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Crab spiders (Araneae, Thomisidae) of Australia and New Guinea. Taxonomy of some species of *Diaea* as described by Kulczyński (1911)*

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Abstract. Australia and New Guinea have drifted on the same tectonic plate. The collision of indo-australian tectonic plate with the Asia plate brought about the final uplift of New Guinea and the majority of islands making the present Orient. Moreover, in the Pleistocene New Guinea was connected with Australia, together with some other nearby islands, in a land known as Sahul. It was probably at that time that the faunal exchange between the New Guinea and Australia started. Despite similar geological history and close vicinity of both areas, the crab spiders show great distinction between New Guinea and Australia. 36 genera on both areas have been recorded, of which only 13 are common (*Amyciaea*, *Cymbacha*, *Diaea*, *Hedana*, *Loxoporetes*, *Mastira*, *Misumena*, *Porropis*, *Runcinia*, *Stephanopis*, *Tharrhalea*, *Tmarus* and *Xysticus*), and 167 species, of which 6 are common (*Amyciaea albomaculata* (O. P. Cambridge, 1874), *Cymbacha saucia*, L. Koch, 1874, *Mastira cimicina* (Thorell, 1881), *Porropis callipoda* Thorell, 1881, *Runcinia acuminata* Thorell, 1881, *Tharrhalea albipes* L. Koch, 1875). Thus, similarity of the spider fauna of the family Thomisidae at genera level is near 37%, while at species level it is 3.7%. 41 species of the genus *Diaea* living on both areas, including 9 species endemic for New Guinea, have been recorded. Five of the latter were described by Kulczyński in 1911 and assigned to *Diaea*: *Diaea decempunctata*, *Diaea papuana*, *Diaea sticta*, *Diaea varians*, *Diaea limbata*. Preliminary revisional studies on those species revealed that *D. sticta* is a synonym of *Diaea evanida* (L. Koch, 1867) and *D. limbata*, *D. decempunctata* and *D. papuana* are closely related species. They belong, together with several others of the "*D. praetexta* group", to an undescribed genus. *Diaea adusta* (L. Koch, 1867) = *Diaea tumefacta* L. Koch, 1874 = *Diaea varians*. Three of the latter have been transferred to *Mastira* - now *Mastira adusta* (L. Koch, 1867) comb.nov. State of knowledge of the spiders of the family Thomisidae of Australia and New Guinea is still insufficient. Some genera seem to be unclearly defined (*Diaea*, *Misumena*, *Thomisus*, *Xysticus*), and so several Australian and New Guinean crab spider species have been incorrectly assigned to them.

Key words: crab spiders, *Diaea*, revisional studies, Australia, New Guinea.

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INTRODUCTION

The collision of Australia with the Asia plate brought about the final uplift of New Guinea and the majority of islands making the present Orient (Raven et Axelrod 1972; Audley-Charles 1983; Bell 1985; Trojan 1997). New Guinea has the same geological history as Australia, as they both drifted on the same tectonic plate. Moreover, in Pleistocene this island was connected with Australia, together with some other nearby islands, in a land known as Sahul (Smith et al. 1993). Probably at that time the mixing of faunas between the Orient and Australia started. However, there is no agreement as to the possible stepping stones in Indonesia (Prószyński 1961; Keast 1981; Diamond et Gilpin 1983; Audley-Charles et Harris 1990).

The family Thomisidae is rich in species and comprises over 2000 species around the world (Jocque et Dippenaar-Schoeman 2006). It is divided into seven subfamilies (Dippenaar-Schoeman et Jocque 1997). Four of them occur in Australia and New Guinea: Bominae, Dietinae, Stephanopinae and Thomisinae. The last one is the most numerous both in the world (75 genera and about 1500 species) (Ono 1988, Platnick - Internet database) and in Australia (14 genera and 76 species – on the basis of the catalogues made by Simon, Roewer, Brignoli and Platnick).

STUDY HISTORY

The first taxonomic papers on crab spiders in Australian region come from the end of the 19th century, and the first described species representing this family were: *Stephanopis malacostracea* (Walckenaer, 1837) from Australia and *Phrynarachne jobiensis* (Thorell, 1877) from New Guinea. In this period a significant number of species was described and the person most devoted to it was Ludwig Koch, who described 71 species of crab spiders from this continent (almost 57% of all known from Australia). Later, the crab spiders have enjoyed less interest, although a considerable contribution to their recognition was brought by: Hickmann (1944), Rainbow (1920), Simon (mainly 1895a, 1895b), Strand (1901, 1911, 1913, 1915) and recently Main (1988), Evans (1995), Schield et Strudwick (2000). Crab spiders of New Gwinea are less studied although Kulczyński (1911) described 17 species from this island. Recently, Lehtinen (2003) presented a few interesting taxonomic remarks on the Palearctic and Oriental Misumenini in his worldwide revision of thomisid genera.

SPECIES RICHNESS

High heterogenity of habitats may lead to considerable variability of fauna. Australia and New Guinea are characterized by huge floristic, topographic and climatic diversity. Thus, these areas may potentially be numerous in species. In spite of many expeditions which took place in the past, Australia is still weakly explored. The number of crab spider species has not yet been estimated precisely. According to Hawkeswood's (2003) estimates, there are nearly 125 species, while Raven et al. (2002) revealed a number of 143 species, including the crab spiders from New Guinea and Papua New Guinea.

Having analyzed subject literature (papers with descriptions of particular taxa) and explained taxonomic discrepancies, the total number of crab spiders present in both territories (including Lord Howe Island and Aru Island) is 167 species (8.2% of world fauna of Thomisidae); more specifically, 126 species of crab spiders assigned to 25 genera in the area of Australia and 47 species of crab spiders assigned to 24 genera in the area of New Guinea have been recorded. The biggest arachnological exploration took place on the Eastern coast of Australia and this is why the best-studied territories of Australia are Queensland and New South Wales.

Hawkeswood (2003) stated that knowledge of many Australian spider families (including Thomisidae) is still insufficient. The number of undescribed species of this family is probably high and may be even a few times higher than the number of known species, similarly to how it has been noted in the studies of the Salticidae family of Australia (Żabka 1991).

SIMILARITY OF AUSTRALIAN AND NEW GUINEAN CRAB SPIDER FAUNA

In spite of a similar geological history and a close vicinity of both areas, the crab spiders show great discrepancy between New Guinea and Australia. 36 genera have been recorded on both areas, of which only 13 are common (*Amyciaea*, *Cymbacha*, *Diaea*, *Hedana*, *Loxoporetes*, *Mastira*, *Misumena*, *Porropis*, *Runcinia*, *Stephanopis*, *Tharrhalea*, *Tmarus* and *Xysticus*), and 167 species, of which 6 are common (*Amyciaea albomaculata* (O. P. Cambridge, 1874), *Cymbacha saucia* L. Koch, 1874, *Mastira cimicina* (Thorell, 1881), *Porropis callipoda* Thorell, 1881, *Runcinia acuminata* Thorell, 1881, *Tharrhalea albipes* L. Koch, 1875). Thus, the similarity of the spider fauna from the family Thomisidae at genera level is near 37%, while at species level it is 3.7%.

DEGREE OF ENDEMISM

According to the theory of continent drift supported by the theory of plate tectonics, it is assumed that India, Australia with Tasmania, New Guinea and New Zealand lie on the same indo-australian lithospheric plate. Although the eldest described spider species comes from the Devonian deposits (Selden et al. 1991), the first families of spiders appeared in late Cretaceous, but no representatives of crab spiders were found among them (Platnick et Gertsch 1976; Penney 2001). The oldest specimens belonging to the Thomisidae family have been found in Baltic amber (about 40 Ma ago) and Dominican amber (about 20 Ma ago) (Wunderlich 1986). As results from the above data, the fauna of Thomisidae developed in the post-Gondwanian period. Given the long time of isolation of Australia (about 55 mya), it should be expected that the endemism of the crab spiders on this continent is greater than assumed until now.

Most species living on the area of Australia and New Guinea are endemic. In Australia there are 119 endemic species (94.4%) and in New Guinea + Aru Island – 41 endemic species (87.2%).

At present, of the 25 genera of the family Thomisidae occurring in Australia, 5 are endemic (*Corynethrix*, *Isala*, *Poecilothomisus*, *Saccodomus, Synalus*), and of 24 genera occurring in New Guinea, 3 are endemic (*Cetratus*, *Latifrons* and *Rhaebobates*). High degree of endemism may be caused by floristic diversity of both areas and may also be elevated by small dispersal abilities of the crab spiders by ballooning (0.4%-13.6% contribution relative to the other spider species migrating this way) (Greenstone et al. 1987; Greenstone 1990; Blandenier et Fürst 1998).

The only species which are widespread and recorded in Australia and/or New Gwinea are: *Runcinia acuminata* (Thorell, 1881) – cosmopolitic distribution and *Thomisus spectabilis* Doleschal, 1859 – pantropical distribution.

TAXONOMIC REMARKS ON SOME GENERA OF THOMISIDAE AND *DIAEA* IN PARTICULAR

Some genera occuring in Australia and New Guinea such as: *Diaea*, *Misumena*, *Thomisus*, *Xysticus* are globally widespread. The dubious status of some of them has been recently questioned by Lehtinen (1993, 2003). Above mentioned author states that such genera as *Misumena*, *Misumenops*, *Diaea* or *Synaema* have not been clearly defined and species not related to the type species are often mistakenly classified as representatives of a particular genera. This thesis has been supported by recent results of Shield et Strudwick (2000). These authors presented a line of arguments indicating the necessity of defining a new genus *Diasterea* for two synonymic species classified to the widespread genus *Diaea* (now *Zgometis* – Lehtinen 2004).

Despite scarce faunistic data and unclear taxonomic statuses of several genera, Lehtinen (1980, 1993) undertook the first attempt at a zoogeographic analysis of the indo-pacific region. He proposed the probable centres of ranges and possible directions of dispersal of selected spider families. According to his studies, crab spiders had arrived to the Australian continent via Melanesia. Taking into account the present stage of research on spiders from the family Thomisidae, it is not possible to conduct a fully-fledged zoogeographic analysis due to the lack of revisions based on analysis of type material. Current revisions of the Australian genus *Diaea* s. lato show presence of numerous synonyms (Szymkowiak in preparation).

Diaea is the most numerous genus of the family Thomisidae in the Australian region, with 32 species occurring in Australia and 9 species occurring in New Guinea.

Due to an unclear genus diagnosis and possibility of convergence connected with their existence in similar habitats, many species most probably not closely related to the type species have been included in Genus *Diaea.* This claim is supported by diverse structure of sexual organs of species present in Australia or New Guinea in comparison to the type species. Also, within the scope of the genus there is a variety of forms, which led Lehtinen (2004) to create new genera or use the old ones and transfer some of the species formerly classified as *Diaea* or *Diasterea* (formerly *Diaea*) there: *Diaea concinna* Thorell, 1877 = *Misumena gamma* Chrysanthus, 1964 (New Guinea) to *Ebrechtella* Dahl, 1907; *Diaea hilaris* (L. Koch, 1876) = *Synema seranicum* Strand, 1913 (New Guinea) to *Henriksenia* Lehtinen, 2004; *Diaea colcloughi* Rainbow, 1912 (Australia: Northern Territory) to *Loxoporetes* Kulczyński, 1911; *Diaea cimicina* Thorell, 1881

(Indonesia: Aru Island, Australia: York Peninsula) to *Mastira* Thorell, 1891; *Diasterea lactea* Shield et Strudwick, 2000 (Australia: New South Wales, Victoria, Queensland) to *Zygometis* Simon, 1901.

Preliminary revisional studies on species of *Diaea* from the area of New Guinea described by Kulczyński revealed that *Diaea sticta* Kulczyński, 1911 is a junior synonym of *Diaea evanida* (L. Koch, 1867). *Diaea decempunctata* Kulczyński, 1911, *Diaea limbata* Kulczyński, 1911 and *Diaea papuana* Kulczyński, 1911 are closely related species and together with *Diaea haematodactyla* L. Koch, 1875, *Diaea multopunctata* L. Koch, 1874 and *Diaea prasina* L. Koch, 1876 are related to *Diaea praetexta* (L. Koch, 1865). They should be included in a separate, new genus in the future. *Diaea bipunctata* Rainbow, 1902 seems to belong to the same group of related species and it may be the junior synonym of *D. praetexta*. Taxonomic position of these species will be established after revisional studies on type material (Australian Museum, KS 6478, female?) (Szymkowiak in preparation). The next species described by Kulczyński (1911) – *Diaea varians* Kulczyński, 1911 is a junior synonym of *Diaea adusta* (L. Koch, 1867) = *Diaea tumefacta* L. Koch, 1874. This species is transferred to *Mastira*: now *Mastira adusta* (L. Koch, 1867) comb. nov. considering habitus, occurrence and position of two teeth on inner row of chelicera, lack of central hood in the epigynal plate and occurrence of dried sperm deposits in female copulatory openings (see Lehtinen 2004).

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