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New records of Uropodina mites from México, Guatemala, Belize and Costa Rica[1]

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ABSTRACT

In this paper are presented new records of Uropodina mites collected in different types of tropical forest from México, Belize and Guatemala, as well as in cloudy forest from México (Chiapas), Costa Rica and Guatemala.

The collects were made in México: at Calakmul Biosphere Reserve; Sian Ka'an Biosphere Reserve; El Cielo Biosphere Reserve; Chetumal Bay; in Belize: at Chiquibul National Park, and Belmopan (U.B campus), in Guatemala: at Gran Reserva Maya and El Petén; in Costa Rica: at Limón, Valle del Silencio. 90 spp are reported belonging to 23 Genera and 19 Families. The Calakmul Biosphere Reserve in México and Costa Rica have the high species richness with 26 spp. the first and 15 the second. The third place is for Chetumal Bay in México with 14 spp., some of them are cited for the first time for México.

KEY WORDS: Uropodina, Mites, México, Guatemala, Belice, Costa Rica, Tropical Forest.

RESUMEN

En este estudio se presenta un listado de nuevos registros de ácaros Uropodina colectados en diferentes tipos de bosques tropicales de México, Belice, Guatemala y Costa Rica.

Las colectas efectuadas en México se llevaron a cabo en las reservas de la Biosfera de Calakmul, Sian Ka'an, el Cielo y en la Bahía de Chetumal. En Belice las colectas se efectuaron en Chiquibul National Park y en el área del Campus de Belmopan, Universidad de Belice, así como en Benque Viejo del Carmen. En Guatemala las colectas se llevaron a cabo en la Gran Reserva Maya y en el área de El Petén. En Costa Rica las colectas fueron hechas en Limón, Valle del Silencio. Noventa especies de Uropodina son reportadas las cuales pertenecen a 23 géneros y a 19 familias. La Reserva de la Biósfera de Calakmul, Campeche en México y el Valle del Silencio en Costa Rica son los sitios que presentan la mayor riqueza de especies con 26 y 15 especies respectivamente y la Bahía de Chetumal, Q. Roo en México con 14 especies. Varias de las especies citadas se registran por primera vez para México, Guatemala y Costa Rica.

PALABRAS CLAVE: Uropodina, ácaros, México, Guatemala, Belice, Costa Rica, Bosque tropical.

INTRODUCTION

The group of Uropodina mites (Acari: Mesostigmata) include a very rich group of soil mites wich reach the high number of species mainly in tropical forest soils. The Uropodina fauna of México and Central America is poorly known (Kontschán, 2005). From countries like Guatemala, Belize and Costa Rica very few species has been recorded, in despite of their Ecosistem's Biodiversity.

The dominant tree species on the tropical forest of Yucatan Peninsula are: *Bucida buceras* L. ("pucte"), *Haematoxylon campechianum* L. ("palo de tinte") and *Dalbergia glabra* Standl. are the most representative at low canopy flood forest in Sian Ka'an Biosphere Reserve, Quintana Roo. *Swietenia* sp. ("caoba" or mahogany) *Cedrela odorata* L. ("cedro") and other commercially valuable hardwoods are the dominant ones at Calakmul Biosphere Reserve in Campeche and Botanical Garden in Quintana Roo.

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In the high parts of Mayan Mountains are present *Pinus caribaea* Morelet (Caribbean pine) and broad leafed tropical forest. In most of that sites the trees are covered with epiphytic plants such as *Tillandsia*, Bromeliaceae, Orchidiaceae and also lichens and bryophytes. Chiquibul National Park is one of the largest Biosphere Reserves in Belize.

In the uppers parts of Guatemala like Volcan del Fuego and Chichicastenango it's possible to see Oak and Pine trees as well as Spanish moss on the trees.

At El Cielo Biosphere Reserve (México) and in Limón, Valle del Silencio (Costa Rica), the vegetation is formed mainly by different spcies of *Quercus*.

The main goal of this study was to know the fauna of Uropodina mites in these main forest types. Many of the species reported in the present work constituted first records for the study sites and countries like Costa Rica and Guatemala.

MATERIAL AND METHODS

As part of a study on soil microarthropods of Quintana Roo and Campeche, México, litter and soil samples were taken bi-monthly from 2001 to 2005, in the Biosphere Reserves cited on this study and incidentally in other sites like Guatemala, Chiapas, México and Costa Rica.

Habitats sampled in Quintana Roo included a variety of sites with secondary forest, as well as river debris, mangrove, and litter. Sampling was performed in 16 sites located in five Biosphere Reserves from México, Guatemala, Belize and Costa Rica, in some of them; the samples were taken systematically while in others we collected only once (Table 1).

All soil and litter samples were processed in Berlese funnels, and the specimens were preserved in 70% ethyl alcohol. After sorting the Uropodina to morphoespecies, representatives of each type were cleared in lactophenol and mounted on microscope slides in Hoyer's solution. The majority of slide-mounted specimens were dissected, with separate dorsal and ventral (+legs) parts of the body on one slide, and mounthparts, gnathosoma and chelicera, on a separate slide. The study is based on about 820 slide mounted specimens with additional material in 70% ethyl alcohol.

Specimens are deposited in the collections of the University of Quintana Roo and Acarology Collection, Ohio State University. Identifications are based largely on Karg (1989) and Hirschmann & Wisniewski (1993).

In order to know the species affinities between localities was made a cluster analisis using the amalgamation rule the unweighted pair- groups average method and the 1- Person r as distance measure.

RESULTS

The high species richness of Uropodina has been finding in Tropical forests Vazquez & Klompen, (2007) (in press). In these sites the mites could find a great variety of microhabitats such us; litter, bark, rotting wood, bromelias, mushrooms as well as invertebrate and vertebrate nests. The highest number of individuals has been find in sites where the decomposition of the organic matter is in the last stage. According to Karg (1989) the Uropodina mites find the optimal condition in soils richs in organic matter.

The Uropodina improve the soil conditions, making soils more productive, Uropodina can be used as bioindicators of soils rich in organic matter (Karg, 1989).

The Cluster Analisis show us, that most of the localities sampled in Quintana Roo state of México are close with exception of Sian Ka'an Reserve biosphere wich is more closed to Palenque in Chiapas and Chichicastenango in Guatemala, while the locality of Limón in Costa Rica is totally different (Fig. 2).

Most of the Localities sampled in Quintana Roo and Campeche in México have a similar type of vegetation and climate, the same condition is for Palenque, México and Chichicastenango, Guatemala.

A total of 90 species of Uropodina mites was recovered from all sites representing 19 families and 23 genera (Tables 2 and 3).

At the generic level two of them are new records for México; for Costa Rica 6 genera, and for Guatemala 5 genera, all of them cited for the first time.

The genus *Polyaspis* is cited for the first time for Guatemala and Costa Rica and it is probably a new species for each country. The genera show a very wide distribution in México and Central America, we have specimens from Sian Ka'an, Calakmul, Noh-Bec and Chiapas, México and from Guatemala, Belize and Costa Rica.

The genera *Kaszajbaloghia* and *Multidenturopoda* are reported in this study for the first time for México.

The genus *Clausiadinychus* has only three described species, one from Martinique, other from Peru and Bolivia and the third from Brazil, this genus has been collected at the high part of the mountain with cloudy forest of Chichicastenango, Guatemala.

The highest species richness was found in the relatively undisturbed tropical rainforest of Calakmul (Campeche), Costa Rica and Chetumal Bay (Quintana Roo) with 26, 15 and 14e respectively for each site (Table 4).

Table 1. Characteristics of the sampled sites in México (M), Belize (B), Guatemala (G) and Costa Rica (CR). * indicate sites sampled bimonthly during two years (2001-2003), **indicate sites sampled eventually.

Site	Vegetation	Mainly vegetal species
*Cozumel Island, Quintana Roo. (M)	Medium high canopy forest.	*Acacia collinsii* Saff. *Lysiloma lalisiliquum* (L.) Benth.
*Botanical Garden, Quintana Roo, (M)	high and medium canopy, tropical forest.	*Ceiba aesculifolia* (Kunth) Britten & Baker *Bursera simaruba* (L.) Sarg. *Piscidia pscipula* (L.) Sarg. *Swietenia sp.* *Cedrela odorata* L.
*La Union, Hondo River and Cenote, on the border between Quintana Roo, México and Belize,	medium high canopy forest.	*Acoelorraphe wrightii* (Griseb & H. Wendland) H. Wendland ex Becc.
*Chetumal Bay, Quintana Roo, (M)	mangrove forest	*Rhizophora mangle* L. *Pouteria reticulata* (Engl.) Eyma subsp. *reticulata*
*Sian Ka'an Biosphere Reserve, Quintana Roo, (M)	low canopy flooded tropical forest.	*Manilkara zapota* (L.) van Royen *Bursera simaruba* (L.) Sarg. *Aechmea bracteata* (Sw) Griseb *Dalbergia glabra* Standl *Haematoxylon campechianum* L.
*Calakmul Biosphere Reserve, Campeche, (M)	high and medium canopy tropical forest.	*Swietenia macrophylla* King *Cedrela odorata* L. *Manilkara zapota* (L.) van Royen
*Bel-Ha, Calakmul, Biosphere Reserve, Campeche. (M)	high and medium canopy tropical forest.	*Nectandra coriacea* (Sw) Griseb *Lysiloma latisiliquum* (L.) Benth.
**Palenque, archaelogical site, Chiapas,	cloudy forest.	*Liquidambar* sp. *Quercus* sp.
El Cielo Biosphere Reserve, Chiapas. (M)	cloudy forest	*Pseudostuga* sp. *Quercus robur* L. *Populus interamericana* Brockh
* Belmopan, Forest Reserve. (B)	high and medium canopy tropical forest.	*Cedrela odorata* L. *Swietenia* sp.
**Chiquibul National Park. (B)	high canopy tropical forest	*Pinus caribeae* Morelet *Swietenia macrophylla* King
**Benque Viejo del Carmen. (B)	high medium canopy tropical forest	*Cedrela odorata* L. *Pinus caribeae* Morelet
**Volcan del Fuego (G)	pine-oak forest	*Abies guatemalensis* Rehder *Pinus tecunumanii* Eguiluz & J.P. Perry
**El Cantil. (G)	pine-oak forest	*Quercus conspersa* Benth. *Pinus montezumae* Lamb.
**Chichicastenango (G)	pine-oak forest and cloudy forest.	*Quercus conspersa* Benth. *Pinus montezumae* Lamb. *Pseudostuga* sp.
**Limón, Valle del Silencio. (CR)	high-medium canopy tropical forest	*Quercus copeyensis* C.H. Miill *Quercus costarricensis* Liebm.

The sites marked with * are the sites where collects were made bimonthly during two years and the sites marked with ** samples were taken incidentally.

DISCUSSION

Tropical forest show the highest species richness of Uropodina thanks to in this sites the mites find a great variety of habitats such as litter, bark, rotting wood, bromeliads, mushrooms, vertebrate and invertebrate nests, and Uropodina could take advantage of this Vazquez & Klompen, (2007) (in press), Kontschan (2005).

Comparing to the intensive studies of forest soils and litter carried out in France and Belgium where the total of species of Uropodina was 19 Athias-Binche (1981), while at the Chetumal Bay were found 14 species, on mangrove soil and litter as well as in debris carried out for the waves and the Hondo River.

Eighteen species of the genus *Polyaspis* has been described. The know species show a wide distribution, although the most species (12) has been described from Europe. With this study, 6 new species are recorded from México, Belize, Guatemala and Costa Rica.

The genus *Polyaspis* has only three species described from America, two from USA and one from Brazil, although the genus seems to have a very wide distribution in the tropical forest. We have at least 6 new species collected in different tropical forest in México, Belize, Guatemala and Costa Rica.

A survey of geographical affinities of the Genera collected in the studied area, shows that 10 of 23 have a mainly tropical and Neotropical distribution that mean 43.47% of the total of species, 11 are considered Cosmopolitan with the 47.82% and 2 Holarctic with the 8.69%. *Multidenturopoda* was only known from Cameroon.

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Table 2. Species Richness and geographic distribution of Uropodina From México, Belize, Guatemala and Costa Rica

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	No of spp. known and Geographic Distribution
1) Clausiadinychus sp.1													X				Neotropical. Martinique, Peru, 3 spp Brazil.
2) *Clausiadinychus* sp.2														X			
3) *Clausiadinychus* sp.3															X		
4) *Cyllibula* sp.1			X	X													Cosmopolitan. 29 spp. Europa
5) *Cyllibula* sp.2											X						
6) *Cyllibula* sp.3								X									
7) *Cyllibula* sp.4												X					
8) *Cyllibula* sp.5													X				
9) *Cyllibula* sp.6									X	X							
10) *Cyllibula lindquisti*						X											From México
11) *Cyllibula mexicana*				X		X											From México
12) *Cyllibula* ca. *mirabilis*											X						From Brazil
13) *Discourella lindquisti*						X											Cosmopolitan 71 spp sp.described from México
14) *Eutrachytes maya*	X	X															Sp. described from México from Yucatan Peninsula
15) *Eutrachytes* sp.																X	
16) *Kaszabjbaloghia* sp.				X													Neotropical mainly 6 spp. Known
17) *Nobuohiramatsuia* sp.	X			X													2spp. One from Japan other from New Guinea
18) *Macrodinychus* ca. *hutuae*				X													21 spp. known mainly Neotropical.
19) *Nenteria* sp. 1									X								Cosmopolitan 125 spp known 9 spp from México
20) *Nenteria* sp. 2																X	Also live associated with Coleoptera

21*) Oplitis belizensis*						X											Cosmopolitan155 spp. known asoc. to ants, Coleoptera detritus
22) *Oplitis cubana*						X											From Cuba
23) *Oplitis dimidiata*						X											
24) *Oplitis uncinata*						X											
25) *Oplitis ca. mayae*										X				X			Described from Belize
26) *Oplitis ca. paraguayensis*			X														From Paraguay
27) *Oplitis castrisimiles*						X											From Chile
28) *Oplitis* sp. 1																X	
29) *Oplitis* sp. 2									X								
30) *Polyaspis* sp. 1					X												Cosmopolitan 18 spp. known none described from México two sp. from USA one from Bolivia one from Brazil These are the first records of the genus from Guatemala and Costa Rica
31) *Polyaspis* sp. 2		X															
32) *Polyaspis* sp. 3										X							
33) *Polyaspis* sp. 4											X						
34) *Polyaspis* sp. 5						X											
35) *Polyaspis* sp. 6													X				
36) *Polyaspis* sp. 7																X	
37) *Poliaspinus* sp. 1					X												Cosmopolitan 10 spp. known. There are not species described from México
38) *Poliaspinus* sp. 2		X															
39) *Dipolyaspis* sp.					X												Associated to Formicidae 2 spp. known from Europe
40) *Uropoda* (*Phaulodinychus*) sp.			X	X													
41) (*Phaulodinychus) similibrasilensis*						X											
42)*Trichouropodella* sp.						X											Mainly Neotropical 9 spp. known one from Japan
43)*Trichouropodella panamensis*			X														
44*)Trichouropodella brasilensis*				X													
45) *Tetrasejaspis* sp.						X											all spp. Neotropical 9 spp. known None from México
46) *Trichouropoda* ca. *vannaoides*		X				X											Cosmopolitan 388 spp. known

47) *Trichouropoda cienfuegui*						X											
48) *Trichouropoda cocoensis*						X											
49) *Trichouropoda.* ca. *kryptopoda*						X											
50) *Trachyropoda mexicana*											X						Cosmopolitan 112 spp. known
51) *Trachyropoda quadriauricularis*						X											
52) *Trachyropoda baloghsimilis*						X											
53) *Trachyropoda ca. castrii*					X												
54) *Trichocylliba* sp.										X							Mainly Neotropical. 49 spp known asoc. to Formicidae
55) *Trigonuropoda* ca. *cubanicolaea.*			X														Tropical 80 spp. known
56) *Trigonuropoda* sp. 1						X	X										
57) *Trigonuropoda* sp. 2								X									
58) *Uroobovella* ca. *flagelliformis*				X													Cosmopolitan 262 spp.
59) *Uroobovella* ca. *foveolatasimilis*						X											
60) *Uroobovella* ca. *ambigua*				X													
61) *Uroobovella* ca. *nantuoensis*				X													
62) *Uroobovella* ca. *takaki*											X						
63) *Uroobovella* ca. *assamomarginata*				X													
64) *Uroobovella.* ca. *japanomarginata*						X											
65) *Uroobovella* ca. *mesoafricana*																X	
66) *Uroobovella* sp. 1																X	
67) *Uroobovella* sp. 2																X	
68) *Uroobovella* sp. 3																X	
69) *Uroobovella* sp. 4																X	
70) *Uroobovella* sp. 5									X								
71) *Urodiaspis* sp. 1						X											Holartic 22 spp. known None from México

72) *Urodiaspis* sp. 2						X											One spp From Chile and USA
73) Urodiaspis sp. 3																X	
74) Uropoda sp. 1																X	Cosmopolitan 340 spp. known
75) *Uropoda* sp. 2																X	
76) *Uropoda* sp. 3																X	
77) *Uropoda* sp. 4																X	
78) *Uropoda* sp. 5																X	
79) *Uropoda* sp. 6													X				
80) *Uropoda* sp. 7									X								
81) *Uropoda* sp. 8						X	X										
82) *Uropoda* sp. 9			X	X													
83) *Uroactinia* sp.	X																Mainly tropical 49 spp. known asociated to Formicidae and guano of marine birds.
84) *Chyropturopoda* sp.				X													
85)*Multidenturopoda* sp.									X								Only one sp. from Cameroon.
86) *Phymatodiscus* sp. 1						X											Tropical 10 spp. known New Guinea and Java None from México Neither from America
87) *Phymatodiscus* sp. 2				X													
88) *Phymatodiscus* sp. 3			X														
89) *Phymatodiscus.* sp. 4						X											
90) *Phymatodiscus.* sp. 5		X															
Total of spp.	3	5	7	14	4	26	2	2	6	6	5	1	4	2	1	15	

1.- Cozumel Island, Quintana Roo, México. 2.- Botanic Garden Puerto Morelos, Quintana Roo, México. 3.- La Unión Hondo River Bank, Quintana Roo, México. 4.- Chetumal Bay, Quintana Roo, México. 5.- Sian Ka'an Biosphere Reserve, Quintana Roo, México. 6.- Calakmul Biosphere Reserve, Campeche, México. 7.- Bel-Ha, Calakmul, Campeche, México. 8.- Palenque, Chiapas, México. 9.- Del Cielo Biosphere Reserve, Chiapas, México. 10.- Belmopan, University of Belize campus Belmopan, Belize.11.- Chiquibul National Park, Belize. 12.- Benque Viejo del Carmen Belize. 13.- Volcán de Fuego, Guatemala. 14.- El Cantil, Guatemala. 15.- Chichicastenango. Guatemala. 16.- Limón Valle de Santiago, Costa Rica.

Table 3. Uropodina: Families and genera present in México, Belize, Guatemala and Costa Rica

Family and Genera	Spp. Known	Geographic Distribution	Countries of the study
1) Clausiadinychidae			
Clausiadinychus	3	Neotropical	Guatemala
2) Cyllibulidae			México, Belize
Cyllibula	29	Cosmopolitan	and Guatemala
3) Discourellidae			
Discourella	71	Cosmopolitan	México
4) Eutrachytidae	?		México
Eutrachytes	3 sp.	Neotropical	Costa Rica
5) Kaszabjbaloghiidae			
Kaszabjbaloghia	6	Neotropical	México
6) Macrodinychidae			
Macrodinychus	21	Neotropical	México
7) Inserta cedis			
Multidenturopoda		Tropical	México
8) Nentereiidae			
Nenteria	125	Cosmopolitan	México
9) Oplitidae			
Oplitis	155	Cosmopolitan	México
10) Polyaspidae			México, Belize, Guatemala
Polyaspis	18	Cosmopolitan	and Costa Rica
Dipolyaspis	2	Europe	México
11) Polyaspinidae			
Polyaspinus	10	Cosmopolitan	México
12) Tetrasejaspidae			
Tetrasejaspis	9	Neotropical	México
13) Trachyuropodidae			
Trachyuropoda	112	Cosmopolitan	México and Belize
14)			
Trichouropoda	388	Cosmopolitan	México
15) Trichouropodellidae			
Trichouropodella	9	Neotropical	México
16) Trigonuropodidae		Neotropical and	
Trigonuropoda	80	Tropical	México
17) Uroatinidae			
Uroactina	49	Tropical	México
Quiropturopoda	1?	Tropical	México
18) Urodiaspidae			
Urodiaspis	22	Holartic	México
19) Urodinychidae			México, Belize
Uroobovella	262	Cosmopolitan	and Costa Rica
20) Uropodidae			México, Belize, Guatemala
Uropoda	340	Cosmopolitan	and Costa Rica
Phaulodynichus		Cosmopolitan	México

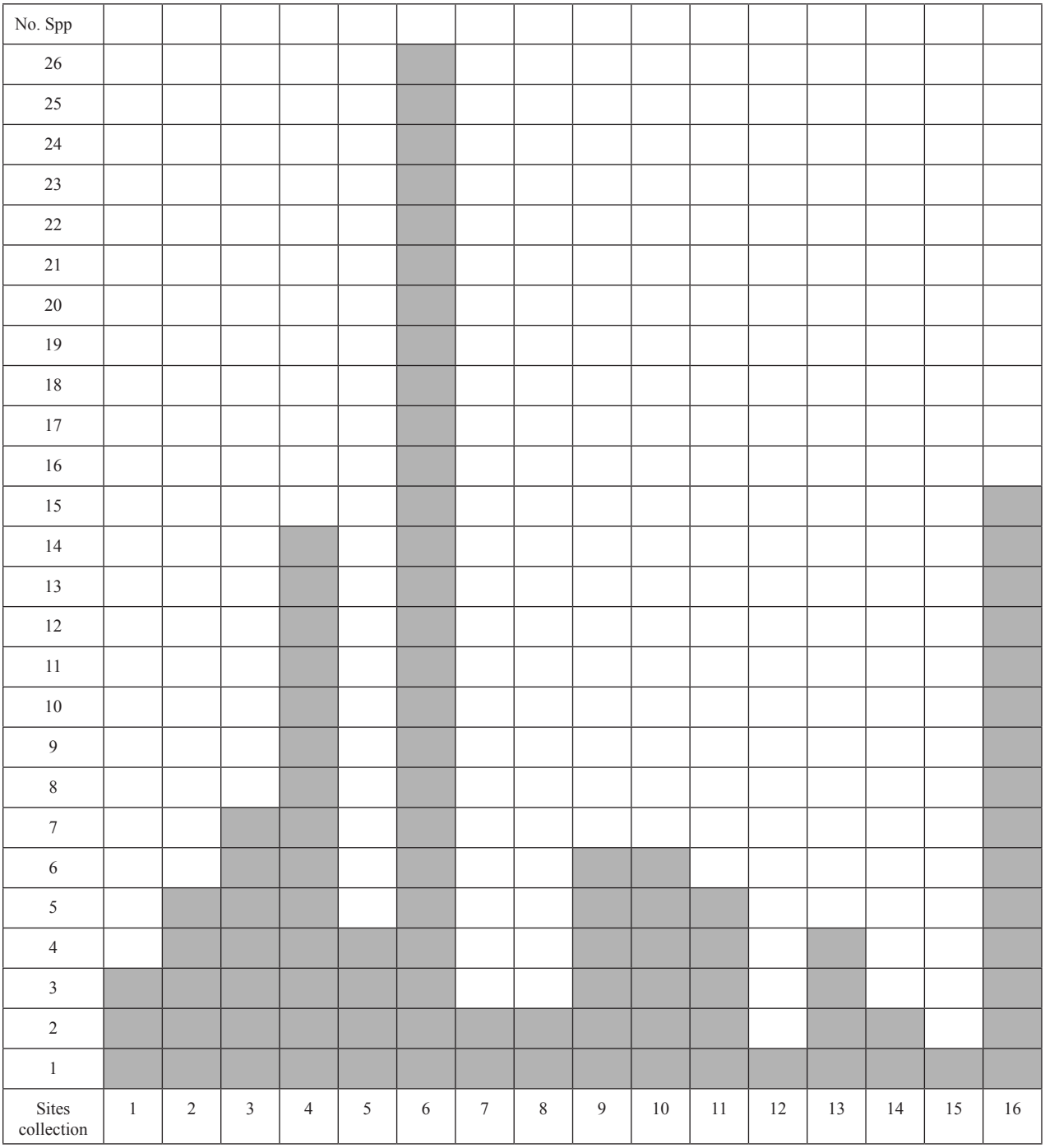

Figure 1.Species Richness of the sites studied. **México**: 1) Cozumel Island (QROO); 2) Botanic Garden, Puerto Morelos (QROO); 3) La Union Hondo River Bank (QROO); 4) Chetumal Bay (QROO); 5) Sian Ka'an Biosphere Reserve (QROO); 6) Calakmul Biosphere Reserve (Campeche);7) Bel-Ha Biosphere Reserve (Campeche); 8) Palenque (Chiapas); 9) Del Cielo Biosphere Reserve (Chiapas). Belice: 10) U.B. Belmopan; 11) Chiquibul National Park; 12)Benque Viejo del Carmen. Guatemala: 13) Volcán de Fuego; 14) El Cantil; 15) Chichicastenango. Costa Rica: 16) Limón, Valle del Silencio.

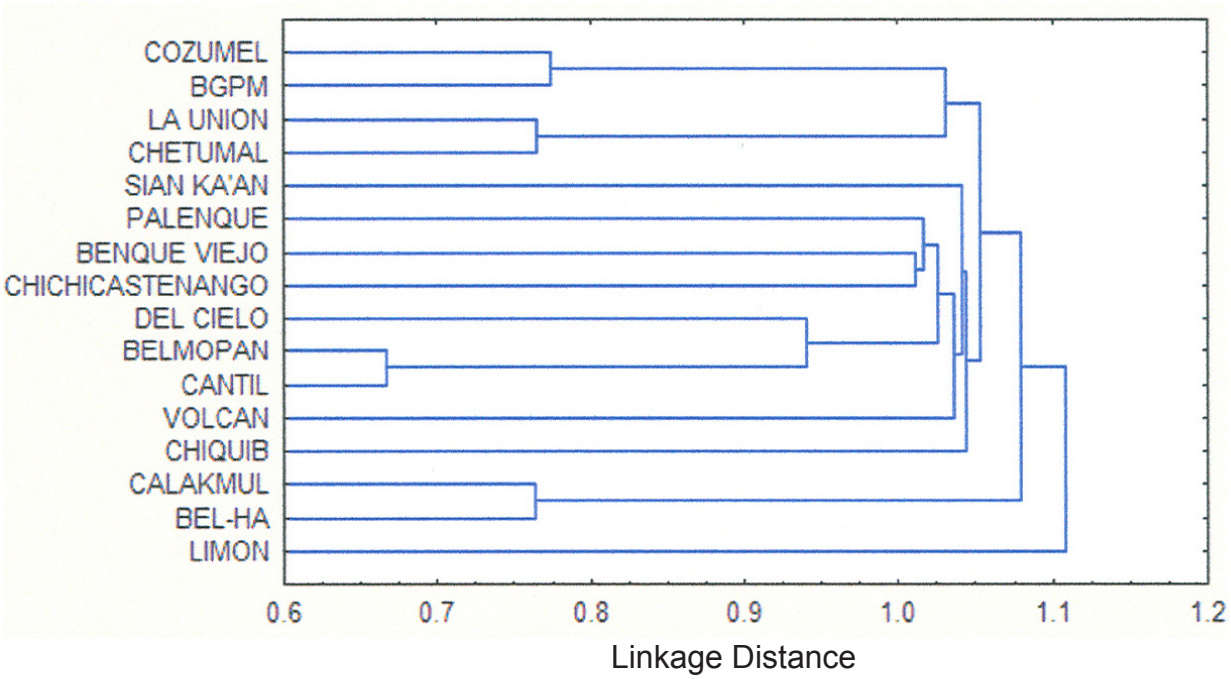

Figure 2. Cluster analysis of the species studied using amalgamation rule the unweighted pair. Group average method, and the 1-pearson *r* as distance measure.

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