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SALTICIDAE (ARACHNIDA, ARANEAE) OF ISLANDS OFF AUSTRALIA

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ABSTRACT. Thirty nine species of Salticidae from 33 Australian islands are analyzed with respect to their total distribution, dispersal possibilities and relations with the continental fauna. The possibility of the Torres Strait islands as a dispersal route for salticids is discussed.

The studies of island faunas have been the subject of zoogeographical and evolutionary research for over 150 years and have resulted in hundreds of papers, with the syntheses by Carlquist (1965, 1974) and MacArthur & Wilson (1967) being the best known.

Modern zoogeographical analyses, based on island spider faunas, began some 60 years ago (Berland 1934) and have continued ever since by, e.g., Forster (1975), Lehtinen (1980, 1996), Baert et al. (1989), Żabka (1988, 1990, 1991, 1993), Baert & Jocqué (1993), Gillespie (1993), Gillespie et al. (1994), Prószyński (1992, 1996) and Berry et al. (1996, 1997), but only a few papers were based on verified and sufficient taxonomic data.

The present contribution is mostly based on material collected by one of us (MZ) while visiting Queensland Museum (Brisbane), Australian Museum (Sydney), Western Australian Museum (Perth) and Australian National Insect Collection (Canberra). The main purposes of this paper are (1). To analyze the species composition in respect to their origin, total distribution and dispersal abilities; (2). To estimate the expansiveness of Australian continental faunas towards studied islands; (3). To evaluate the role of Torres Strait islands in faunistic exchange between Australia and New Guinea.

THE AREA

The islands are of coral, volcanic or continental origin and are (with few exceptions) located along the NE coast of Australia (Fig. 1). Their surfaces are rather flat, either barren or vegetated, mostly by *Eucalyptus*, wattles, palms and ferns. Few have developed rainforest or mangrove communities. Due to ocean level fluctuations over the last 50,000 years, at least some islands have been submerged or formed land bridges with the continent (e.g., Torres Strait islands). All these circumstances and the human occupation make it rather unlikely for the majority of islands to have developed their own endemic salticid faunas.

When one of us (MZ) began research on the Australian and New Guinean Salticidae over ten years ago, close relationships between the faunas of these two regions were expected. Consequently, it was hypothesized that the Cape York Peninsula and Torres Strait islands were the natural passage for dispersal/expansion. In fact, the parts of this area covered with savannah and *Eucalyptus* forests do form such a passage zone within these habitats, but mostly in one direction—from Australia to South Papua, and no further north because of rainforest barrier. During glacial cooling, aridization and rainforest regression, habitats were further enhanced in favor of the Australian fauna. Thus, for northern (Oriental and New Guinean) rainforest dwellers, the Cape York Peninsula and Torres Strait islands should be treated as filters rather than a dispersal route.

THE SALTICIDS

Continental fauna—the source.—About 340 salticid species have been reported from Australia so far (Davies & Żabka 1989; Żabka 1990, 1991, unpubl. data). Of them 286 belong to 63 verified genera, others are classified as *incertae sedis*. Approximately 60% of species are endemic and these increase in number towards southern and central-western Australia. The long-term isolation of the con-

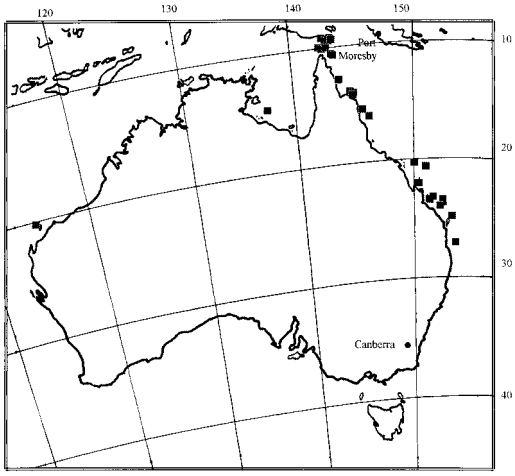

Figure 1: Map showing the geographical location of the analyzed islands along the coast of Australia (for detailed information see Table 1).

tinent and uniqueness of the Australian biota made the speciation so successful. Furthermore, inhabiting various *Eucalyptus* communities, remote desert and semi-desert areas and/or microhabitats (e.g., under bark, in leaf litter), particular species have biological and structural limitations to expansion. The second largest group of continental salticids, but smaller than expected especially in comparison with other spider families (Araneidae, Theridiidae, see Main 1981), is formed of tropical immigrants from the Oriental Region and New Guinea. They spread to north and north-eastern coastal rainforest remnants, and decrease in number to the south. Finally, the third group is made up of cosmopolitan/pantropical species, distributed by human activity.

Island fauna.—During the last ten years substantial progress has been made in studies of the Pacific island Salticidae (Żabka 1988; Prószyński 1992, 1996; Berry et al. 1996, 1997). In our research, we analyzed 39 species, though no island had more than eight species. Being aware of the limitations, we distinguish three groups of species (Tables 2, 3).

Group 1: The largest (24 species) is made up of Australian endemics. Although some of them have also spread to south Papua (savannah, *Eucalyptus* forests) they seem to be of Australian origin and belong to Australian endemic genera (*Abracadabrella, Astia, Holoplatys, Ligurinus, Mopsus, Mopsolodes, Simaetha, Tauala*). Four species of this group (*Ergane cognata, E. insulana, Simaetha atypica* and *Tauala minutus*) are known exclusively from the islands. However, their endemic island status seems doubtful due to the young age of the inhabited islands.

Group 2: At least 11 species are of wide distribution, ranging from west Africa through Sri Lanka to western Pacific islands (in one case even to Hawaii) and belong to genera of alien (outside Australian) origin—usually SE Asian and New Guinean. *Cytaea plumbeiventris*, reported from 12 islands, was the most common here. This species can be found in gardens and parks of NE Queensland and as such has probably been dispersed by man. *Cosmophasis thalassina* has a similar biology and distribution, though it is less common (three islands).

Group 3: Four island species have cosmopolitan/pantropical distribution, and all live in human habitations and are spread by man.

Dispersal.—For the analyzed case two dispersal methods, aerodispersal and antropodispersal, should be considered. Rafting, though theoretically possible, is not discussed because of lack of published or other data regarding Salticidae.

Aerodispersal: Salticidae occupy various habitats, each providing different aerodispersal possibilities. Leaf-litter or bark dwellers, for instance, are poorer candidates for ballooning than those living in open areas, tree canopies or human habitats. Salticidae constitute only 1.5–7% of all spiders in aeroplankton (Horner 1975; Salmon & Horner 1977; Greenstone et al. 1987). It is widely known that juveniles are more effective ballooners than adults; and in our research they constituted 50.7% of all specimens which seems to support the aerodispersal hypothesis. Some indirect data from the analyzed area were provided by Żabka (1991) from tree canopies of NE Queensland. Amongst 70 specimens found there, the most common were representatives of *Tara, Simaethula, Opisthoncus, Prostheclina*. Except for the latter, those genera have also been recorded in our study. *Tara* and *Simaethula* have not been considered as identified to the genus (not species) level only. *Helpis minitabunda* (found in tree canopies) is spread from Australia and New Guinea to adjacent archipel-

Table 1.—Number of species recorded on individual islands.

Number of species	Island	Geographical location	
		S E	
8	Fitzroy	16°56′, 146°00′	Queensland
8	Masthead	23°32′, 151°43′	Queensland
7	Horn	10°37′, 142°17′	Torres Strait
5	Heron	23°26′, 151°55′	Queensland
4	Barrow	20°46′, 115°24′	Western Australia
4	Lizard	14°40′, 145°28′	Queensland
4	Motmot		
3	Cairncross West	11°15′, 142°55′	Torres Strait
3	Hannibal East	11°36′, 142°56′	Torres Strait
2	Campbell	9°34′, 143°29′	Torres Strait
2	Darnley	9°35′, 143°46′	Torres Strait
2	Fraser	25°22′, 153°07′	Queensland
2	Friday	10°36′, 142°10′	Torres Strait
2	Murray	9°56′, 144°04′	Torres Strait
2	North West	23°18′, 151°42′	Queensland
2	Pellew	15°31′, 136°53′	Northern Territory
2	Pethebridge	14°44′, 145°05′	Queensland
2	Stephens	9°31′, 143°32′	Torres Strait
2	Thursday	10°35′, 142°13′	Torres Strait
2	Tryon	23°15′, 151°46′	Queensland
2	Yam	9°53′, 143°45′	Torres Strait
1	Binstead	13°13′, 143°33′	Queensland
1	Gannett Cay	21°59′, 152°28′	Queensland
1	Little Fitzroy	16°55′, 146°01′	Queensland
1	Low	22°03′, 150°06′	Queensland
1	Moreton	27°11′, 153°24′	Queensland
1	Percy	21°42′, 150°20′	Queensland
1	Rocky	15°36′, 145°21′	Queensland
1	Saibai	9°23′, 142°40′	Queensland
1	Tana		
1	Wharton Reef	14°08′, 144°00′	Queensland
1	Wilson	23°18′, 151°55′	Queensland
1	Yorke	9°44′, 143°25′	Torres Strait

agos and to New Zealand, and has also been found in our research.

Anthropodispersal: This way of dispersal is typical for species occupying human habitations, and their distribution is world-wide. Four such species (*Hasarius adansoni*, *Menemerus bivittatus*, *Plexippus paykulli*, *P. petersi*) are found on the islands. It is likely that also other island species (e.g., *Cytaea plumbeiventris*, *Cosmophasis thalassina*) can disperse this way.

CONCLUSIONS

Only 10% of all continental Australian salticid species are found on the analyzed islands, indicating they are either poorly studied, scanty in species and/or ecologically inappropriate. Even some large continental genera are missing on the islands or are represented by single species only (Table 4). This supports the idea (quite obvious for resident Australian arachnologists) that the enormously diverse Australian spider/salticid fauna is largely the result of habitat variability and floristic diversity. The islands, being poor in plant communities, are mostly inhabited by eurytopic species. However, until the material is more complete, it is premature to reliably discuss such ''island problems'' as size effect, distance from the source of the fauna, island age, plant communities and topographic influence. For the majority of islands only one or two species are listed. Even for the richest (Fitzroy) only eight species are recorded. Of all

Table 2.—The distribution of species recorded on islands off Australia. WA = Western Australia, NT = Northern Territory, SA = South Australia, TAS = Tasmania, QLD = Queensland, NSW = New South Wales, NG = New Guinea, PNG = Papua New Guinea, C = central, M = middle, S = south, W = west, NE = north-east, E = east, N = north.

Species	Islands	Records in continental Australia				Other records
		WA	NT	QLD	NSW	
Abracadabrella elegans	Binstead			NE, E	E	
Astia hariola	Fraser			E	E	NG
Bavia aericeps	Horn, Campbell			NE		NG, C and W Pacific Archipelagoes
Bianor maculatus	Gannett Cay, Motmot			S	E	New Caledonia, Samoa, Vietnam
Clynotis severus	Yam, Horn	+		E	E	S PNG
Cosmophasis bitaeniata	Fitzroy			E	E	PNG, Aru Is.
Cosmophasis micarioides	Motmot			NE		
Cosmophasis thalassina	Cairncross West, Fitzroy, Hannibal East			N		Malay Arch., NG
Cyrba ocellata	Barrow, Masthead					from Africa to Oriental Region and Australia
Cytaea mitellata	Campbell					Aru Is., Yule Is., Sunda Arch.
Cytaea frontaligera	Darnley			E	N	PNG, Aru Is.
Cytaea plumbeiventris	Fitzroy, Hannibal East, Heron, Horn, Little Fitzroy, Lizard, Low, Masthead, Murray, Pethebridge, Stephens, Tryon			NE		Aru Is., PNG, New Mecklenburg
Cytaea severa	Barrow, Lizard, Masthead, Yam			+		
Ergane cognata	Pellew					
Ergane insulana	Pellew					
Euryattus bleekeri	Cairncross West, Fitzroy, Thursday			NE, M		NG, Ambon, Aru, Malaysia
Evarcha infrastriata	Horn			NE, E		
Gangus longulus	Motmot			+		
Hasarius adansoni	Heron, Masthead, North West, Percy, Wilson					Pantropical
Helpis minitabunda	Fitzroy			SE		
Holoplatys colemani	Lizard, Masthead			+	+	
Holoplatys complanata	Fitzroy, Masthead, Tryon		N	E		PNG
Ligurinus bipenicilatus	Fraser			+	+	
Menemerus bivittatus	Barrow, Heron, Masthead					Pantropical
Mopsolodes australiensis	Horn		+	N, NE, SE		
Mopsus mormon	Fitzroy, North West, Saibai			+	N	NG
Opisthoncus abnormis	Wharton Reef			+	+	
Plexippus paykulli	Hannibal East					Pantropical
Plexippus petersi	Thursday					Pantropical
Servaea vestita	Yorke			E	+	Tasmania
Simaetha atypica	Pethebridge		+			
Simaetha robustior	Stephen			NE		Aru
Simaetha tenuidens	Friday, Heron, Horn, Moreton			E		PNG
Simaetha tenuior	Barrow, Heron, Masthead			E		

Table 2.—Continued

Species	Islands	Records in continental Australia				Other records
		WA	NT	QLD	NSW	
Tauala minutus	Murray					
''Trite'' longula	Cairncross West, Darnley, Motmot, Rocky			NE		
Zenodorus arcipluvius	Tana					New Hebrides
Zenodorus metallescens	Horn			E	E	
Zenodorus orbiculatus	Fitzroy, Fraser, Friday, Lizard			E	E	

39 species, three zoogeographic groups are distinguished: Australian endemics, Oriental and New Guinean immigrants, and cosmopolitan/pantropical elements. We hypothesize that no island endemics are found, unless confirmed by further research. Ballooning and man agency seem possible ways of dispersal; however, it is more likely that, at least some islands were colonized *via* past land bridges. The Torres Strait islands are the barrier for northern tropical (rainforest) species and the passage for southern savannah and *Eucalyptus* forest inhabitants.

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Table 3.—Island species and their zoogeographic distribution.

Australian endemics	Widely distributed	Cosmopolitan/pantropical
Abracadabrella elegans	*Bavia aericeps*	*Hasarius adansoni*
Astia hariola	*Bianor maculatus*	*Menemerus bivittatus*
Clynotis severus	*Cosmophasis bitaeniata*	*Plexippus paykulli*
Cosmophasis micarioides	*Cosmophasis thalassina*	*Plexippus petersi*
Cytaea severa	*Cyrba ocellata*	
Ergane cognata	*Cytaea frontaligera*	
Ergane insulana	*Cytaea mitellata*	
Evarcha infrastriata	*Cytaea plumbeiventris*	
Gangus longulus	*Euryattus bleekeri*	
Helpis minitabunda	*Zenodorus arcipluvius*	
Holoplatys colemani	*Zenodorus orbiculatus*	
Holoplatys complanata		
Mopsus mormon		
Ligurinus bipenicilatus		
Mopsolodes australiensis		
Opisthoncus abnormis		
Servaea vestita		
Simaetha atypica		
Simaetha robustior		
Simaetha tenuidens		
Simaetha tenuior		
Tauala minutus		
''Trite'' longula		
Zenodorus metallescens		

Table 4.—Island genera in comparison with the continental fauna (after Żabka 1991, unpubl.).

Australian genera	Number of species on the Continent	Number of species on the Islands
Abracadabrella	3	1
Adoxotoma	2	
Afraflacilla	5	
Arasia	2	
Ascyltus	1	
Astia	2	1
Bavia	3	1
Bianor	2	1
Canama	1	
Clynotis	1	1
Cocalus	1	
Coccorchestes	1	
Copocrossa	1	
Cosmophasis	6	3
Cyrba	1	1
Cytaea	5	4
Damoetas	1	
Diolenius	1?	
Ergane	—	2
Euryattus	4	1
Evarcha	1	1
Frigga	1	
Gangus	2	1
Grayenulla	5	
Harmochirus	1	
Hasarius	2	1
Helpis	3	1
Holoplatys	36	2
Hypoblemum	3	
Jacksonoides	7	
Jotus	1	
Lauharulla	1	
Ligonipes	4	
Lycidas	22?	
Maratus	7	
Margaromma	1	
Megaloastia	1	
Menemerus	2	1
Mintonia	1	
Mopsolodes	1?	1
Mopsus	1	1
Myrmarachne	10	
Ocrisiona	8	
Omoedus	1	
Opisthoncus	31	1
Palpelius	2	
Paraplatoides	5	
Plexippus	2	2
Portia	1	
Prostheclina	1	
Pseudomaevia	1	
Pseudosynagelides	6	
Rombonatus	1	
Servaea	3	1
Simaetha	10	4
Simaethula	8	
Sondra	11	
Tara	3?	
Tauala	7	1
Trite	5?	1
Zebraplatys	4	
Zenodorus	14	3

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