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Ptyctimous mites of Southern Hemisphere (Acari: Oribatida)

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Abstract. The greatest number of species occurs in Neotropical Region. In general Phthiracaroidea are more speciose than Euphthiracaroidea. Mesoplophoridae are the most numerous in the Oriental region. Protoplophoridae are the most abundant in Neotropical Region, while they do not occur in Ethiopian, Australian and South Africa Regions. The faunas of all regions seem harmonious, i.e. in the same proportion represented by the primitive and evolved genera. The most abundant and harmonious is the fauna of the Oriental Region. The species representations of particular genera in the regions are different: *Mesoplophora*, *Mesotritia*, *Euphthiracarus*, *Arphthicarus* and *Protophthiracarus* are the most specious in the Neotropical region. *Apoplophora* is typically Oriental, while *Austrotritia* is mostly Oriental and Australian. The other species show some preferences of occurrence. Four genera are endemic of Oriental Region. Each region has its characteristic specific dominance of different genera. In all regions the proportion of endemic and indigenous species is high (over 80 %) and a small number of widespread species exists. Each region has specific faunistic features.

Key words: acarology, zoogeography, ptyctimous mites, Southern Hemisphere.

INTRODUCTION

Ptyctimous mites have specific, ptychoidal construction of body. They are capable of folding the aspidosoma against the opisthosoma to protect their appendages and in this way they avoid predation. Ptyctimous mites occur wherever there is decaying organic matter. They are secondary decomposers and as macrophytophages they play an important role in mechanical fragmentation of organic matter.

Ptyctimous mites belong to Oribatida (Acari) inferiores – Macropylina, comprising two families and two superfamilies. Protoplophoridae are the sister group of Sphaerochthoniidae and together with three other families they belong to the superfamily

Protoplophoroidea, whereas Mesoplophoridae are the sister group of Eniochthoniidae and together with Hypochthoniidae belong to the superfamily Hypochthonioidea. These two superfamilies are included in the group of Enarthronota. Euphthiracaroidea and Phthiracaroidea known also as Euptyctima belong to the group of Mixonomata (Niedbała 2002). Euphthiracaroidea have the body considerably compressed laterally and genitoaggenital and anoadanal regions narrow, V-shaped. Phthiracaroidea have the body less compressed laterally and genitoaggenital and anoadanal regions relatively wide, U-shaped.

This paper sums up my investigation of the ptyctimous mites of all zoogeographic regions of Southern Hemisphere, presented in a few monographs (Niedbała 1998, 2000, 2001, 2004, 2006). The different regions have not been uniformly explored and the results have proved that many of the species were new to science, described from one site or one habitat, and preliminary classified as endemic.

RESULTS

1. The greatest number of species occurs in the Neotropical Region. In almost all regions the number of the Phthiracaroidea species is higher than that of the species representing Euphthiracaroidea. Only in the Oriental Region the number of species representing those two superfamilies is similar. In the Oriental Region the number of the Mesoplophoridae species is the highest. Protoplophoridae are most abundantly represented in the Neotropical Region, but they do not occur in the Ethiopian, Australian and South Africa Regions (tab. 1, 2).

2. In all regions the faunas seem harmonious, that is equally represented by the primitive and evolved genera. The most abundant and most harmonious is the fauna of the Oriental Region in which the number of the Euphthiracaroidea genera is higher than that of Phthiracaroidea. The proportions of genera in the Ethiopian and South Africa Regions are the same. In the Neotropical and Australian Regions the number of Phthiracaroidea is higher than that of Euphthiracaroidea.

The genera are unevenly represented by species in particular regions. *Mesoplophora*, *Mesotritia*, *Euphthiracarus*, *Arphthicarus* and *Protophthiracarus* are represented by the greatest number of species in the Neotropical Region; *Apoplophora* is an Oriental genus; *Austrotritia* is met chiefly in the Oriental and Australian Regions.

The percent representations of the genera: *Oribotritia*, *Acrotritia*, *Microtritia*, *Phthiracarus*, *Plonaphacarus* and *Hoplophthiracarus* in all the regions are similar. The other genera show some preferences of occurrence, i.e. *Indotritia* prefers South Africa, *Pocsia* and *Hoplophorella* prefer the Ethiopian Region. *Atropacarus* is a subgenus not represented on the continent of Africa. A few genera represented by a scarce number of species and clearly endemic occur only in the Oriental Region: *Terratritia*, *Sumatrotritia*, *Sabahtritia*, *Temburongia* or in the Oriental and Australian Regions (*Sobacarus*).

Another feature differentiating the regions is the specific dominance of certain genera in each of them. For instance, the Neotropical Region is characterised by high abundance or dominance of a few - at least nine - species, while in the Australian Re-

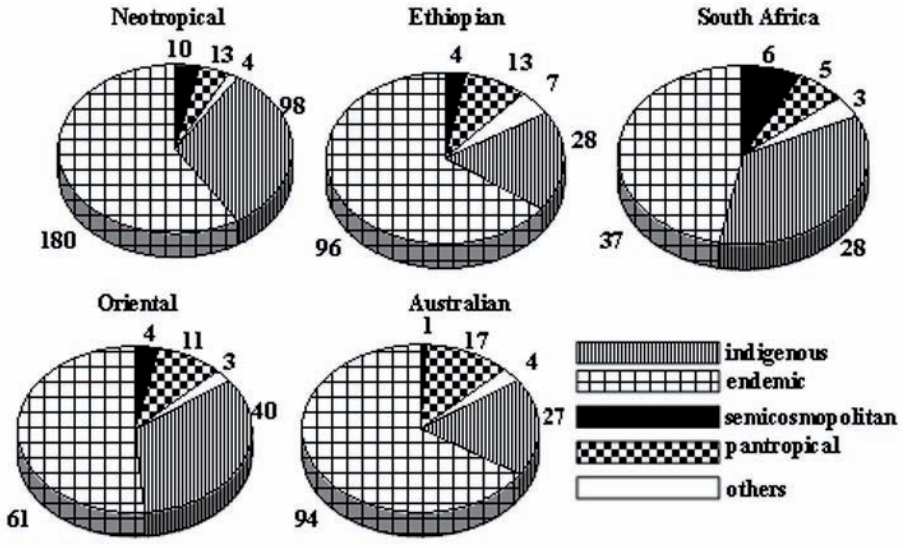
gion the dominant genera are only *Notophthiracarus* and *Austrophthiracarus*, in the Oriental Region, similarly as in the Ethiopian Region and South Africa the dominant are only *Notophthiracarus* and *Phthiracarus* (additionally in the Ethiopian Region *Hoplophorella* and in the Oriental Region *Acrotritia*) (tab. 1).

3. The number of endemic species is the highest (over 60 %) in the Oriental and Australian Regions. In all the regions the number of endemic and indigenous species reaches over 80 % and it is the highest - of over 90% - in the Neotropical Region. The number of widespread species is low; from a few (Neotropical Region) to fewer than 20% in the other regions. The contribution of the species originating from the neighbouring regions is very low (less than a few percent), e.g. the contribution of the Ethiopian Region species in South Africa, or that of Oriental species in the Australian Region or the number of Nearctic species in the Neotropical Region (Fig. 1).

4. Each region has its unique faunistic features.

Neotropical: The greatest number of species. Almost exclusive occurrence of Protoplophoridae. The greatest number of species representing Mesoplophora. The greatest number of the species representing *Mesotritia*, *Euphthiracarus*, *Arphthicarus*, *Protophthiracarus*, *Steganacarus* (along with Ethiopian Region), *Austrophthiracarus* (along with Australian Region).

Ethiopian: No occurrence of Protoplophoridae. The greatest number of the species representing *Pocsia*, *Hoplophorella*, *Steganacarus* (together with Neotropical Region), no occurrence of *Atropacarus* (*Atropacarus*).



1. Number of zoogeographical elements of ptyctimous mites

Table 1. Number of ptyctimous species within genera in zoogeographical regions of southern hemisphere.

GENERA	NEOTROPICAL		ETHIOPIAN		SOUTH AFRICA		ORIENTAL		AUSTRALIAN	
	∑	%	∑	%	∑	%	∑	%	∑	%
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Protoplophoridae										
Aedoplophora	1	20.0								
Bursoplophora	2	40.0								
Cryptoplophora	1	20.0								
Prototritia	1	20.0					2	100.0		
∑	**5**						**2**			
Mesoplophoridae										
Archoplophora	1	6.7					1	5.9		
Mesoplophora										
Mesoplophora	12	80.0	2	50.0	1	20.0	3	17.6	1	33.3
Parplophora	2	13.3	2	50.0	4	80.0	5	29.4	1	33.3
Apoplophora							8	47.0	1	33.3
∑	**15**		**4**		**5**		**17**		**3**	
Euphthiracaroidea										
Oribotritia	18	19.6	7	19.4	4	18.2	7	14.9	6	23.1
Mesotritia	14	15.2	2	5.6	1	4.5	1	2.1		
Protoribotritia					1	4.5				
Indotritia										
Indotritia	6	6.5	6	16.7	8	36.4	3	6.4	4	15.4
Afrotritia			1	2.8						
Sobacarus							1	2.1	1	3.8
Terratritia							2	4.2		
Austrotritia			1	2.8	1	4.5	5	10.6	4	15.4
Euphthiracarus										
Euphthiracarus	22	23.5	1	2.8	2	9.1	4	8.5	1	3.8
Pocsia	5	5.4	8	22.2			1	2.1		
Acrotritia	20	21.7	6	16.7	4	18.2	10	21.3	6	23.1
Bukitritia			1	2.8			1	2.1		
Smatrotritia							2	4.2		
Microtritia	7	7.6	3	8.3	1	4.5	2	4.2	4	15.4
Synichotritia							3	6.4		
Sabahtritia							4	8.5		
Temburongia							1	2.1		
∑	**92**		**36**		**22**		**47**		**26**	
Phthiracaroidea										
Phthiracarus	21	10.9	17	15.7	14	26.9	10	18.9	5	4.4
Plonaphacarus	3	1.5	9	8.3			8	15.1	8	7.0
Hoplophthiracarus	8	4.1	4	3.7			6	11.3	6	5.3

Table 1. Continuation.

GENERA	NEOTROPICAL		ETIOPIAN		SOUTH AFRICA		ORIENTAL		AUSTRALIAN	
	∑	%	∑	%	∑	%	∑	%	∑	%
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Steganacarus										
Steganacarus	14	7.2	10	8.3					1	0.9
Rhacaplacarus	11	5.7	9	9.3					2	1.7
Austrophthiracarus	31	16.1	2	1.8	1	1.9	3	5.7	29	25.4
Arphthicarus	34	17.6	9	8.3	1	1.9	5	9.4	4	3.5
Protophthiracarus	25	12.9	5	4.6	2	3.8				
Phrathicarus									1	0.9
Notophthiracarus	28	14.5	21	19.4	29	55.8	13	24.5	51	44.7
Atropacarus										
Hoplophorella	13	6.7	22	20.4	5	9.6	7	13.2	5	4.4
Atropacarus	5	2.6					1	19.0	2	1.7
∑	**193**		**108**		**52**		**53**		**114**	
Total	**305**		**148**		**79**		**119**		**143**	

Table 2. Number of genera/subgenera and (number of species) of ptyctimous mites of zoogeographical regions.

	Neotropical	Ethiopian	South Africa	Oriental	Australian
Protoplophoridae Mesoplophoridae	**7 (20)**	**2 (4)**	**2 (5)**	**5 (19)**	**3 (3)**
Euphthiracaroidea	**7 (92)**	**10 (36)**	**8 (22)**	**15 (47)**	**7 (26)**
Phthiracaroidea	**11 (193)**	**10 (108)**	**6 (52)**	**8 (53)**	**11 (114)**
Σ	**25 (305)**	**22 (148)**	**16 (79)**	**28 (119)**	**21 (143)**

South Africa: The lowest number of species and genera. No occurrence of Protoplophoridae. The lack of representatives of a few genera, e.g. *Euphthiracarus* (*Pocsia*), *Steganacarus* (*Steganacarus*), *Atropacarus* (*Atropacarus*). The greatest number of species representing *Indotritia*.

Oriental: The occurrence of a few endemic genera. The greatest number of genera. The almost exclusive presence of *Apoplophora*. The almost exclusive presence of the species *Austrotritia* (together with Australian Region). The lack of representatives of *Steganacarus* and *Protophthiracarus*.

Australian: Exclusive presence of endemic *Phrathicarus*. The lack of representatives of Protoplophoridae and *Protophthiracarus*. The lack of a few genera, e.g. *Mesotritia*, *Pocsia*. The most abundant presence of the species *Notophthiracarus*, *Austrotritia* (together with Oriental region), *Austrophthiracarus* (together with Neotropical Region).

5. The degree of similarity of the ptyctimous mite fauna of the regions of southern hemisphere is very low and limited to a common presence of a few widespread pantropical and semicosmopolitan species. However, the presence of the widespread species cannot be an argument for the similarity of faunas. The actual degree of similarity of the faunas of particular regions could be estimated on the basis of the number of vicariants – the species that had probably occurred over vast areas prior to the drift of the continents but after their separation and whose morphological features were modified under the effect of environmental differences to such a degree that today they are classified as different species. The investigation of vicariantes has not been complete yet.

A comparative analysis of the ptyctimous mite faunas of the Southern Hemisphere reveals a very weak similarity as well poor exchange of the neotropical, ethiopian, oriental and australian elements.

It would be interesting to compare the fauna of Southern Hemisphere with that of Holarctic and Palearctic in particular, to - among others - identify the centres of speciation and origin of species. The relevant study is underway.

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