NAT. HIST. BULL. SIAM SOC. 50(2): 239–243, 2002

ECTOPARASITIC MITES (ACARI, TROMBICULIDAE) ON OPLIONIDS (OPILIONES, GAGRELLIDAE) IN NORTHERN THAILAND

Pakawin Dankittipakul[1] *and Saowapa Sonthichai*[1]

ABSTRACT

Five species of opilionids viz, *Gagrella alba, G. fumosa, G. sexmaculata, Metagagrella curvispina,* and *M. fusca,* from Doi Inthanon National Park and Doi Suthep-Pui National Park, Chiang Mai Province, northern Thailand, are reported for the first time in association with ectoparasitic larvae of trombiculid mites. Forty-three percent of opilionid individuals examined were carrying mites, most of which were attached to the hosts' legs. Different degrees of parasitism in the opilionid hosts were observed. The possible reasons for this phenomenon are discussed.

Key words: Opiliones, *Gagrella, Metagagrella,* parasitic mites, Trombiculidae, Thailand.

INTRODUCTION

Nematodes are the major parasites of opilionids, but several opilionid species have also been found carrying conspicuous, bright red mites of the family Thrombidiidae. These mites are *Erythraeus phalangioides, Belaustium nemorum,* and at least four species of *Leptus* (CLOUDSLEY-THOMPSON, 1968; FAIN & D' AMICO, 1997).

So far, no parasitic Trombiculidae have been found on opilionids. Trombiculid mites are typically found on vertebrates, which they feed on as parasites or use for dispersal (phoresy). Many trombiculid mites are parasitic on rodents, birds, and bats (AMIN-BABJEE *ET AL.*, 1997; BROWN, 1998; DOOD & KURTA, 1988; GOFF, 1984, 1988; GOFF & WHITAKER, 1984; GOFF *ET AL.*, 1984; IWASA *ET AL.*, 1990; KOLEBINOVA, 1985; MORSY *ET AL.*, 1999; SPALDING *ET AL.*, 1997; URAKAMI *ET AL.*, 1999; YANG, 1987; ZHAO, 1984). Some have been found on marsupials, reptiles, and frogs (GOFF & EASTON, 1989; LESTER, 1983; OAKWOOD & SPRATT, 2000; SPIELER & LINSENMAIR, 1999). However, to our knowledge, no trombiculid mite larvae have ever been recorded on opilionids. Here we present the first published descriptions of ectoparasitic trombiculid larvae on opilionids in Thailand.

[1]Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai 50200
Received 3 June 2002; accepted 24 September 2002.

MATERIALS AND METHODS

The majority of mites and opilionids examined in this study were collected from Doi Inthanon National Park (18° 32' N, 98° 34' E) and from Doi Suthep-Pui National Park (18° 48' N, 98° 55' E), Chiang Mai Province, northern Thailand, between June and August 2000, in the course of faunistic surveys of spiders. The opilionids were collected by hand from the vegetation, placed in a plastic vial, and a cotton ball with ethyl acetate was added for a minute or so. The specimens were then taken to the Terrestrial Arthropods Research laboratory, Chiang Mai University, for sorting and identification.

Mites are considered to be parasitic when their mouthparts are firmly embedded in the cuticle of the host. Parasitic mites were identified to family using the key of KETHLEY (1990) and confirmed by Dr Sandor Mahunka (Hungary). Opilionids were identified using the key provided by SUZUKI (1985).

RESULTS

We collected 205 opilionid individuals, belonging to two genera and five species, during this study (Table 1). They were *Gagrella alba* Suzuki 1985, *G. fumosa* Suzuki 1985, *G. sexmaculata* Suzuki 1969, *Metagagrella curvispina* Suzuki 1985 and *M. fusca* Suzuki 1985. A multi-species aggregation was observed at one locality, near a riverbank in deciduous dipterocarp–oak forest about 1,000 m elevation on Doi Inthanon. These were 138 individuals of *G. fumosa*, 18 of *G. sexmaculata*, 4 of *M. curvispina*, and 5 of *M. fusca*. The other specimens were collected from different localities on Doi Inthanon and Doi Suthep.

All five species were infested with larvae of trombiculid mites (Acari, Trombidiformes, Trombiculidae), with 43 percent of all opilionid individuals examined being parasitized (Table 1). The degrees of parasitism in each host varied considerably: *Metagagrella fusca* (100%), *M. curvispina* (75%), *G. fumosa* (40%), *G. sexmaculata* (39%), and *G. alba* (31%).

The number of mites per host specimen ranged from 1 to 10, with a mean of 1.5 (± 0.9 SD), median value 1 and mode of 2. *Metagagrella fusca* was the most abundantly parasitized host, always carrying 3–10 mites. Several individuals of *G. fumosa* carried 1–4 mites, those of *Gagrella alba* and *M. curvispina* 1–2 mites, while all specimens of *G. sexmaculata* had only one mite (Table 1).

Table 1. Parasitism of trombiculid mites on five species of opilionids from northern Thailand

Species	No. hosts studied	No. hosts occupied	% parasitism	No. mites/host
Gagrella alba	16	5	31.3	1–2 (mean 1.3)
Gagrella fumosa	162	64	39.5	1–4 (mean 1.6)
Gagrella sexmaculata	18	7	38.8	1–1 (mean 1.0)
Metagagrella curvispina	4	3	75.0	1–2 (mean 1.2)
Metagagrella fusca	5	5	100.0	3–10 (mean 6.5)
Total	205	84	40.97	1.4–3.8 (mean 1.5)

Mites were found mainly on the legs of the hosts (Table 2) where they apparently preferred attaching themselves to the long segments. Mites were most abundant on the host's femora (40%), patellae (39%), often also attached to the tibiae (9%), and occasionally to the metatarsi (1%). Seven mites (6%) were present on the dorsal scutum. No mites were found on the ventral part of the body such as the sternum and coxae.

Table 2. Numbers of trombiculid mites attached to various parts of five species of opilionids from northern Thailand. T = tarsus, Mt = metatarsus, Ti = tibia, Pt = patella, Fe = femur, Tr = trochanter, Cx = coxa, Ds = dorsal scutum, St = sternum.

Species	Ds	St	Cx	Tr	Fe	Pt	Ti	Mt	T
Gargella alba	1	0	0	0	4	3	0	0	0
Gargella fumosa	5	0	0	0	24	32	7	1	0
Gagrella sexmaculata	0	0	0	0	6	2	0	0	0
Metagagrella curvispina	1	0	0	0	4	3	0	0	0
Metagagrella fusca	0	0	0	6	7	4	3	0	0
Total	7	0	0	6	45	44	10	1	0

DISCUSSION

Aggregations of opilionids have been recorded in some Palpatores including Gagrellidae (CODDINGTON *ET AL.*, 1990; HOLMBERG *ET AL.*, 1984). HOLMBERG *ET AL.*, (1984) suggested that gregarious behavior in opilionids occurs in certain places in order to avoid dehydration and exposure to sunlight. The observed aggregations of *G. fumosa* together with other species (multi-species aggregation) near a riverbank may explain this phenomenon, since this microhabitat is constantly moist. As numerous individuals of *G. fumosa* were found occurring together at the same place (mono-species aggregation), it is possible that the formation of mating groups is another reason for this behavior (see HOLMBERG *ET AL.*, 1984).

Metagagrella fusca was the most strongly parasitized host species observed, with 100% parasitism and with the highest numbers of mites per individual. The physical factors of the exoskeleton may influence choice of host. All coxae of *M. fusca* are thickly coated with a white secretion. This secretion, known to function in intraspecific recognition (HOLMBERG, 1986), may contain specific substances that could stimulate the mites to attack certain species of opilionids. Another member of the genus, *M. curvispina*, ranks second in number of parasites. It is possible that *Metagagrella* produces chemical substances that are attractive to these mites. The coloration of the *Metagagrella* is different from that of other genera. The bodies of the *Metagagrella* species examined were blackish dorsally and ventrally, while the species of *Gagrella* examined were brown or dark yellow in color.

Mites attached to the patellae of their hosts were mainly found piercing their mouthparts into the membranous joint between patella and tibia, where they could feed more easily. The leg femora carried mites mostly in their distal parts, including the membranous joint

between the femur and patella. The long femoral segment provides easy access to soft tissue. Mites were absent on the tarsi, the long articulated distal segments of the legs, which bend as the opilionids move. Opilionids carefully clean their distal leg segments by pulling them through the chelicerae; this habit may explain why there were no mites on the tarsi and only one mite on the metatarsi.

Parasitism of opilionids by mites may be regarded as a modification of an ancestral behavioral pattern. Some species of mites are rarely found free-living, but mostly occur in association with mammals and other vertebrates where they do not feed directly on the host, but on other mites and insects living on it. It is easy to imagine that some of these epizoic mites later evolved an easy way to obtain their food by sucking the blood of the animal on which they lived. By this means, many families of mites may have become ectoparasitic on birds and mammals (BELL & WHELAN, 1993; GOFF & WHITAKER, 1984; HADI & CARNEY, 1977; PEREIRA-LORENZO, 1993). In the same way, mites may attack opilionids for two reasons. First, opilionids provide a place where these mites can obtain food. Secondly, opilionids are used as a mechanism to stay in moist environments. TODD (1949) found a strong correlation between humidity and the migration of Phalangiidae. Later, these mites may also have evolved a new life style and become parasites. However, they do not remain permanently attached to hosts, but feed on them before returning to the ground.

Although parasitized opilionids have not yet been collected from localities other than Doi Inthanon National Park and Doi Suthep-Pui National Park, it is probable that mites parasitic on opilionids occur commonly elsewhere in Thailand. Opilionids in association with ectoparasitic mites have been reported from different geographical regions by various authors (CLOUDSLEY-THOMPSON, 1968; FORSTER, 1954; FAIN & D'AMICO, 1997), but all there records refer to Trombidiidae, not Trombiculidae.

ACKNOWLEDGMENTS

We are especially grateful to Dr. Peter J. Schwendinger (Musém d'histoire naturelle, Genève), Dr. Stephen Elliott and Mr. J. F. Maxwell (both at Chiang Mai University) for their critical comments on the manuscript. We are indebted to Dr. Sandor Mahunka (Museum of Natural History, Budapest) for confirmation of our identifications of mite specimens.

REFERENCES

AMIN-BABJEE, S. M., C. C. LEE, AND A. A. MAHMOOD. 1997. Prevalence of ectoparasite infestations in different age groups of village chickens. *Journal Veterinary Malaysia* 9(2): 55–59.

BELL, P. J., AND P. I. WHELAN. 1993. A scrub typhus vector *Leptotrombidium deliense* Australia. *J. Australian Entomol. Soc.* 32(3): 207–208.

BROWN, W. A. 1998. *Walchiella* (Acari: Trombiculidae) from rodent hosts from the Philippines. *Internat. J. Acarol.* 24(2): 107–112.

CLOUDSLEY-THOMPSON, J. L. 1968. *Spiders, Scorpions, Centipedes and Mites.* Pergamon Press, Oxford.

CODDINGTON, J. A., M. HARNER, AND E. A. SODERSTROM. 1990. Mass aggregation in tropical harvestmen (Opiliones, Gagrellidae: *Prionostemma* sp.). *Revue Arachnologique* 8: 213–219.

DOOD, S. B., AND A. KURTA. 1988. Additional records of Michigan bat ectoparasites. *Great Lakes Entomol.* 21(3): 115–117.

FAIN, A., AND F. D'AMICO. 1997. Observation on larval mite (Acari) parasitic on Opilionids from the French Pyrenees. *Internat. J. Acarol.* 23: 39–48.

FORSTER, R. R. 1954. The New Zealand Harvestmen (sub-order Laniatores). *Canterbury Mus. Bull.* 2: 1–329.

GOFF, M. L. 1984. A new species of *Gahrliepia* (Acari: Trombiculidae) from a shrew-hedehog (Insectivora) in China. *J. Med. Entomol.* 21(6): 690–691.

GOFF, M. L. 1988. A new species of chigger (Acari: Trombiculidae) from a vampire bat (Chiroptera: Desmodontidae) collected in Costa Rica. *Internat. J. Acarol.* 14(1): 5–7.

GOFF, M. L., AND E. R. EASTON. 1989. Two new species and new records of chiggers (Acari: Trombiculidae) collected from mammals and reptiles in Papua New Guinea. *Internat. J. Acarol.* 15(4): 235–239.

GOFF, M. L., AND J. O. WHITAKER, Jr. 1984. A small collection of chiggers (Acari: Trombiculidae) from mammals collected in Paraguay. *J. Med. Entomol.* 21(3): 327–335.

GOFF, M. L., J. O. WHITAKER, JR., AND L. J. BARKLEY. 1984. A new species of *Loomisia* (Acari: Trombiculidae) from a Peruvian bat. *J. Med. Entomol.* 21(1): 80–81.

HADI, T. R. AND W. P. CARNEY. 1977. Two new trombiculid mites from mammals of South Vietnam, with locality records for six additional species (Acarina: Trombiculidae). *J. Med. Entomol.* 14(4): 455–460.

HOLMBERG, R. G. 1986. The scent glands of Opilionids: A review of their function. Proc. 9th Internat. Congress of Arachnology, Panama, 1983, Smithsonian Inst. Press.

HOLMBERG, R. G., N. P. D. ANGERLLI, AND J. L. LACASSE. 1984. Overwintering aggregation of *Leiobunum paessleri* in caves and mines (Arachnida, Opiliones). *J. Arachnol.* 12: 195–204.

Iwasa, M., S. KASUYA, N. NODA, A. HIOKI, A. ITO, AND H. OHTOMO. 1990. Trombiculid mites (Acari; Trombiculidae) and *Rickettsia tsutsugamushi* isolated from wild rodents in new endemic area of Japan. *J. Med. Entomol.* 27(4): 501–508.

KETHLEY, J. 1990. Acarina: Prostigmata (Actinedida). Pp.667-778 in Dindal, D. L. (ed.). *Soil Biology Guide*. John Wiley & Sons, New York.

KOLEBINOVA, M. G. 1985. Parasitism of rodents of the genus *Apodemus* Kaup in Bulgaria by trombiculid larvae (Acarina, Trombiculidae). *Acta Zoologica Bulgarica* 27: 21–26.

LESTER, L. 1983. Two new chiggers from Australian marsupials (Acari: Trombiculidae). *Proc. Linnean Soc. New South Wales* 107(4): 493–499.

MORSY, T. A., S. A. MAZYARD, AND M. S. YOUNIS, 1999. Feather and nest mites of two common resident birds in two ecologically different Egyptian governorates. *J. Egyptian Soc. Parasitol.* 29 (2): 417–430.

OAKWOOD, M., AND D. M. SPRATT. 2000. Parasites of the northern quoll, *Dasyurus hallucatus* (Marsupialia: Dasyuridae) in tropical savanna, Northern Territory. *Australian J. Zool.* 48(1): 79–90.

PEREIRA-LORENZO, A. 1993. Chiggers (Acarina: Trombiculidae) parasitising small mammals in Galicia (NW Spain). *Acarologia* 34(4): 323–329.

SPALDING, M. G., W. J. WRENN, S. T. SCHWIKERT, AND J. A. SCHMIDT. 1997. Dermatitis in young Florida sandhill cranes (*Grus cannadensis pratensis*) due to infestation by the chigger, *Blankaartia sinnamaryi*. *J. Parasitol.* 83(4): 768–771.

SPIELER, M., AND K. E. LINSENMAIR. 1999. The larval mite *Endotrombicula pillersi* (Acarina: Trombiculidae) as a species-specific parasite of a West African savannah frog (*Phrynobatrachus francisci*). *Amer. Midl. Nat.* 142(1): 152–161.

SUZUKI, S. 1985. A synopsis of the Opilionids of Thailand (Arachnida) II. Palpatores. *Steenstrupia* 11(7): 209–257.

TODD, V. 1949. The habits and ecology of the British harvestmen (Arachnida, Opiliones), with special reference to those of the Oxford district. *J. Anim. Ecol.* 18: 209–216.

URAKAMI, H., A. TAMURA, I. V. TARASEVICH, T. KADOSAKA, AND F. N. SHUBIN. 1999. Decreased prevalence of *Orientia tsutsugamushi* in trombiculid mites and wild rodents in the Primorye region, Far East Russia. *Microbiol. Immunol.* 43(10): 975–978.

YANG, B. X. 1987. Investigation of ectoparasitic mites of rodents in Sandu District, Fujian Province. *Ann. Bull. Soc. Parasitol., Guangdong Province* 8–9: 37.

ZHAO, S. X. 1984. A new species of chigger mite parasitic on bats (Acarina: Trombiculidae). *Acta Zootaxonomica Sinica* 9(3): 281–283.