AMAZONIANA XVII (1/2): 1-14 Kiel, Dezember 2002

Arachnida at 'Reserva Ducke', Central Amazonia/Brazil*

by

J. Adis, A.B. Bonaldo, A.D. Brescovit, R. Bertani, J.C. Cokendolpher, B. Condé, A.B. Kury, W.R. Lourenço, V. Mahnert, R. Pinto-da-Rocha, N.I. Platnick, J.R. Reddell, C.A. Rheims, L.S. Rocha, J. M. Rowland, P. Weygoldt & S. Woas

Prof. Dr. Joachim Adis, Tropical Ecology Working Group, Max-Planck-Institute for Limnology, Postfach 165, 24302 Plön, Germany, and Projeto INPA/Max-Planck, Manaus/AM, Brazil; e-mail: adis@mpil-ploen.mpg.de
Dr. Alexandre B. Bonaldo, Depto. de Zoologia, Museu Paraense Emílio Goeldi, Caixa Postal 399, 66040-170 Belèm/Pará, Brazil; e-mail: bonaldo@museu-goeldi.br
Dr. Antonio D. Brescovit, M.Sc. Rogério Bertani & Cristina A. Rheims, Laboratório de Artrópodos Peçonhentos, Instituto Butantan, Av. Vital Brasil 1500, 05503-900 São Paulo/SP, Brazil; e-mails: adbresc@terra.com.br, rbert@usp.br, cris.rheims@uol.com.br
James C. Cokendolpher, 3428 56th Street, Lubbock, Texas 79413-4747,USA; e-mail: cokendolpher@aol.com
Prof. Dr. Bruno Condé, Musée de Zoologie de l'Université e de la Ville, 34, rue Sainte-Catherine, 54000 Nancy, France; e-mail:
Dr. Adriano B. Kury, Museu Nacional (UFRJ), Quinta da Boa Vista, São Cristóvão, 20940-040 Rio de Janeiro/RJ, Brazil; e-mail: adrik@alternex.com.br
Dr. Wilson R. Lourenço, Laboratoire de Zoologie (Artropodes), Muséum national d'Histoire naturelle, 61, rue de Buffon, 75005 Paris, France; e-mail: arachne@mnhn.fr
Prof. Dr. Volker Mahnert, Muséum d'histoire naturelle, Case Postale 6434, 1211 Genève 6, Switzerland; e-mail: volker.mahnert@mhn.ville-ge.ch
Dr. Ricardo Pinto-da-Rocha, Depto. de Biologia, Instituto de Biociências da USP, Rua do Matão, Travessa 14, No. 321, 05508-900 São Paulo/SP, Brazil; e-mail: ricrocha@usp.br
Dr. Norman I. Platnick, Div. of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024, USA; e-mail: platnick@amnh.org
James R. Reddell, Texas Natural History Collection, Texas Memorial Museum, 10100 Burnet Road, Austin, Texas 78758, USA; e-mail: jreddell.caves@mail.utexas.edu
M.Sc. Lincoln S. Rocha, Depto. de Biologia, Instituto de Biociências da USP, Rua do Matão, Travessa 14, No. 321, 05508-900 São Paulo/SP, Brazil; e-mail: linro-

*Dedicated to Prof. Dr. Harald Sioli on the occassion of his 90th anniversary.

ISSN 0065-6755/2002/001/ © MPI für Limnologie, AG Tropenökologie, Plön; INPA, Manaus

cha@ib.usp.br
Dr. Mark Rowland, Dept. of Biology, 167 Castetter Hall, University of New Mexico, and Dept. of Surgery, University of New Mexico Health Sciences Center, Albuquerque, New Mexico, 87131, USA; e-mail: rowland@unm.edu
Dr. Steffen Woas, Staatliches Museum für Naturkunde, Postfach 111364, 76063 Karlsruhe, Germany
Prof. Dr. Peter Weygoldt, Albert-Ludwigs-Universität, Institut für Biologie I (Zoologie), Hauptstr. 1, 79104 Freiburg, Germany; e-mail: weygoldt@sun2.ruf.uni-freiburg.de
(Accepted for publication: June, 2001).

Abstract

The class Arachnida contains 11 recent orders: Acari, Amblypygi, Araneae, Opiliones, Palpigradi, Pseudoscorpiones, Ricinulei, Schizomida, Scorpiones, Solifugae and Uropygi (Thelyphonida). In total, >570 families, >9165 genera and >93455 species are known world-wide. More than 136 families, >482 genera and >1547 described species occur in Amazonia. Data show, that almost one-fourth of the families presently known in the Arachnida and about 2% of the worlds described species are represented in Amazonia. In the forest reserve 'Reserva Ducke' near Manaus, the Acari-Oribatida represent 45 families, 72 genera and 35 described species, the Aranea 30 families, 143 genera and 295 described species, the Opiliones 5 families, 7 genera and 8 decribed species, the Scorpiones 2 families, 4 genera and 5 described species, the Pseudoscorpiones 6 families, 11 genera, and 15 described species, the Schizomida 1 family, 2 genera and 2 described species, and the Amblypygi, Palpigradi, Solifugae and Uropygi (Thelyphonida) one species each. Most names are listed.
Keywords: **Arachnida, diversity, Amazonia, Brazil, Neotropics**.

Resumo

A classe Arachnida contém 11 recentes ordens: Acari, Amblypygi, Araneae, Opiliones, Palpigradi, Pseudoscorpiones, Ricinulei, Schizomida, Scorpiones, Solifugae e Uropygi (Thelyphonida). No total, >570 famílias, >9165 gêneros e >93455 espécies são conhecidas mundialmente. Mais que 136 famílias, >482 gêneros e >1547 espécies descritas ocorrem na Amazônia. Os dados mostram, que quase um quarto das famílias conhecidas atualmente em Arachnida e cerca de 2% de todas as espécies descritas mundialmente é representada na Amazônia. Na reserva florestal 'Reserva Ducke' perto de Manaus, os Acari-Oribatida representam 45 famílias, 72 gêneros e 35 espécies descritas, os Aranea 30 famílias, 143 gêneros e 295 espécies descritas, os Opiliones 5 famílias, 7 gêneros e 8 espécies descritas, os Scorpiones 2 famílias, 4 gêneros e 5 espécies descritas, os Pseudoscorpiones 6 famílias, 11 gêneros e 15 espécies descritas, os Schizomida 1 família, 2 gêneros e 2 espécies descritas, e os Amblypygi, Palpigradi, Solifugae e Uropygi (Thelyphonida) uma espécie descrita cada. A maioria dos nomes está alistada.

Introduction

The forest reserve Reserva Florestal Adolpho Ducke ('Reserva Ducke') is part of the National Institute for Amazonian Research (INPA) at Manaus, Brazil, and one of the best studied areas of Amazonian rainforest. Located 26 km northeast of the capital of Amazônia (59°58'W, 02°54'S), it comprises 10 x 10 km. A description of its geology, soil characteristics and floristic composition is given by GENTRY (1990), PENNY & ARIAS (1982), and RIBEIRO et al. (1999). A synopsis of the insects at Reserva Ducke is found in PENNY & ARIAS (1982). Zoological species inventories have been presented e.g. for Arachnida (ADIS 2002; HÖFER & BECK 1995, 1996; HÖFER & BRESCOVIT 2001), termites (APOLINÁRIO 1993), ants (ADIS et al. 1998; HARADA & ADIS 1998), frogs (HERO 1990), and birds (WILLIS 1977). A book on the arthropod fauna of the reserve edited by INPA scientists is in preparation. The source material for

this contribution on Arachnida is derived from the book 'Amazonian Arachnida and Myriapoda' (ADIS 2002).

The class Arachnida contains 11 recent orders: Acari (mites), Amblypygi (whip-spiders), Araneae (spiders), Opiliones (harvestmen), Palpigradi (micro whip-scorpions), Pseudoscorpiones (pseudoscorpions), Ricinulei (ricinuleids), Schizomida (short-tailed whip-scorpions), Scorpiones (scorpions), Solifugae (camel-spiders) and Uropygi (whip-scorpions) (cf. CODDINGTON & COLWELL 2001; PARKER 1982). The wingless and mainly terrestrial arthropods without antenna represent the Chelicerata. Members of this group have a segmented or an unsegmented abdomen. Their phylogeny is discussed by WEYGOLDT (1998) and WHEELER & HAYASHI (1998). The use of ordinal names in Arachnida was proposed by SAVORY (1972) and recommended by the Arachnology Nomenclature Committee (ACN 1996), including the use of Uropygi instead of Thelyphonida and Opiliones rather than Phalangida. The rank assigned to the Schizomida and Uropygi has changed over the past century. Some authors threat them as suborders (e.g. MILLOT 1949; WEYGOLDT & PAULUS 1979) but most others as separate orders (e.g. CODDINGTON & COLWELL 2001; GRUNER 1993; REDDELL & COKENDOLPHER 1995; PARKER 1982; SHULTZ 1990).

In Arachnida, > 570 families, > 9165 genera and > 93455 described species are known. Since 1982, the increase in world-wide described species was 23% (about 1200 species/year). In some less diverse taxa, species numbers have doubled (Amblypygi) or even tripled (Schizomida). In hyper- (or mega-) diverse taxa, the increase was between 6 % (Araneae) and 33 % (Acari). Opiliones and Acari still need taxonomic work and revision. Data show, that almost one-fourth of the families presently known in the Arachnida and about 2 % of the worlds described species are represented in Amazonia (cf. ADIS 2002). More than 136 families, > 482 genera and > 1547 described species occur in Amazonia. In the forest reserve 'Reserva Ducke' near Manaus, the Acari-Oribatida are represented by 45 families, 72 genera and 35 described species, the Aranea by 30 families, 143 genera and 295 described species, the Opiliones by 5 families, 7 genera and 8 decribed species, the Scorpiones by 2 families, 4 genera and 5 described species, the Pseudoscorpiones 6 families, 11 genera, and 15 described species, the Schizomida 1 family, 2 genera, and 2 described species, and the Amblypygi, Palpigradi, Solifugae and Uropygi (Thelyphonida) by one species each. Holotypes and several paratypes of new species that have been described since 1975 from Central Amazonia are housed in the Entomological Collection of INPA at Manaus, Brazil.

1. Amblypygi

Amblypygids are easily distinguished by their flat body lacking a terminal flagellum, the narrow constriction (petiole) between pro- and opisthosoma, the raptorial pedipalps, and the extremely elongate first legs that are used as feelers (antenniform legs). In Amazonia, whip-spiders are inhabitants of primary and secondary forest as well as of caves. They are nocturnal and live on large (hollow) trees, hiding inside cavities or under the bark during the day. At night they appear outside, sitting on the bark and waiting for prey. Such a tree is used and defended as a territory. Their prey consists of various insects and occasionally small lizards or frogs. Prey capture is so fast that a flying sphingid or noctuid moth passing by can be caught. Adults live for many years (up to 10 in large species) and moult once every year to every three years. Females carry their eggs in an egg sac glued to the ventral side of the opisthosoma. Embryonic development

takes about three months. The hatching praenymphae attach themselves to their mother's opisthosoma. Eight to 12 days later, they moult to the protonymph stage, the first free living instar (see ADIS (2002) for further information).

Amblypygi presently comprise 5 families, 17-20 genera and 136 species world-wide. One family, 3-4 genera and >18 described species occur in Amazonia. Only one amblypygid genus, *Heterophrynus*, is endemic to the Amazonian region, representing the Neotropical Phrynidae. The large species (up to 35 mm body length) underwent their adaptive radiation in Amazonia and the surrounding mountainous regions. *Heterophrynus batesii* (BUTLER, 1873) (formerly *Admetus pumilio* C.L. KOCH) is the only described species known from Reserva Ducke at present (see ADIS (2002) for identification).

Ecological publications on Amblypygi from Reserva Ducke

BECK, L. (1968a): Aus den Regenwäldern am Amazonas II. - Natur und Museum **98**: 71-80.

BECK, L. (1968b): Sobre a biologia de algunos aracnidos na floresta tropical da Reserva Duke (INPA, Manaus, Brasil). - Amazoniana **1**(3): 247-250.

BECK, L. (1972): Zur Tagesperiodik der Laufaktivität von *Admetus pumilio* C. KOCH (Arach., Amblypygi) aus dem neotropischen Regenwald II. - Oecologia **9**: 65–102.

BECK, L. & K. GÖRKE (1974): Tagesperiodik, Revierverhalten und Beutefang der Geißelspinne *Admetus pumilio* C.L. KOCH im Freiland. - Z. Tierpsychol. **35**: 173–186.

BECK, L. & H. PABST (1969): Zur Tagesperiodik der Laufaktivität von *Admetus pumilio* C. KOCH (Amblypygi, Arachnida) aus dem neotropischen Regenwald. - Verh. dt. zool. Ges. **33**: 178–184.

WEYGOLDT, P. (1974): Vergleichende Untersuchungen an zwei *Hetereophrynus* (*Admetus*)-Arten, *H. longicornis* BUTLER und *H. batesii* BUTLER (Arachnida, Amblypygi, Tarantulidae). – Zool. Anz. **192**: 175-191.

WEYGOLDT, P. (2000): Whip spiders (Chelicerata: Amblypygi) – their biology, morphology and systematics. - Apollo books, Stenstrup.

2. Palpigradi

Palpigrads are 1-3 mm long, light yellow to white or colorless, thin-skinned animals. They resemble the young of Thelyphonida. The body is divided into the prosoma (with legs, pedipalps and chelicerae) and the opisthosoma (with a flagellum). Palpigrads are considered to be hygrophilous, photophobic, euedaphic inhabitants of soils or troglobites. The phenology is only known in *Eukoenenia janetscheki* from Central Amazonia, Brazil. Like some other arachnids, no discernible fragments of food can be detected in the alimentary duct. This suggests that either the food is completely digested or only fluids are ingested. Little information is available on reproduction. The males produce a spermatophore, the spermatozoans are aflagellate. The way of insemination and the embryology are still unknown. Larvae, juvenile and adult stages can be recognized by the different number of setae on the front side of the basitarus of leg IV (see ADIS (2002) for further information).

Palpigradi presently comprise 2 families, 6 genera and about 80 species world-wide. Two families, 2 genera and 3 described species occur in Amazonia. At present there is only *Eukoenenia janetscheki* CONDÉ, 1997 known from Central Amazonia, including Reserva Ducke (see ADIS (2002) for identification).

Ecological publication on Palpigradi from Reserva Ducke

ADIS, J., SCHELLER, U., MORAIS, J.W. DE, CONDÉ, B. & J.M.G. RODRIGUES (1997): On the abundance and phenology of Palpigradi (Arachnida) from Central Amazonian upland forests. – J. Arachnol. **25**: 326-332.

3. Pseudoscorpiones

Pseudoscorpions are small to medium-sized chelicerates, with a body length of 1 to 5 mm (Amazonian species). They are predators, normally possessing venom glands in one or both chelal fingers, with exception of the Chthonioidea. They feed on small arthropods, such as mites, beetle larvae or springtails, but some larger species may also attack ants. Most species inhabit soil and litter, but the members of some families (e.g. Chernetidae, Withiidae, Atemnidae) can frequently be found under bark of living or fallen trunks. Of particular biological and ecological interest is the phoretic behaviour of certain species. The developmental stages of most species can be distinguished by the number of trichobothria on the movable finger of the pedipalp (see ADIS (2002) for further information).

Pseudoscorpiones presently comprise 24 families, 428 genera and 3235 species world-wide. Twelve families, 31 genera and 75 described species occur in Amazonia (see ADIS (2002) for identification). From Reserva Ducke, 6 families, 11 genera and 15 described species are known at present (Table 1).

Table 1: Pseudoscorpion species at Reserva Ducke.

Atemnidae	
1. *Brazilatemnus browni* MUCHMORE, 1975	2. *Caecatemnus setosipygus* MAHNERT, 1985
Chernetidae	
3. *Lustrochernes similis* (BALZAN, 1892)	4. *Phymatochernes crassimanus* MAHNERT, 1979
5. *Pseudopilanus crassifemoratus* MAHNERT, 1979	
Chthoniidae	
6. *Pseudochthonius homodentatus* J.C. CHAMBERLIN, 1929	7. *P. tuxeni* MAHNERT, 1979
8. *Tyrannochthonius minor* MAHNERT, 1979	9. *T. rotundimanus* MAHNERT, 1985
Ideoroncidae	
10. *Albiorix arboricola* (MAHNERT, 1979)	11. *A. gracilis* MAHNERT, 1985
Syarinidae	
12. *Ideobisium schusteri* MAHNERT, 1985	13. *I. tenuis* MAHNERT, 1985
14. *Microblothrus tridens* MAHNERT, 1985	
Tridenchthoniidae	
15. *Tridenchthonius brasiliensis* MAHNERT, 1979	

Ecological publications on Pseudoscorpiones from Reserva Ducke

ADIS, J. & MAHNERT, V. (1990): On the species composition of Pseudoscorpiones from Amazonian dryland and inundation forests in Brazil. – Rev. suisse Zool. **97**(1): 49-53.

ADIS, J. & V. MAHNERT (1993): Vertical distribution and abundance of pseudoscorpions (Arachnida) in the soil of two different Neotropical primary forests during the dry and rainy seasons. - Mem. Queensland Mus. **33**(2): 431-440.

ADIS, J., MAHNERT, V., MORAIS, J.W. DE & J.M.G. RODRIGUES (1988): Adaptation of an Amazonian pseudoscorpion (Arachnidae) from dryland forests to inundation forests. - Ecology **69**(1): 287-291.

MAHNERT, V. & J. ADIS (1985): On the occurrence and habitat of pseudoscorpions (Arachnida) from Amazonian forests of Brazil. - Stud. Neotrop. Fauna & Environm. **20**(4): 211-215.

MORAIS, J.W. DE (1985): Abundância e distribuição vertical de Arthropoda do solo numafloresta primária não inundada. - M.Sc.-thesis, CNPq/INPA/FUA, Manaus, Brazil: 92 pp.

4. Ricinulei

Ricinuleids are easily distinguished from all other arachnids by the presence of a cucullus, a sclerite that extends down from the anterior edge of the cephalothorax and covers the chelicerae. In adult males, there is a unique copulatory process on the third pair of legs. The posterior edge of the cephalothorax and the anterior edge of the abdomen are modified to form a unique coupling device that allows the prosoma and opisthosoma to unite, protecting the soft pedicel (which bears the actual copulatory openings). Ricinuleids are largely restricted to leaf litter and underlying soil layers, and are commonly found under rotten logs in lowland forests. Species covered with scale-like setae resist temporary flooding of their habitat during heavy rainfalls by means of plastron respiration. Ricinuleids are predators but selective; prey records include termites, fly larvae, and juvenile spiders, and observations indicate that the cucullus is used in prey capture, along with the chelicerae and pedipalps. Mating has been observed. As in spiders, the male copulatory organs must be charged with sperm, and these organs are used to convey the sperm to the female's copulatory opening. There are five post-embryonic life stages: a larval stage, three nymphal stages, and the adults. As in some mites, the larva has only six legs, rather than eight, with the fourth pair represented only by a pair of small limb buds (see ADIS (2002) for further information).

Ricinulei presently comprise one family, the Ricinoididae, 3 genera and 55 species. One genus and 16 described species occur in Amazonia. From Reserva Ducke, two described species are known at present: *Cryptocellus adisi* PLATNICK, 1988 and *Cryptocellus becki* PLATNICK & SHADAB, 1977 (see ADIS (2002) for identification).

Ecological publications on Ricinulei from Reserva Ducke

ADIS, J., MESSNER, B. & N. PLATNICK (1999): Morphological structures and vertical distribution in the soil indicate facultative plastron respiration in *Cryptocellus adisi* (Arachnida, Ricinulei) from Central Amazonia. - Stud. Neotrop. Fauna & Environm. **34**(1): 1-9.

ADIS, J., PLATNICK, N.I., MORAIS, J.W. DE & J.M.G. RODRIGUES (1998): On the abundance and ecology of Ricinulei (Arachnida) from Central Amazonia, Brazil. - J. New. Entomol. Soc. **97**(2): 133-140.

5. Schizomida

Schizomids are small (2-12.5 mm) arachnids with leg-like, raptorial pedipalps and a long abdomen ending in a short flagellum. The first pair of legs are long appendages which are primarily sensory in nature. The body is divided into two regions, the cephalothorax and abdomen. The Schizomida is unique in having the cephalothorax divided into three regions. Adult females and immatures have a segmented flagellum. The flagellum of penultimate and adult males is unsegmented, often at least twice as thick and slightly shorter than that of females. Schizomids are related to the Uropygi and have in the past been placed as a suborder of the Uropygi. Now, they are recognized as a distinct order (see Introduction). The South American fauna is poorly known and at least 30 species await description. Most species of Schizomida appear to have extremely limited distributions, with many known only from a single locality. Schizomids are usually found in moist areas in leaf litter or on the underside of rocks and logs. Several species have been found associated with termites and a few others with ants. The mating was studied in *Surazomus sturmi* from Colombia and its numerous behaviors described, e.g. locomotion, prey capture, cleaning habits, and digging (see ADIS (2002) for further information).

Schizomida presently comprise 2 families, 34 genera and 219 species world-wide. One family, the Hubbardiidae, 4 genera and 10 described species occur in Amazonia. From Reserva Ducke, two species are known at present: *Adisomus duckei* COKENDOLPHER & REDDELL, 2000 and *Surazomus brasiliensis* KRAUS, 1967 (see ADIS (2002) for identification).

Ecological publication on Schizomida from Reserva Ducke

ADIS, J., REDDELL, J., COKENDOLPHER, J. & J.W. DE MORAIS (1999): Abundance and phenology of Schizomida (Arachnida) from a primary upland forest in central Amazonia. - J. Arachnol. **27**: 205-210.

6. Solifugae

Solifuges are commonly called 'camel-spiders', 'sun-spiders' and 'wind-scorpions'. Such names refer to the desert habitats of some species and the great speed with which they can run on hot sand. The body length of adult solifuges ranges from 8-25 mm in Neotropical species. The most remarkable features of these predators are: (1) huge and powerful chelicerae that are pointed forward with the two fingers articulated vertically, (2) the gripping organ at the distal end of the pedipalps, and (3) the malleoli, five triangular-shaped sensorial organs located on the venter of leg-IV. Usually leg-I has a sensorial role and only legs II, III and IV are used for walking, running and burrowing. Solifuges are considered rare animals, and, even in suitable environments, their density is thought to be low. They are predators that feed on surface-dwelling arthropods, and even small vertebrates. The pedipalps are used for handling the prey. Solifuges are often associated with termite nests, where they feed on the termites, and in some cases, resemble termites in the shape of their body. Solifuges are also capable of climbing trees, since they have been collected in trunk traps and inside arboreal termite nests in Central Amazonia. Eremobatidae is the only family from the Americas for which first observations on mating and reproduction are available. The gravid females lay eggs in burrows on the ground. The eggs hatch into the post-embryonic stage, where most of the appendages are not well developed and body movements are rudimentary. The first ecdysis gives rise to the successive nymphal stages, usually eight in number. No data are available about the development of Neotropical Solifugae. Sexual dimorphism is noticeable only in adult individuals. Adult males bear a flagellum, which is a membranous or hairy organ placed in the mesal face of the fixed finger of each chelicerae

and is formed during the last ecdysis (see ADIS (2002) for further information).

Solifugae presently comprise 12 families, 140 genera and 1064 species world-wide. One family, 1 genus and 2 species occur in Amazonia (see ADIS (2002) for identification). From Reserva Ducke, only young individuals were collected in ground or arboreal termite nests as well as in trunk traps. They can only be determined to family and represent the Ammotrechidae.

Ecological publication on Solifugae from Reserva Ducke

HÖFER, H. & L. BECK. (1995): Die Spinnentierfauna de Regenwaldreservats "Reserva Ducke" in Zentralamazonien I. - Natur und Museum **125** (12): 389-401.

7. Uropygi (Thelyphonida)

Thelyphonids (whip-scorpions) are somewhat scorpion-like in appearance, but lack a sting and have a whip-like tail at the end of their opisthosoma. When disturbed, some species produce an odor like vinegar and for this reason are also called 'vinegaroons'. The adult body length in South American species is about 18-65 mm. They are nocturnal, predaceous and generally found under logs, in litter, or burrowed in the soil. It has become common practice to employ the order name Uropygi instead of Thelyphonida for the thelyphonids (see Introduction). The biology of thelyphonids has not been broadly investigated. Almost all that has been written concerning Amazonian thelyphonids is on the behavior, taxonomy and phenology of the single species yet known from Central Amazonia (see ADIS (2002) for further information).

Uropygi presently comprise 2 families, 16 genera and 106 species world-wide. The two families Hypoctonidae and Thelyphonidae, 2 genera (*Mastigoproctus, Thelyphonellus*) and 3 described species occur in Amazonia. At present only *Thelyphonellus amazonicus* (BUTLER, 1872) is known from Central Amazonia, including Reserva Ducke (see ADIS (2002) for identification).

Ecological publications on Uropygi (Thelyphonida) from Reserva Ducke

ADIS, J., SCHELLER, U., MORAIS, J.W. DE, CONDÉ, B. & J.M.G. RODRIGUES (1997): On the abundance and phenology of Palpigradi (Arachnida) from Central Amazonian upland forests. - J. Arachnol. **25**: 326-332.

HÖFER, H. & L. BECK (1995): Die Spinnentiere des Regenwaldreservats "Reserva Ducke" in Zentralamazonien. - Natur und Museum **125**(12): 1-12.

WEYGOLDT, P. (1978): Paarungsverhalten und Spermatophorenmorphologie bei Geisselskorpionen: *Thelyphonellus amazonicus* BUTLER und *Typopeltis crucifer* POCOCK (Arachnida, Uropygi). - Zoomorphologie **89**: 145-146.

8. Other orders

The following data on the remaining orders of Arachnida are available at present:

1. Acari

Acari comprise 350-420 families, 3300-4000 genera and 45000 species world-wide. Thirty-five families, 50 genera and 150-300 described species occur in Amazonia (see ADIS (2002) for identification). From Reserva Ducke, data are available for oribatid mites (Oribatida) only (see ADIS (2002) for identification). They comprise 45 families, 72 genera, 35 described species and 109 undescribed morphospecies (Table 2).

Table 2: Oribatida species at Reserva Ducke (described species and undescribed morphospecies).

I. LOWER ORIBTIDA

Palaeosomata GRANDJEAN, 1969

Acaronychidae GRANDJEAN, 1932

1. *Acaronychus proximus* SCHUBART, 1986

Enarthronota GRANDJEAN, 1947

Cosmochthoniidae GRANDJEAN, 1947

2. *Cosmochthonius lanatus reticulatus* BECK, 1962
3. *Cosmochthonius reticulatus* GRANDJEAN, 1947

Haplochthoniidae HAMMEN, 1959

4. *Haplochthonius* sp.

Hypochthonioidea BERLESE, 1910

Hypochthoniidae BERLESE, 1910

5. *Malacoangelia remigera* BERLESE, 1913
6. *Eohypochthonius gracilis* JACOT, 1936
7. *Eohypochthonius* sp.

Lohmaniidae BERLESE, 1916

8. *Lohmannia* sp. A
9. *Xenolohmannia* sp.

Mesoplophoridae EWING, 1917

10. *Mesoplophora* sp.

Mixonomata GRANDJEAN, 1969

Epilohmanniidae OUDEMANS, 1923

11. *Epilohmannia* sp.

Phthiracaridae PERTY, 1841

12.-16. Phthiracaridae spp. (ca. 5 species of 3 genera: *Hoplophorella* BERLESE, 1923, *Hoplophthiracarus* JACOT, 1933, *Phthiracarus* PERTY, 1841)

Oribotritiidae GRANDJEAN, 1954 and Euphthiracaridae JACOT, 1930

17.-21. Oribtritiidae/Euphthiracaridae spp. (ca. 5 species of 3 genera: *Oribotritia* JACOT, 1924, *Rhysotritia* MÄRKEL & MEYER, 1959, *Euphthiracarus* EWING, 1917)

Nothroidea GRANDJEAN, 1954

Malaconothridae BERLESE, 1916

22. & 23. *Malaconothrus* spp. (2 species)

Genus *Archegozetes* GRANDJEAN, 1931

24. *Archegozetes longisetosus* AOKI, 1965
25. *Archegozetes* sp.

Genera *Afronothrus* WALLWORK, 1961 & *Allonothrus* HAMMEN, 1953

26. & 27. *Afronothrus* spp. (ca. 2 species)
28. *Allonothrus neotropicus* BALOGH & MAHUNKA, 1969

Nanhermanniidae SELLNICK, 1928

29. *Cyrthermannia* sp.
30. *Nanhermannia* sp.

II. HIGHER ORIBATIDA

1. ANCIENT GROUPS OF HIGHER ORIBATIDA

Opsiopheredermous groups

Hermanniellidae GRANDJEAN, 1934

31. Hermanniellidae sp.

Eupheredermous groups (the Anderemaeidae tentatively included) Pasmobatidae GRANDJEAN, 1961

32. Plasmobatidae sp.

Liodidae GRANDJEAN, 1954

33. *Teleioliodes* sp.

Arceremaeidae BALOGH, 1972

34. *Arceremaeus* sp.

Anderemaeidae BALOGH, 1972

35. *Carabodoides* sp.

Apheredermous groups

Cymbaeremaeidae SELLNICK, 1928

36. *Scapheremaeus* sp.

Carabodidae C.L. KOCH, 1837

37.-39. Carabodidae spp. (ca. 3 species)

40. *Carabodes* sp.

41. *Carabodes irmayii* BALOGH & MAHUNKA, 1969

42. *Neocarabodes* sp.

43. *Machadocepheus* sp. (ca. 1 species)

44. *Spathulocepheus amazonicus* BALOGH & MAHUNKA, 1969

45. *Spathulocepheus* sp.

46. & 47. *Gibbicepheus* spp. (ca. 2 species)

Dampfiellidae BALOGH, 1961

48. *Beckiella foveolata* BALOGH & MAHUNKA, 1969

Otocepheidae BALOGH, 1961

49. *Dolicheremaeus amazonicus* BALOGH & MAHUNKA, 1969

50. *Dolicheremaeus* sp.

51. *Cavernocepheus monstruosus* BALOGH & MAHUNKA, 1969

2. TRANSITIONAL GROUPS OF HIGHER ORIBATIDA

Eupheredermous gymnodamaeoid and eremuloid groups

Gymnodamaeoidea GRANDJEAN, 1954

Plateremaeidae TRÄGHARDH, 1931

52. *Plateremaeus* sp.

Eremuloidea GRANDJEAN, 1965

Damaeolidae GRANDJEAN, 1965

53. *Fosseremus* sp.

Eremobelbidae BALOGH, 1961

54. *Eremobelba foliata*, HAMMER 1958

55. *Eremulus nigrisetosus* HAMMER, 1958

56. *Eremulus rigidisetosus* BALOGH & MAHUNKA, 1969

57. *Eremulus translamellatus* BALOGH & MAHUNKA, 1969

58. *Eremulus* sp.

Heterobelbidae BALOGH, 1961

59. *Heterobelba crassisetosa* BECK, 1962

60. *Heterobelba* sp.

Eupheredermous cepheoid groups (the Microtegaeidae tentatively included)

Microtegeidae BALOGH, 1972

61. & 62. *Microtegeus* spp. (ca. 2 species)

Eupheredermous charassobatid and apheredermous tegeocranellid groups

Charassobatidae GRANDJEAN, 1958

63. *Charassobates ornatus* BALOGH & MAHUNKA, 1969

64. *Charassobates simplex* BALOGH & MAHUNKA, 1969

Eremellid and licneremaeid groups

Licneremaeidae GRANDJEAN, 1931

65. *Licneremaeus* sp.

Liacaroidea BALOGH, 1961

Peloppiidae BALOGH, 1943

66. *Ceratoppia* sp.

Genus Ceratorchestes BALOGH & MAHUNKA, 1969

67.-69. *Ceratorchestes* spp. (ca. 3 species)

70. *Ceratorchestes setosus* BALOGH & MAHUNKA, 1969

Xenillidae WOLLEY & HIGGINS, 1966

71. *Xenillus brasilianus* BALOGH & MAHUNKA, 1969

Pterogasterine groups

Eupheredermous or apheredermous fully or widely aporonotic Pterogasterina

Microzetidae GRANDJEAN, 1936

72.-76. Microzetidae spp. (minimum 5 species)

Eremaeozetidae PIFFL, 1972

77. *Eremaeozetes arboreus* NÜBEL-REIDELBACH & WOAS, 1992

78.-82. *Eremaeozetes* spp. (ca. 5 species)

Genus *Tegeozetes* BERLESE, 1913

83. *Tegeozetes tunicatus* BERLESE, 1913

Tectocepheidae GRANDJEAN, 1954

84. & 85. *Tectocepheus* spp. (2 species)

Genus *Allozetes* BERLESE, 1914

86. *Allozetes* sp.

Poronotic Pterogasterina

Nasobatidae BALOGH, 1972

87. *Nasobates mirabilis* BALOGH & MAHUNKA, 1969

Epactozetidae GRANDJEAN, 1930

88. *Epactozetes setosus* BALOGH & MAHUNKA, 1969

89. *Epactozetes* sp.

90. *Truncozetes mucronatus* BALOGH & MAHUNKA, 1969

Oribatellidae JACOT, 1925

91. *Oribatella serrata* BALOGH & MAHUNKA, 1969

Lamellobatid and related genera

92. & 93. *Lamellobates* spp. (at least 2 species)

Genus *Rostrozetes* SELLNICK, 1925

94. *Rostrozetes carinatus* BECK, 1965

95. *Rostrozetes foveolatus* SELLNICK, 1925
96. *Rostrozetes rimachensis* BECK, 1965
97. *Rostrozetes* cf. *rimachensis* BECK, 1965
98. *Rostrozetes* sp. 2
Oripodidae JACOT, 1925
99. *Benoibates bolivianus* BALOGH & MAHUNKA, 1969

Oppiid-like groups with eremuloid characters
Genus *Suctoribates* BALOGH, 1963
100. *Suctoribates neotropicus* BALOGH & MAHUNKA, 1969
Rhynchoribatidae BALOGH, 1961
101. *Rhynchoribates brasiliensis* WOAS, 1986
102.-106. *Rhynchoribates* spp. (ca. 5 species)

Sternoppiid groups
Sternopiidae BALOGH & MAHUNKA, 1969
107. *Sternoppia reticulata* BALOGH & MAHUNKA, 1969
108. *Sternoppia* sp.

3. DERIVED GROUPS OF HIGHER ORIBATIDA
Poronotic Pterogasterina
Macroscleritic groups
Galumnidae JACOT, 1925
109.-125. Genera *Galumna, Pergalumna, Orthogalumna* (ca. 17 species)

Microscleritic groups
Mochlozetidae GRANDJEAN 1960
126. & 127. *Podoribates* spp. (ca. 2 species)
Parakalummidae GRANDJEAN, 1936
128. *Parakalumma foveolata* BALOGH & MAHUNKA, 1969
Haplozetidae GRANDJEAN, 1936
129. & 130. *Haplozetes* spp. (ca. 2 species)
131. & 132. *Peloribates* spp. (ca. 2 species)
133. *Paraxylobates* sp.
Scheloribatidae GRANDJEAN, 1954
134.-137. *Scheloribates* spp. (ca. 4 species)

Oppioidea sensu GRANDJEAN, 1951
Suctobelbidae JACOT, 1938
Genus Rhynchobelba WILLMANN, 1953
138. & 139. *Rhynchobelba* spp. (ca. 2 species)
Oppiidae GRANDJEAN, 1954.
140.-144. Oppiidae spp. (ca. 5 species, mainly of the genera *Arcoppia* HAMMER, 1977, *Amerioppia* HAMMER, 1961, *Ramusella* HAMMER, 1962, *Oppia* C.L. KOCH, 1836)

2. Araneae

Spiders presently comprise 108 families, 3449 genera and ca. 37296 species world-wide. More than 65 families, >300 genera and >1000 described species occur in Amazonia (see ADIS (2002) for identification). From Reserva Ducke, 30 families, 143 genera and

295 described species (cf. Adis 2002; HÖFER & BRESCOVIT 2001) are known at present. In addition, ca. 205 undescribed morphospecies, repesenting >150 genera and 45 families, have been collected (cf. HÖFER & BRESCOVIT 2001).

3. Opiliones

Opilionids presently comprise 46 families, >1616 genera and >5014 species word-wide. Thirteen families, 75 genera and 173 described species occur in Amazonia (see ADIS (2002) for identification). From Reserva Ducke, 5 families, 7 genera and 8 described species are known at present (Table 3).

Table 3: Opiliones species at Reserva Ducke.

Agoristenidae
1. *Trinella matintaperera* PINTO-DA-ROCHA, 1996

Cosmetidae
2. *Eucynortula lata* (BANKS, 1909)

Cranaidae
3. *Parkocranaus bimaculatus* MELLO-LEITÃO, 1914

Neogoveidae
4. *Metagovea oviformis* MARTENS, 1969

Stygnidae
5. *Auranus hoeferscovitorum* PINTO-DA-ROCHA, 1997
6. *A. parvus* MELLO-LEITÃO, 1941
7. *Protimesius longipalpis* (ROEWER, 1943)
8. *Stygnus pectinipes*(ROEWER, 1943)

4. Scorpiones

Scorpions presently comprise 18-20 families, 156-165 genera and 1250-1500 species word-wide. Four families, 12-14 genera and 100-150 described species occur in Amazonia (see ADIS (2002) for identification). From Reserva Ducke, 2 families, 4 genera and 5 described species are known at present (Table 4).

Table 4: Scorpiones species at Reserva Ducke.

Buthidae
1. *Ananteris pydanieli* LOURENÇO, 1982
2. *Tityus metuendus* POCOCK, 1897
3. *T. raquelae* LOURENÇO, 1988
4. *T. silvestris* POCOCK, 1897

Chactidae
5. *Brotheas amazonicus* LOURENÇO, 1988

References

ACN (1996): Report of the Nomenclature Committee. - Arachnologia **13**: 5.

ADIS , J. (ed.) (2002): Amazonian Arachnida and Myriapoda. - Pensoft, Sofia.

ADIS, J., HARADA, A.Y., FONSECA, C.R.V. DA, PAARMANN, W. & J.A. RAFAEL (1998): Arthropods obtained from the Amazonian tree species "Cupiuba" (*Goupia glabra*) by repeated canopy fogging with natural pyrethrum. - Acta Amazonica **28**(3): 273-284.

APOLINÁRIO, F.B. (1993): Composição faunística e hábitos de nidificação de térmitas (Insecta: Isoptera) em florestas de terra firme da Amazônia Central. - M.Sc.-thesis, INPA/FUA, Manaus/Brazil.

CODDINGTON, J.A. & R.K. COLWELL (2001): Arachnids. - In: LEVIN, S.A. (ed.): Encyclopedia of Biodiversity: Vol. **1**: 199-218. Academic Press, San Diego.

GENTRY, A.H. (1990): Four Neotropical rainforests. - Yale Univ. Press, New Haven.

GRUNER, H.-E. (ed.) (1993): Lehrbuch der Speziellen Zoologie. - Vol. **1**: Wirbellose Tiere. Part 4: Arthropoda (ohne Insekten). G. Fischer, Stuttgart.

HARADA, A. Y. & J. ADIS (1998): Ants obtained from trees of a "Jacaréuba" (*Calophyllum brasiliense*) forest plantation in Central Amazonia by canopy fogging: first results. - Acta Amazonica **28**(3): 309-318.

HERO, J.-M. (1990): An illustrated key to tadpoles occurring in the Central Amazon rainforest, Manaus, Amazonas, Brasil. - Amazoniana **11**(2): 201-262.

HÖFER, H. & L. BECK (1995): Die Spinnentierfauna des Regenwaldreservats "Reserva Ducke" in Zentralamazonien I.- Natur und Museum **125**(12): 389-401.

HÖFER, H. & L. BECK (1996): Die Spinnentierfauna des Regenwaldreservats "Reserva Ducke" in Zentralamazonien II.- Natur und Museum **126**(3): 69-85.

HÖFER, H. & A.D. BRESCOVIT (2001): Species and guild structure of a Neotropical spider assemblage (Araneae) from Reserva Ducke, Amazonas, Brazil. - Andrias **15**: 99-119.

MILLOT, J. (1949): Ordre des Uropyges. - In: GRASSÉ, P.P. (ed.): Traité de Zoologie **6**: 533-562. Masson, Paris.

PARKER, S.P. (ed.) (1982): Synopsis and classification of living organisms. Vols. **1 & 2**. McGraw-Hill, New York.

PENNY, N. & J.R. ARIAS (1982): Insects of an Amazon forest. - Colombia Univ. Press, New York.

REDDELL, J.R. & J.C. COKENDOLPHER (1995): Catalogue, bibliography, and generic revision of the order Schizomida (Arachnida). - Texas Mem. Mus., Speleological Monographs **4**: 1-169.

RIBEIRO, J.E.L. DA S., HOPKINS, M.J.G., VICENTINI, A. et al. (1999): Flora da Reserva Ducke: guia de identificação das plantas vasculares de uma floresta de terra-firme na Amazônia Central. - INPA, Manaus.

SAVORY, T.H. (1972): On the names of the orders of Arachnida. - Syst. Zool. **21**: 122-125.

SHULTZ, J.W. (1990): Evolutionary morphology and phylogeny of Arachnida. - Cladistics **6**: 1-38.

WEYGOLDT, P. (1998): Evolution and systematics of the Chelicerata: - Exp. Appl. Acarol. **22**: 63-79.

WEYGOLDT, P. & H.F. PAULUS (1979): Untersuchungen zur Morphologie, Taxonomie und Phylogenie der Chelicerata. II. Cladogramme und die Entfaltung der Chelicerata. - Z. Zool. Syst. Evol. **17**: 177-200.

WHEELER, W.C. & C.Y. HAYASHI (1998): The phylogeny of the extant chelicerate orders. - Cladistics **14**: 173-192.

WILLIS, E.O. (1977): Lista preliminar das aves da parte noroeste e áreas vizinhas da Reserva Ducke, Amazonas, Brasil. - Rev. Bras. Biol. **37**(3): 585-601.