												*						
47	*L. bifurcata* Garcia Aldrete, 1986			1														*					
48	*L.* sp. (*forcepeta* group)		2	14				6	5	4	1		*						*				
49	*L. cuala* Garcia Aldrete, 1988										2		*										
50	*L. denticulata* Garcia Aldrete, 1988		4	29	1			23			6		*					*				*	*

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats										
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
51	*L. disjuncta* Garcia Aldrete, 1988		2	7		17		1					*					*					
52	*L. nuptialis* Badonnel & Garcia Aldrete, 1980		2	6	1	1	3	5			9	1	*	*								*	*
53	*L. penta* Sommerman, 1946		5	3		19	2	3		6	6		*										*
54	*L. riegeli* Sommerman, 1946							2			1		*										
55	*L. tropica* Garcia Aldrete, 1982					1	1	1	1	1	3		*						*			*	*
56	*L. yanomamioides* Garcia Aldrete, 1996		10	22		1		37		2	6		*					*					
57	*Lachesilla* Westwood, 1840. sp. F9B			11									*										
58	*L.* sp. (*pedicularia* group)	1	3	2				2	1	1	1		*						*				
	Ectopsocidae																						
59	*Ectopsocus mexicanus* Garcia Aldrete, 1991			1											*								
60	*E. titschacki* Jentsch, 1929		19	11	4	6	40	10			18		*	*		*	*	*		*			

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats										
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
61	*E. vilhenai* Badonnel, 1955				3			2	5				*									*	
	Peripsocidae																						
62	*Peripsocus potosi* Mockford, 1971			1				1			3		*										
63	*P. chamelanus* Badonnel, 1986							1			1		*										
64	*P. ca. stagnivagus* Chapman, 1930		1								1		*					*					
65	*P.* sp. 1		1	2									*					*					
	Archipsocidae																						
66	*Archipsocopsis* Badonnel, 1966. sp. 1		1	1		8	47	1		18	13		*	*								*	
67	*A.* sp. 2						5			2	3		*									*	
68	*A.* sp. 3						2							*									
69	*Archipsocus* Hagen, 1882 sp. 1						2						*										
70	*A.* sp. 2		1	9	1	2	2	2	1	3	36		*	*	*							*	
71	*A.* sp. 3						2						*										

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats										
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
72	*A.* sp. 4	1			1								*									*	
73	*A.* sp. 5						1													*			
74	*Pseudarchipsocus guajiro* Mockford, 1974									3			*										
	Pseudocaeciliidae																						
75	*Pseudocaecilius citricola* (Ashmead), 1879		1	1			1	4					*	*									*
76	*Heterocaecilius badonneli* Garcia Aldrete, 1989				14								*				*						
77	*Scytopsocus* Roesler, 1940 (ca. coriaceous Roesler, 1940)			3							3	1	*	*				*					
	Philotarsidae																						
78	*Haplophallus* Thornton, 1959			1				1			4		*										
79	*Aaroniella* Mockford, 1951										2		*										

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats									
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
	Elipsocidae																						
80	*Palmicola* Mockford, 1955					1	1						*		*								
81	*Nepiomorpha brasiliana* Badonnel, 1973			1				14					*										
	Hemipsocidae																						
82	*Hemipsocus africanus* Enderlein, 1907		1		58			6		16	5			*	*		*					*	*
83	*H. pretiosus* Banks, 1930			8										*			*						
	Psocidae																						
84	*Blastopsocus* Roesler, 1943. Sp.1			3				1			1		*		*					*			*
85	*B.* sp. 2			14							4		*		*			*					
86	*B*. sp. 3			1																*			
87	*Cerastipsocus trifasciatus* (Provancher), 1876		3	13				1					*										*
88	*Metylophorus* Pearman, 1932			1											*								

TABLE 3. (CONTINUED) PSOCOPTERA OF THE CALAKMUL BIOSPHERE RESERVE, CAMPECHE, AND VICINITY. NUMBER OF SPECIES TAKEN IN EACH LOCALITY, AND HABITATS IN WHICH EACH SPECIES WAS COLLECTED. I. BRANCHES AND FOLIAGE OF SHRUBS. II. LEAF LITTER. III. TREE TRUNKS AND BARK. IV. *TYPHA* FOLIAGE. V. DEAD PALM FRONDS. VI. BROMELIADS, ORCHIDS AND OTHER EPIPHYTES. VII. HERBACEOUS PLANTS. VIII. CALCAREOUS ROCK FACES. IX. ABANDONED TERMITE NEST. X. MALAISE TRAP. XI. LIGHT TRAP.

		Localities											Habitats										
		1	2	3	4	5	6	7	8	9	10	11	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
89	*Steleops* Enderlein, 1910				1										*								
90	*Ptycta* Enderlein, 1925. sp. 1							1					*										
91	*P.* sp. 2			1																*			
92	*P. tikala* (Mockford), 1957										1												*
93	*Trichadenotecnum* Enderlein, 1909. sp. 1			4								1	*										
94	*T.* sp. 2			3							1		*		*								
	Myopsocidae																						
95	*Lichenomima varia* (Navas), 1927		25	1											*					*			
96	*Myopsocus* Hagen, 1866			2		4	2	1							*		*	*		*		*	
Number of species		5	25	57	16	22	25	50	10	13	36	6	62	19	22	4	21	21	7	20	3	22	11
Number of individuals		7	126	408	110	102	231	290	29	59	298	15											

IX. Species occurring in tropical Mexico and Central America (5 species).

Caecilius totonacus Mockford, *C.* sp. 3, *Lachesilla tropica* Garcia Aldrete, *Scytopsocus* ca. *coriaceous* Roesler, *Lichenomima varia* (Navas).

X. Species restricted to the Yucatan Peninsula (5 species).

Psyllipsocus spp. 1 and 3, *Lithoseopsis* sp. 1, *Loneura leonilae* Garcia Aldrete, *Ptycta* sp. 2.

XI. Species occurring in the Yucatan Peninsula and neighbouring areas (6 species).

Lithoseopsis spp. 2 and 3, *Archipsocus* sp. 1, *Heterocaecilius badonneli* Garcia Aldrete, *Aaroniella* sp., *Myopsocus* sp.

XII. Species occurring in tropical Mexico (20 species).

Electrentomopsis variegatus Mockford, *Tapinella vittata* Garcia Aldrete, *Pachytroctes ixtapaensis* Garcia Aldrete, *Epipsocus* sp., *Dolabellopsocus roseus* Eertmoed, *Cladiopsocus ocotensis* Garcia Aldrete, *Caecilius* sp. 2, *Lachesilla bifurcata* Garcia Aldrete, *L.* sp. (*forcepeta* group), *L. pedicularia group*, *Ectopsocus mexicanus* Garcia Aldrete, *Peripsocus chamelanus* Badonnel, *P.* ca. *stagnivagus* Chapman, *Archipsocopsis* spp. 1 and 2, *Archipsocus* spp. 2, 3, 4, and 5, *Haplophallus* sp.

XIII. Species occurring in Cuba (2 species).

Embidopsocus cubanus Mockford, *Pseudarchipsocus guajiro* Mockford.

XIV. Species restricted to Guatemala or Belize (3 species).

Tapinella sp. 2, *Notiopsocus* sp., *Lachesilla* F9B.

Given the geographic location of Calakmul, the composition of its psocid fauna does not contain elements of surprise and it is rather as expected for an area near the edge of tropical Mexico, and close to Central America and the Caribbean; it is dominated by Mexican tropical species, with the addition of the species widespread in tropical America, plus the species also shared with Central America and the Caribbean region, plus the usual array of tropical waifs and cosmopolitans. Categories IX and X, of species restricted to the Yucatan Peninsula or occurring nearby, point to the biotic distinctness of that area (see also Barrera 1962). The category of endemics, comprising 19.79% of the fauna of Calakmul, gives it the element of uniqueness. It is pertinent to note that 18 of the 26 species previously recorded in Campeche, were found in the area of the Calakmul Reserve.

The results of this survey indicate that the psocid community of the Calakmul Biosphere Reserve area is rich in species, with a high proportion of endemics. It also indicates that the community shows fragility in that there is a large number of "rare" species (e.g. 40 species of which only 1-3 specimens were collected throughout the sampling period), and in that a large number of species have only a small amplitude of local distribution (e.g. 72 species collected in only one or two localities), with which environmental changes, either natural or anthropogenic, could result in local extinctions.

ACKNOWLEDGEMENTS

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