World distribution of the genera of fungus gnats (Diptera: Sciaroidea, excluding Sciaridae)

[Verbreitung der Genera der Pilzmücken der Weltfauna (Diptera: Sciaroidea, außer Sciaridae)]

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Abstract A list and an analysis of the distribution of 226 genera of fungus gnats in the world have been completed. The number of genera, the endemism at generic level in the zoogeographical regions and the degrees of correlation between fungus gnats and their faunas have been subjected to analysis. The data about the species recognised to exist by 1997 (these being over 4100) have been summarised.

Key words Diptera, Sciaroidea, zoogeography, biogeography, endemism, biodiversity

Zusammenfassung Es wird eine Liste der 226 Pilzmückengattungen der Weltfauna erarbeitet und die weltweite Verbreitung der Genera analysiert. Die Anzahl der Gattungen, die Verteilung endemischer Gattungen in Bezug auf ihre Verbreitung in den zoogeographischen Hauptregionen sowie Korrelationen des Auftretens der einzelnen Gattungen mit ihrer Verbreitung in den Faunenreichen wurde analysiert. Es wurden alle Arten berücksichtigt, die bis Ende 1997 beschrieben waren (> 4100).

Stichwörter Diptera, Sciaroidea, Zoogeographie, Biogeographie, Endemismus, Biodiversität

Introduction

Superfamily Sciaroidea belongs to the infraorder Bibionomorpha of the order Diptera. It includes the families of Bolitophilidae, Diadociidae, Ditomyiidae, Keroplatidae, Lygistorrhinidae, Mycetophilidae and Sciaridae (MATILE 1990). So far over 4100 species belonging to 226 genera (excluding Sciaridae) have been described for the world. With the exception of some species which also occur in the tundra, the fungus gnats are most common in forest habitats and on the whole do not inhabit dry areas. The larvae of most species develop in fungal microhabitats and are mycetophagous, while only a few species are xylomycetophagous, zoomycetophagous, zoophagous or feed on mosses.

Material and methods

This paper analyses the distribution of the genera of fungus gnats in the zoogeographical regions of the world. The number of species and genera of the particular families (see appendix) is taken from the respective region catalogues (SOÓS & PAPP 1988, LAFFOON 1965, COLLESS & LIEPA 1973, MATILE 1980, 1989; PAPAVERO 1977a-c, 1978a, b). The data have been amended in accordance with the contemporary developments in the classification and nomenclature of superfamily and have been completed by including all the genera and most of the described species published up to 1997 inclusive. The borders of the zoogeographical regions are outlined as specified in the respective catalogues which corresponds to a great extent to the classic view of zoogeographical regions as stated in WALLACE (1876). The faunal similarity between the regions is expressed by Czekanovski - Dice - Sørensen's index

I_{cs} = 2a / (a+b) + (a+c) (after PESENKO 1982: 135) calculated with computer programme BIODIV (BAEV & PENEV 1995). Designations in the formulae are: a = number of genera in common for the two regions being compared; b = number of genera present in the first region only; c = number of genera in the second region only.

Results and discussion

The greatest number of fungus gnats genera are distributed in the Palaearctic (96 genera), Nearctic (92), Neotropical (92) and Australian (92) regions: (Table 1; Fig. 1). The number of genera is lower in the Afrotropical (64) and Oriental (75) areas. There are 109 genera in the Holarctic (Palaearctic + Nearctic) and 190 outside it. The presence of the families in the zoogeographical regions varies (Table 1). Most of the families are distributed in all or almost all the regions, but the Bolitophilidae is found only in the Holarctic. The youngest phylogenetic family Mycetophilidae (see MATILE 1990: 386) has its richest presence in the Holarctic, while the older families such as Ditomyiidae and especially Keroplatidae have theirs outside this area.

Tab. 1: Distribution of the families of fungus gnats. Abbreviations: **PAL** = Palaearctic, **NEA** = Nearctic, **OR** = Oriental, **AFR** = Afrotropical, **NEO** = Neotropical, **AUS** = Australian Region. Numbers = number of genera; in brackets = number of endemic genera

REGION	PAL	NEA	OR	AFR	NEO	AUS	Total
DITOMYIIDAE	3 (1)	2 (0)	2 1)	0 (0)	5 (3)	2 (0)	9 (5)
DIADOCIDIIDAE	1 (0)	1 (0)	0 (0)	0 (0)	2 (1)	1 (0)	2 (1)
KEROPLATIDAE	19 (1)	15 (3)	26 (6)	27 (11)	31 (9)	33 (15)	79 (45)
BOLITOPHILIDAE	1 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)
LYGISTORRHINIDAE	1 (0)	1 (0)	1 (0)	2 (1)	1 (0)	1 (0)	2 (1)
MYCETOPHILIDAE	71 (4)	72 (4)	46 (4)	35 (8)	53 (9)	55 (21)	133 (50)
TOTAL	**96 (6)**	**92 (7)**	**75 (11)**	**64 (20)**	**92 (22)**	**92 (36)**	**226 (102)**
% endemic of total No of genera in the region	(6.2)	(7.6)	(14.7)	(31.2)	(23.9)	(39.1)	(45.1)
% of total No of endemic genera	(5.9)	(6.9)	(10.8)	(19.6)	(21.6)	(35.3)	

The total amount of endemic fungus gnats genera is impressive - 102 or 45.1 %. Despite the fact that there is a large number of genera in the Palaearctic and Nearctic, the endemism in these areas is lowest (Fig. 1). The highest generic endemism is occurs in the Australian (39.1 % of its genera), Afrotropical (31.2 %) and Neotropical (23.9 %) regions (Table 1). It is relatively highest in phylogenetically older families Ditomyiidae (55.6 % of its genera), Keroplatidae (57.0 %) and Diadocidiidae (50.0 %).

The degree of correspondence between the faunas of the zoogeographical regions (Table 2; Fig. 2 and Fig. 3) indicates the basic faunal relations among them in relation to the fungus gnats fauna. The greatest is the similarity between the Palaearctic and Nearctic, followed by the Palaearctic and the Oriental and the Afrotropical and the Oriental regions. The genera found in only two of the regions complement the above mentioned data and emphasise additionally two relations: Palaearctic - Nearctic and Australian - Neotropic. Out of the 51 genera the distribution of which follows this pattern, 23 are Holarctic and 13 Australian - Neotropical, the latter commonly restricted to Chile and Patagonian part of Argentina.

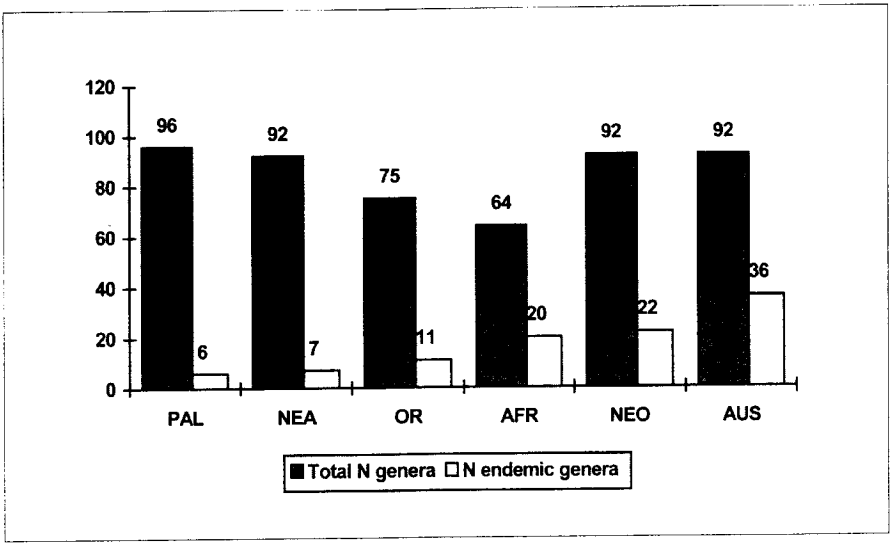

Fig. 1: Disposition of the total number and number of endemic genera of fungus gnats under zoogeographical regions. Abbreviations: as in table 1.

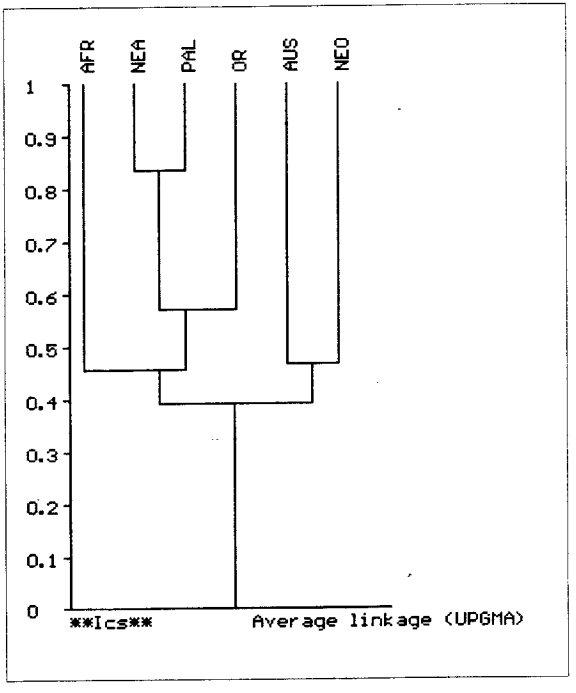

Fig. 2: Dendrogram of similarity between the zoogeographical regions based on the distribution of the genera of fungus gnats. Abbreviations: as in table 1; Ics = Czekanovski - Dice - Sørensen's index.

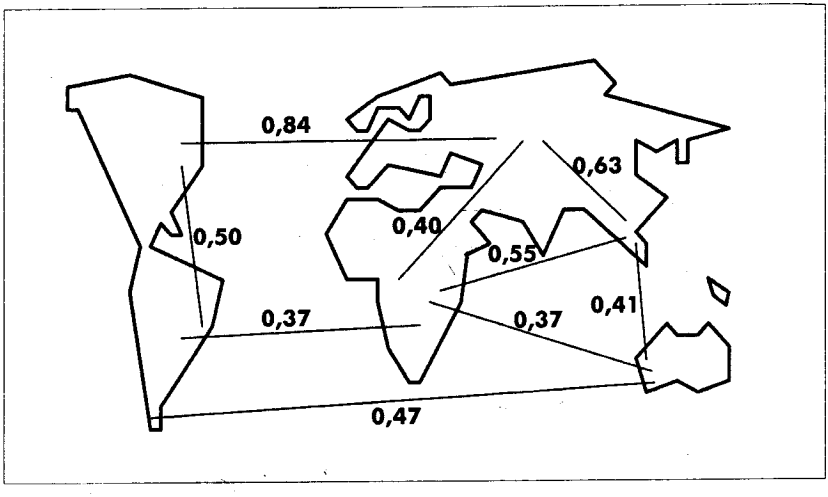

Fig. 3: Degrees of faunal similarity between the zoogeographical regions, based on the distribution of the genera of fungus gnats. Numbers = Czekanovski - Dice - Sørensen's index.

Tab. 2: Coefficients of faunal similarity (Ics) between the zoogeographical regions based on the distribution of the genera of fungus gnats. Abbreviations: as in table 1

	AUS	NEA	NEO	OR	PAL
AFR	0.372	0.333	0.372	0.547	0.398
	AUS	0.315	0.467	0.407	0.360
		NEA	0.500	0.515	0.836
			NEO	0.419	0.476
				OR	0.628

The analysis of the geographical distribution of the fungus gnats genera shows a certain regularity in their world distribution:

(1) There are fewer genera, and fewer endemic genera, in the Holarctic region than in the more southern regions. This is due to the long isolation of the biotas of the old fragments of Gondwana, as a prerequisite for divergence and considerable endemism in the southern zoogeographical areas.

(2) The greatest similarity exists between the faunas in the Palaearctic and the Nearctic. This is due to their late separation, to the considerable faunal exchange between them, and also to the fact that these regions have similar habitats.

(3) The relatively large similarity between the faunas of the Australian and Neotropical regions is indicative for the considerable faunal connections between them and probably results from transantarctic distribution of some genera before the break-up of southern parts of Gondwana. There are several other key papers which also discused relationships between southern South America and Australian regions (see MATILE, 1990: 554-556) . This high degree of similarity warrants further examination.

Appendix: Distribution of the genera of fungus gnats.
Abbreviations: **PAL** = Palaearctic, **NEA** = Nearctic, **OR** = Oriental, **AFR** = Afrotropical, **NEO** = Neotropical, **AUS** = Australian Region. Numbers = approximate number of species in region, "+" = reported.

	PAL	NEA	OR	AFR	NEO	AUS
DITOMYIIDAE						
Asioditomyia	1	-	-	-	-	-
Australosymmerus	-	-	-	-	20	14
Calliceratomyia	-	-	-	-	1	-
Celebesomyia	-	-	1	-	-	-
Ditomyia	7	2	-	-	-	-
Neocrionisca	-	-	-	-	1	-
Nervijuncta	-	-	-	-	2	23
Rhipidita	-	-	-	-	2	-
Symmerus	9	4	2	-	-	-
DIADOCIDIIDAE						
Diadocidia	8	3	-	-	2	2
Pterogymnus	-	-	-	-	1	-
KEROPLATIDAE						
Arachnocampinae						
Arachnocampa	-	-	-	-	-	4
Keroplatinae						
Keroplatini						
Cerotelion	5	1	1	-	6	7
Ctenoceridion	-	-	1	1	1	-
Duretina	-	-	-	-	1	-
Euceroplatus	-	-	5	-	-	4
Heteropterna	1	1	4	2	10	9
Hikanoption	-	-	-	1	-	-
Keroplatus	8	4	1	2	9	1
Mallochinus	-	-	-	-	-	2
Nauarchia	-	-	-	-	-	1
Neoceroplatus	-	1	-	-	12	-
Paracerotelion	-	-	-	1	-	-
Placoceratias	-	-	-	-	7	-
Platyroptlion	-	-	3	-	9	2
Rocetelion	1	3	-	-	-	-
Setostylus	1	-	4	-	4	-
Tergostylus	-	-	-	6	-	-
Tolletia	-	-	-	1	-	-
Xenokeroplatus	-	-	-	-	-	3
Orfeliini						
Antlemon	3	-	-	-	-	-
Antriadophila	-	-	-	-	-	4
Apyrtula	-	-	-	-	3	-
Asindulum	2	2	-	-	-	-
Asynaphleba	-	-	-	1	-	-
Burmacrocera	-	-	1	-	-	-
Chetoneura	-	-	1	-	-	-
Cloeophoromyia	-	-	-	6	-	-
Dimorphiela	-	-	-	-	-	2
Dolichodactyla	-	-	-	-	1	-

Continuation of appendix

	PAL	NEA	OR	AFR	NEO	AUST
Isoneuromyia	2	-	8	-	21	3
Lapyruta	-	-	-	-	2	-
Laurypta	-	-	2	2	-	1
Lutarpya	-	-	-	-	-	1
Lutarpyella	-	-	-	-	-	1
Lyprauta	-	-	-	3	8	-
Maborfelia	-	-	-	1	-	-
Macrorrhyncha	16	1	-	-	-	-
Micrapemon	-	-	-	-	2	-
Monocentrota	5	-	-	4	1	-
Neoantlemon	-	-	-	-	-	1
Neoditomya	-	-	-	-	7	-
Neoplatyura	6	2	1	5	9	20
Nicholsonomyia	-	-	-	-	-	1
Orfelia	21	34	6	-	2	-
Paleoplatyura	-	3	-	-	-	-
Planarivora	-	-	-	-	3	1
Platyceridion	-	-	1	-	-	-
Platyura	3	7	-	-	-	-
Plautyra	-	-	-	-	9	-
Proceroplatus	-	-	4	7	16	3
Pseudoplatyura	-	-	-	-	-	4
Pyratula	5	-	1	-	1	-
Pyrtaula	-	-	-	-	8	14
Pyrtulina	-	-	-	1	-	2
Ralytupa	-	-	1	34	-	-
Rhynchoplatyura	-	-	1	-	-	-
Rhynchorfelia	-	-	-	-	-	1
Rofelia	-	-	-	1	-	-
Rutylapa	1	-	4	6	-	6
Rypatula	-	-	-	-	1	3
Schizocyttara	-	-	-	2	-	-
Tamborinea	-	-	-	-	-	1
Taulyrpa	-	-	-	2	3	-
Trigemma	-	-	-	-	-	1
Truplaya	1	-	3	23	-	-
Tylparua	-	-	-	-	-	4
Urytalpa	5	-	1	-	-	-
Xenoplatyura	4	-	3	19	10	6
Macrocerinae						
Macrocerini						
Angazidzia	-	-	-	1	-	-
Chiasmoneura	-	-	2	10	-	6
Chiasmoneurella	-	-	-	1	-	-
Fenderomyia	-	1	-	-	+	-
Hesperodes	-	1	-	-	-	-
Macrocera	62	23	27	21	25	24
Paramacrocera	-	-	-	-	2	5
Vockerothia	-	-	-	-	1	-
Robsonomyini						
Micrepimera	-	-	1	-	-	-

	PAL	NEA	OR	AFR	NEO	AUS
Robsonomyia	-	1	-	-	-	-
Srilankana	-	-	1	-	-	-
BOLITOPHILIDAE						
Bolitophila	36	20	-	-	-	-
LYGISTORRHINIDAE						
Lygistorrhina	1	1	2	6	7	2
Seguyola	-	-	-	2	-	-
MYCETOPHILIDAE						
Mycomyinae						
Dinempheria	-	-	-	6	-	-
Echinopodium	-	-	-	-	36	-
Moriniola	-	-	-	1	-	-
Mycoleia	-	1	-	-	-	-
Mycomya	136	97	31	8	84	13
Mycomyiella	-	-	-	2	-	-
Neoempheria	28	7	12	10	68	2
Parempheriella	-	-	-	36	1	-
Syndocosia	-	-	-	8	-	-
Viridivora	-	-	-	2	-	-
Vecella	1	-	-	-	-	-
Sciophilinae						
Acnemia	14	13	1	1	5	-
Acomoptera	1	1	-	-	-	-
Adicroneura	-	1	-	-	2	-
Allocotocera	2	1	-	-	5	4
Anaclileia	4	3	1	-	-	-
Aneura	-	-	-	-	2	11
Austrosciophila	-	-	-	-	-	1
Azana	5	1	1	1	-	-
Baeopterogyna	1	1	-	-	-	-
Cluzobra	-	1	-	-	29	-
Coelophthinia	1	1	-	-	3	-
Drepanocercus	1	1	-	-	-	-
Eudicrana	2	1	+	-	7	1
Impleta	1	1	-	-	-	-
Leptomorphus	4	8	2	10	3	-
Loicia	-	1	-	-	-	-
Megalopelma	1	1	-	-	4	-
Monoclona	6	5	-	-	7	-
Morganiella	-	-	-	-	-	1
Neoallocotocera	-	-	-	-	-	1
Neoaphelomera	-	-	-	-	4	8
Neoneurotelia	1	-	-	-	-	-
Neoparatinia	1	-	-	-	-	-
Neotrizygia	-	-	-	-	-	1
Neuratelia	10	14	1	-	1	-
Paramorganiella	-	-	-	-	-	1
Paratinia	2	1	-	-	-	-
Paratrizygia	-	-	-	-	3	1
Pareudicrana	-	-	-	-	-	2
Parvicellula	-	-	-	-	4	9

Continuation of appendix

	PAL	NEA	OR	AFR	NEO	AUS
Phthinia	14	6	-	-	3	1
Polylepta	4	1	1	-	-	-
Sciophila	56	57	8	20	17	-
Speolepta	1	1	-	-	-	-
Stenophragma	-	2	-	-	12	4
Tasmanina	-	-	-	-	-	1
Taxicnemis	-	-	-	-	-	2
Trizygia	-	-	-	-	1	1
Gnoristinae						
Acomopterella	-	2	-	-	-	-
Aglaomyia	2	1	-	-	-	-
Aisenmyia	-	-	-	-	+	-
Apolephthisa	1	1	-	-	-	-
Austrosynapha	-	-	-	-	23	8
Boletina	77	36	10	-	-	-
Boletiniella	-	-	-	1	-	-
Coelosia	11	10	1	-	6	-
Dziedzickia	3	7	1	5	33	-
Ectrepesthoneura	12	5	-	-	-	-
Gnoriste	8	4	-	-	-	-
Grzegorzekia	1	1	-	-	-	-
Hadroneura	2	6	-	-	-	-
Palaeodocosia	3	1	-	-	-	-
Saigusaia	1	1	1	-	-	-
Schnusea	-	-	-	-	5	-
Synapha	2	4	1	5	10	1
Syntemna	12	7	-	-	-	-
Tetragoneura	6	8	-	-	35	26
Allactoneurinae						
Allactoneura	1	-	5	1	-	3
Metanepsiinae						
Chalastonepsia	-	-	1	-	-	-
Metanepsia	-	-	1	7	-	-
Leiinae						
Acrodicrana	-	-	3	1	-	3
Anomalomyia	-	-	-	-	-	13
Aphrastomyia	-	1	-	-	3	-
Atelia	-	-	-	-	-	1
Caledoniella	-	-	-	-	-	1
Cawthronia	-	-	-	-	-	1
Clastobasis	2	-	6	5	-	6
Cycloneura	-	-	-	-	-	3
Docosia	21	15	-	-	2	-
Garrettella	-	1	-	-	-	-
Gracilileia	-	-	-	-	-	5
Greenomyia	6	2	4	-	-	-
Indoleia	-	-	1	-	-	1
Leia	26	19	10	23	71	2
Leiella	-	-	-	-	10	-
Megophthalmidia	4	1	-	-	7	-
Mohelia	-	-	-	1	-	-
Neoclastobasis	2	-	-	-	-	-

	PAL	NEA	OR	AFR	NEO	AUS
Novakia	2	1	-	-	1	-
Paracycloneura	-	-	-	-	-	1
Paradoxa	-	-	-	-	-	1
Paraleia	-	-	-	-	15	1
Procycloneura	-	-	-	-	4	-
Rondaniella	1	1	1	-	-	-
Sigmoleia	-	-	-	-	-	3
Sticholeia	-	-	-	-	-	2
Thoracotropis	-	-	-	-	1	-
Trichoterga	-	-	-	-	-	1
Manotinae						
Eumanota	-	-	2	-	-	-
Manota	1	1	1	18	3	3
Paramanota	-	-	1	-	-	-
Promanota	-	-	1	-	-	-
Mycetophilinae						
Exechiini						
Allodia	33	13	3	2	-	3
Allodiopsis	5	+	+	-	-	-
Anatella	30	5	-	-	-	1
Boraceomyia	-	-	-	-	8	-
Brachypeza	6	4	+	-	-	-
Brevicornu	37	20	-	1	7	5
Cordyla	19	10	-	-	-	-
Exechia	62	48	17	8	-	13
Exechiopsis	52	+	+	-	7	-
Neoallodia	-	-	-	-	1	-
Pseudexechia	7	5	1	7	-	-
Pseudobrachypesa	1	1	+	-	-	-
Pseudorymosia	2	-	+	-	-	-
Rymosia	40	21	1	2	5	-
Synplasta	15	2	-	-	1	2
Tarnania	5	1	-	-	-	-
Mycetophilini						
Aspidionia	-	-	1	1	-	1
Dynatosoma	14	11	-	-	-	-
Epicypta	5	1	19	22	52	7
Macrobrachius	1	1	1	-	-	-
Mycetophila	142	97	10	4	157	56
Phronia	84	49	1	4	1	1
Platurocypta	3	1	2	11	1	2
Platyprosthiogyne	-	-	-	3	-	-
Pleurogymnus	-	-	-	-	1	-
Pseudalisina	-	-	-	-	-	1
Sceptonia	14	2	1	1	4	1
Trichonta	52	43	2	-	6	2
Zygomyia	17	9	2	3	15	30
Zygophronia	-	-	-	-	-	1
Total No species	**1365**	**826**	**269**	**413**	**1028**	**466**

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