

SHORT COMMUNICATION

Harvestmen (Opiliones) as hosts of Parasitengona (Acari: Actinotrichida, Prostigmata) larvae

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Abstract. New records of parasitic *Parasitengona* larvae on harvestmen hosts from the Palaearctic region are provided. Four species of harvestmen have been found to be new hosts of *Parasitengona* and four species of mites have been recorded as new parasites of Opiliones. The first case of parasitism of Hydrachnidia on harvestmen has been found.

Keywords: Nemastomatidae, Phalangidae, Erythraeidae, Trombidiidae, Hydryphantidae, parasitic mites

Parasitengona constitute one of the most numerous and diverse groups of mites. There are at least 9000 described (nominal) species that represent more than 800 genera, 60 families, and 14 superfamilies. More than half of them, i.e., ca 5000 species, belong to aquatic *Parasitengona* (= Hydrachnidia), the “water mites”. The remaining taxa belong to terrestrial *Parasitengona* (= Trombidiidae), the “velvet mites”. The life cycle of *Parasitengona* consists of seven stages, including three active ones: larva, deutonymph and adult. The egg, prelarva, protonymph, and tritonymph are inactive. The active postlarval instars of *Parasitengona* are predatory and feed on insect eggs, larvae, and pupae as well as on other small arthropods. The heteromorphic larvae (excluding Calyptostomatidae that have homeomorphic ones) are parasites, with few exceptions pertaining, e.g., to members of *Balaustium* spp., some *Abrolophus* and *Allothrombium*, which are known for their predatory life style (Wohltmann 2001; Wohltmann et al. 2007).

The majority of Trombiculidae larvae are parasites of mammals, but members of some genera parasitize amphibians, reptilians and birds. Invertebrates are scarcely reported as hosts for Trombiculidae. The larvae of remaining terrestrial *Parasitengona* are parasites on invertebrates, and Opiliones can be found among the known hosts of these mites (Welbourn 1983; Wohltmann 2001).

Fifty-seven species of harvestmen have been reported as hosts of *Parasitengona*, and 24 species of *Parasitengona* representing Trombidiidae and Erythraeidae have been reported as parasites of harvestmen (Baker & Selden 1997; Beron 2008; Cokendolpher 1993; Cokendolpher & Mitov 2007; Fain & Jocqué 1996; Lawrence 1940; Stašiov 2003; Townsend et al. 2006; Wijnhoven et al. 2009).

Our aim was to summarize new records of harvestmen-associated *Parasitengona* from the Palaearctic region. The material was collected in Poland, Russia and Kazakhstan. Mites were sampled with an entomological sieve, a sweeping net, pitfall traps or directly from soil, and then preserved in 70–75% ethyl alcohol. Larvae of mites that served for light microscope studies were macerated in Nesbitt's fluid prior to fixation on slides in Hoyer's or Swan's fluid. Mites were identified under a Nikon Eclipse E600, on the basis of Fain (1991), Fain & Amico (1997), Łaydanowicz & Mąkol (2010), Southcott (1992), Tuzovskij (1990), Wohltmann & Mąkol (2009) and Wohltmann et al. (2007). Harvestmen were studied under a stereomicro-

scope Olympus SZX-12 and determined using Staręga (1976) and Gricenko (1979). The mites are deposited at the Department of Zoology, University of Zielona Góra, Poland, and the Institute of Biology, Department of Invertebrate Systematics and Ecology, Wrocław University of Environmental and Life Sciences, Poland. The harvestmen are deposited at the Natural History and Humanistic University, Siedlce, Poland.

Four species of harvestmen were found to be new hosts of *Parasitengona*: *Nemastoma lugubre*, *Paranemastoma quadripunctatum*, *Platybunus pallidus*, and *Phalangium ghissaricum* (Table 1). The new records of mites were *Leptus mariae* (Erythraeidae) and *Allothrombium meridionale* (Trombidiidae). Additionally, a new species of *Leptus* sp. nov. has been collected from *Mitopus morio*, *Phalangium opilio* and *Lacinius ephippiatus*. The first case of parasitism of Hydrachnidia on harvestmen has been found – a juvenile *Oligolophus tridens* parasitized by water mite larva, *Hydryphantes ruber* (Hydryphantidae). The number of parasites per host varied from 1 to 24. The maximum intensity of infestation was observed for *Leptus molochinus* parasitizing the female of *P. opilio*.

The records of *Parasitengona* parasitizing Opiliones in nature are generally very scarce and new data on *Parasitengona* of the Palaearctic region are reported rather sporadically (Baker & Selden 1997; Beron 2008; Cokendolpher 1993; Cokendolpher & Mitov 2007; Fain & Jocqué 1996; Gabryś 1991; Lawrence 1940; Stašiov 2003; Wijnhoven et al. 2009). Although Wohltmann & Mąkol (2009) found that Opiliones constitute potential hosts of *A. meridionale* in the laboratory, our present finding is the first report of such association found in nature.

Mites of the genus *Leptus* show the strongest association with Opiliones of all *Parasitengona* terrestria, and *L. beroni* is the most frequently observed parasite of harvestmen: it was found on 12 species of harvestmen (Cokendolpher 1993; Cokendolpher & Mitov 2007; present paper). Two species of *Leptus* (*L. mariae* and *L. molochinus*) were found on one *P. opilio*, indicating that syntopic occurrence of two species of parasites on one host is possible.

The water mite larva (*H. ruber*), recorded from Opiliones for the first time, was attached to a juvenile *O. tridens*, collected directly from the wet detritus of periodically flooded shrubs. Infestation of harvestmen by Hydrachnidia is clearly possible in wet microhabitats.

Table 1.—Larval Parasitengona (Acari, Actinotrichida) that parasitize harvestmen (Arachnida, Opiliones). New hosts/parasites records are given in bold. *Larvae underwent further development and metamorphosed into inactive protonymphs. The identification of the parasite is possible only after reaching the deutonymph instar.

Parasite (larvae)	Host (Opiliones)	No. of larvae (attachment site)	
Trombidia (Erythraeidae)			
<i>Leptus beroni</i> Fain 1991	<i>Nemastoma lugubre</i> (O.F. Müller 1776), 1 ♀	1 (cephalothorax), 2 (legs)	
	<i>Oligolophus tridens</i> (C.L. Koch 1836), 2 juv.	6 (legs)	
	<i>Phalangium opilio</i> L. 1758, 4 juv., 2 ♀	9 (legs), 1 (cephalothorax), 3 (detached)	
	<i>Mitopus morio</i> (Fabricius 1779), 2 ♀	2 (legs), 5 (detached)	
	<i>Platybunus bucephalus</i> (C.L. Koch 1835), 2 ♂	13 (detached)	
	<i>Platybunus pallidus</i> Šilhavý 1938, 1 ♀	5 (legs), 7 (detached)	
	<i>Phalangium opilio</i> L., 1 ♂, 1 ♀	2 (legs)	
	<i>Rilaena triangularis</i> (Herbst 1799), 1 juv.	1 (?)	
	<i>Leptus molochinus</i> (C.L. Koch 1837)	<i>Mitopus morio</i> (Fabricius 1779), 1 ♂, 1 ♀	1 (abdomen), 1 (detached)
		<i>Phalangium opilio</i> L., 3 ♀	26 (?)
<i>Leptus</i> sp. n.	<i>Mitopus morio</i> (Fabricius 1779), 1 ♀	?	
	<i>Lacinius ephippiatus</i> (C.L. Koch 1835), 1 ♀	1 (leg), 1 (detached)	
	<i>Phalangium opilio</i> L., 1 ♂	?	
<i>Leptus</i> sp.*	<i>Paranemastoma quadripunctatum</i> (Perty 1833), 1 ♂	7 (?)	
Trombidia (Trombidiidae)			
<i>Allothrombium meridionale</i> Berlese 1910	<i>Phalangium ghissaricum</i> Gricenko 1976, 1 ♂, 1 ♀	3 (legs), 2 (detached), 6 (?)	
Hydrachnidia (Hydryphantidae)			
<i>Hydryphantes ruber</i> (De Geer 1778)	<i>Oligolophus tridens</i> (C.L. Koch 1836), 1 juv.	1 (?)	

The development of a larva into subsequent life instars (i.e., protonymph and deutonymph), observed under laboratory conditions, provides evidence for successful parasitism completed on the harvestman.

Data on site selectivity within the host body confirm the earlier information provided by Cokendolpher & Mitov (2007). The majority of erythraeid and trombidiid larvae parasitizing harvestmen were attached to the leg segments, whereas attachment to the cephalothorax or abdomen was observed in only a few cases (Table 1).

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