Acarologia

A quarterly journal of acarology, since 1959
Publishing on all aspects of the Acari

All information:
http://www1.montpellier.inra.fr/CBGP/acarologia/
acarologia-contact@supagro.fr

OPEN ACCESS

Acarologia is proudly non-profit,
with no page charges and free open access

Please help us maintain this system by
encouraging your institutes to subscribe to the print version of the journal
and by sending us your high quality research on the Acari.

Subscriptions: Year 2019 (Volume 59): 450 €
http://www1.montpellier.inra.fr/CBGP/acarologia/subscribe.php
Previous volumes (2010-2017): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under
the reference ID 1500-024 through the « Investissements d’avenir » programme
(Labex Agro: ANR-10-LABX-0001-01)

Acarologia is under free license and distributed under the terms of the
Creative Commons-BY-NC-ND which permits unrestricted non-commercial use, distribution, and
reproduction in any medium, provided the original author and source are credited.
LARDOGLYPHUS FALCONIDUS N. SP.
(ACARINA : ACARIDAE) FROM THE NEST
OF AN AMERICAN KESTREL (FALCO SPARVERIUS L.)

BY

J. R. PHILIPS ¹ and R. A. NORTON ²

ABSTRACT

Lardoglyphus falconidus n. sp. (Acarina : Acaridae) is described from an American kestrel (Falco sparverius L.) nest in central New York. The biology of Lardoglyphus is briefly discussed and a key to the described species is presented.

Résumé

Description de Lardoglyphus falconidus n. sp. du nid d’une crécerelle Américaine (Falco sparverius L.) du centre de l’état de New York.
Présentation d’une clé des espèces décrites du genre Lardoglyphus, et discussion de sa biologie.

The genus Lardoglyphus was established by Oudemans (1927) for L. zacheri, first found in a culture of the beetle Dermestes lardarius L. on hides in South America. Hughes (1956) provided a more complete description of L. zacheri. A second species, L. konoi (Sasa and Asanuma, 1951), is of economic importance. It was first found on dried fish in Japan, and later (Hughes, 1956) on dried seafood in India. Vijayamkka and John (1973, 1974b, 1975a, b, c) have examined its internal morphology and histology. Fain and Caceres (1973) described another species, L. angolensis, from hypopi found on an otter shrew, Potamogale volox. A fourth species, undescribed and also known only from the hypopus, was found by Radosky (1970) on fecal material found in a human mummy in Nevada.

Hughes (1961) reviewed the main characteristics of the genus. The claws of all legs are bifid in the female. The chaetotaxy of the dorsal and lateral surfaces of the idiosoma is complete. Setae ve are finely pectinate and arise at the same level as vs. Setae sce are longer than sci. None of the dorsal leg setae are thickened as spines. Only heteromorphic males are formed and there is no posteriorly projecting opisthosomal plate.

In the following description, Hughes’ (1961) terminology is followed except where noted. All measurements are given in micrometers (μm) and represent ranges or averages from 10 specimens. Claws and pretarsi are excluded from tarsal length measurements. Femoral measurements include sections inserted in the trochanter.

1. 29 Mattakeset Street, Mattapam, Mass. 02126, U.S.A.
Lardoglyphus faloonidus n. sp.

**Female**

Length of idiosoma 384-447; greatest width 239-306. Body widest between second and third pairs of legs; posteriorly shallowly bilobed (Fig. 1A). Dorsal and ventral surfaces mostly striate; posterodorsal region spiny, not striate. Spines smaller, rounded and scale-like on lateral and anterior portions of opisthosoma. Three pairs of opisthosomal cupules (ia, im, ip) 1. Latero-opisthosomal gland (gla) opens between la and lp. Idiosomal setae finely barbed. Propodosomal-opisthosomal groove indistinct, indicated by changes in pattern of striation. Lengths of setae: vi 88-104; ve 60-92; sci 81-111; sce 116-156; d1 144-178; d2 156-197; d3 120-172; d4 185-219; hi 85-124; he 127-177; hv 61-80; la 145-179; lp 179-220, sae 117-164.

Ventrally, two pairs of coxal setae, three pairs of genital setae, five pairs of anal setae (a1 26-32; a2 33-43; a3 60-80; a4 16-28; a5 12-26) and two pairs of postanals (pa1 109-159; pa2 187-224). Bursa copulatrix opening posteroventrally.

Gnathosoma slender. Chelicerae 69-82; fixed digit with one large tooth; movable digit with one very small tooth.

Legs long and slender, with well developed pretarsi and bifid claws. Leg segment lengths given in Table 1. Setation given in Table 2. Solenidion o₁ 2.5 times the length of o₂. Famulus (Fig. 1B) short, partially sunken in integument, distally rounded, dorsoventrally flattened. Solenidion o long, whiplike; solenidion o₁ about five times longer than o₂. Supracoxal seta tapering, finely barbed, length 38-47.

**Male**

Length of idiosoma 325-381; greatest width 192-235. Idiosomal shape similar to female except rounded posteriorly (Fig. 2A). Idiosoma with dorsal and ventral striations but without spines or scales. Posterior dorsal and ventral hysterosoma smooth. Idiosomal setae and cupules as in female. Setal lengths: vi 54-81; ve 53-66; sci 59-83; sce 96-127; d1 108-156; d2 110-180; d3 83-142; d4 125-177; hi 65-94; he 104-140; hv 50-70; la 104-148; lp 87-135; sae 134-176; sae 86-129.

Ventrally, with two pairs of coxal setae and three pairs of genital setae. Anal setae anterior to anal suckers (Fig. 2B), bifid (Fig. 2C), length 10-16. Three pairs of postanal setae: pa1 30-45; pa2 59-92; pa3 119-166. Aedeagus between coxae IV.

Gnathosoma and chelicerae as in female. Cheliceral length 53-67.

Legs (Tables 1, 2) terminating in a single claw which is modified on leg III (Fig. 2D). Setae r and s spinose on legs III and IV. Leg IV (Fig. 2E) with two setae replaced by suckers in the distal half of the tarsus. Supracoxal seta as in female, length 31-37.

**Hypopus**

Length of idiosoma 217-252; greatest width 171-198. Idiosoma rounded (Fig. 3A). Propodosomal and hysterosomal shields reticulate, punctate as in other species of the genus. Lengths

1. These cupules are homologous to those described by Grandjean (1933) for oribatid mites. Hughes (1961) used the term "chitinous rings" for these structures.

*Acarologia*, t. XX, fasc. 1, 1978.
Fig. 1. — A. *Lardoglyphus falconidus* n. sp. Female dorsal aspect. B. famulus, *L. falconidus*. C. famulus, *L. zacheri* and *L. konoi*,
Fig. 2. — Lardoglyphus falconidus, n. sp. male. A. dorsal aspect. B. anal region. C. anal seta. D. tarsus III, dorsal aspect. E. tarsus IV, dorsal aspect.
**Fig. 3.** — *Lardoglyphus falconidus*, n. sp. hypopus. A. dorsal aspect.  
F. paddle-like tarsal seta.
of propodosomal setae: \(vi\) 18-22; \(ve\) 8-11; \(sci\) 11-13; \(sce\) 13-17. Setae of the \(d\) series ranging from thin and setiform \((d_1, \text{Fig. 3B})\) to thicker spines \((d_2, d_4)\). Seta \(hv\) laterally inserted. Lengths of hysterosomal setae: \(d_1\) 9-12; \(d_2\) 7-9; \(d_3\) 8-11; \(d_4\) 8-11; \(hi\) 11-17; \(he\) 8-15; \(hv\) 13-15; \(la\) 10-13; \(lp\) 10-12; \(sai\) 15-21; \(sae\) 5-8.

Ventral surface smooth. Epimeres I unite to form a short sternum. Epimeres II-IV free. Three pairs of chitinous rings; one pair on coxal fields I and III, and one pair between coxae II and III. A pair of setae present between coxae II and III and a pair between coxae IV. Anal setae \((a)\) bifid (Fig. 3C), length 8-9.

Sucker plate (Fig. 3C) with a hyaline margin; two large central suckers, two anterior, four posterior and two lateral. Length of sucker plate 48-56; width 66-77. Two ridged horns lateral to central suckers as in \(L. konoi\). Central sucker width 10-11; anterior suckers sometimes asymmetrical, width 5-9.

Gnathosoma (Fig. 3D) divided distally, with two pairs of setae. Length of apical solenidion \(\omega\) 27-32.

Legs I-III with a single claw; leg IV clawless but terminating in two long flagellate setae. Segment lengths and chaetotaxy given in Tables 1, 2. Tarsi I and II with five leaf-like setae (Fig. 3E). Tarsus III with seven widened setae, ranging from leaf-like to paddle-like (Fig. 3F). Tarsus IV with three paddle-like setae.

**Protonymph**

Length of idiosoma 203-298; greatest width 130-159. Body oval, striate. Idiosomal setae as in adult, lengths: \(vi\) 31-38; \(ve\) 21-27; \(sci\) 24-34; \(sce\) 57-76; \(d_1\) 39-58; \(d_2\) 40-74; \(d_3\) 25-47; \(d_4\) 38-59; \(hi\) 24-43; \(he\) 40-57; \(hv\) 19-23; \(la\) 43-57; \(lp\) 27-40; \(sai\) 48-65; \(sae\) 16-26. Chelicerae as in adult, length 41-51. Leg setation and segment lengths in Tables 1, 2. Legs I-IV monodactyl. Supracoaxal seta as in adults, length 21-23.

**Larva**

Length of idiosoma 141-177; greatest width 89-116. Body oval, striate. Odiosomal setae lengths: \(vi\) 21-26; \(ve\) 7-13; \(sci\) 12-20; \(sce\) 37-48; \(d_1\) 14-20; \(d_2\) 13-21; \(d_3\) 14-20; \(d_4\) 17-27; \(hi\) 11-14; \(he\) 14-21; \(hv\) 8-12; \(la\) 12-17; \(lp\) 11-14. Chelicerae as in adults, length 31-40. Legs I-III monodactyl. Leg setation and segment lengths in Tables 1, 2. Supracoaxal seta as in adults, length 11-14. Leg IV absent.

**Egg**


**Remarks**

The spiny opisthosoma readily distinguishes females of this species from its congeners. The striations are also apparently unique to the adults of this species. Descriptions of \(L. zacheri\) and \(L. konoi\) both state that the skin is smooth in both sexes. We have examined females of both species and males of \(L. zacheri\) and found no striations.

The famulus is quite distinct from that of \(L. zacheri\) and \(L. konoi\) in all stages. It is long and tapering in the latter two species (Fig. 1C).
**TABLE 1:** Mean Leg Segment Lengths (in μm) of *Lardoglyphus falconidus*

<table>
<thead>
<tr>
<th>Developmental Stage</th>
<th>Leg</th>
<th>Tarsus</th>
<th>Tibia</th>
<th>Genu</th>
<th>Femur</th>
</tr>
</thead>
<tbody>
<tr>
<td>larva</td>
<td>I</td>
<td>20</td>
<td>13</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>19</td>
<td>11</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>23</td>
<td>13</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>protonymph</td>
<td>I</td>
<td>26</td>
<td>18</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>27</td>
<td>17</td>
<td>17</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>27</td>
<td>16</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>34</td>
<td>18</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>hypopus</td>
<td>I</td>
<td>40</td>
<td>23</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>39</td>
<td>22</td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>22</td>
<td>17</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>13</td>
<td>9</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>female</td>
<td>I</td>
<td>56</td>
<td>34</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>57</td>
<td>34</td>
<td>35</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>62</td>
<td>36</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>88</td>
<td>40</td>
<td>39</td>
<td>42</td>
</tr>
<tr>
<td>male</td>
<td>I</td>
<td>54</td>
<td>34</td>
<td>36</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>55</td>
<td>34</td>
<td>33</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>38</td>
<td>44</td>
<td>37</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>40</td>
<td>43</td>
<td>39</td>
<td>46</td>
</tr>
</tbody>
</table>

**TABLE 2:** Leg Setation of described species of *Lardoglyphus* (tarsus to trochanter, famulus not included)

<table>
<thead>
<tr>
<th>Species</th>
<th>Stage</th>
<th>Leg I</th>
<th>Leg II</th>
<th>Leg III</th>
<th>Leg IV</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>L. falconidus</em></td>
<td>larva</td>
<td>10-2-2-1-0</td>
<td>10-2-2-1-0</td>
<td>8-1-1-0-0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>protonymph</td>
<td>10-2-2-1-0</td>
<td>10-2-2-1-0</td>
<td>8-1-1-0-0</td>
<td>5-0-0-0-0</td>
</tr>
<tr>
<td></td>
<td>hypopus</td>
<td>9-2-2-1-1</td>
<td>9-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>8-1-0-1-0</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>11-2-2-1-1</td>
<td>10-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>8-1-0-1-0</td>
</tr>
<tr>
<td></td>
<td>male</td>
<td>11-2-2-1-1</td>
<td>10-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>8-1-0-1-0</td>
</tr>
<tr>
<td></td>
<td>protonymph</td>
<td>11-2-2-1-0</td>
<td>10-2-2-1-0</td>
<td>8-1-1-0-0</td>
<td>5-0-0-0-0</td>
</tr>
<tr>
<td></td>
<td>hypopus</td>
<td>9-2-2-1-1</td>
<td>9-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>6-1-0-1-0</td>
</tr>
<tr>
<td></td>
<td>male</td>
<td>11-2-2-1-1</td>
<td>10-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>6-1-0-1-0</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>11-2-2-1-1</td>
<td>10-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>8-1-0-1-0</td>
</tr>
<tr>
<td><em>L. zacheri</em></td>
<td>larva</td>
<td>10-2-2-1-0</td>
<td>10-2-2-1-0</td>
<td>8-1-1-0-0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>protonymph</td>
<td>10-2-2-1-0</td>
<td>10-2-2-1-0</td>
<td>8-1-1-0-0</td>
<td>5-0-0-0-0</td>
</tr>
<tr>
<td></td>
<td>hypopus</td>
<td>9-2-2-1-1</td>
<td>9-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>8-1-0-1-0</td>
</tr>
<tr>
<td></td>
<td>male</td>
<td>11-2-2-1-1</td>
<td>10-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>6-1-0-1-0</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>11-2-2-1-1</td>
<td>10-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>8-1-0-1-0</td>
</tr>
<tr>
<td><em>L. konoi</em></td>
<td>larva</td>
<td>10-2-2-1-0</td>
<td>10-2-2-1-0</td>
<td>8-1-1-0-0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>protonymph</td>
<td>10-2-2-1-0</td>
<td>10-2-2-1-0</td>
<td>8-1-1-0-0</td>
<td>5-0-0-0-0</td>
</tr>
<tr>
<td></td>
<td>hypopus</td>
<td>9-2-2-1-1</td>
<td>9-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>8-1-0-1-0</td>
</tr>
<tr>
<td></td>
<td>male</td>
<td>11-2-2-1-1</td>
<td>10-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>6-1-0-1-0</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>11-2-2-1-1</td>
<td>10-2-2-1-1</td>
<td>8-1-1-0-1</td>
<td>8-1-0-1-0</td>
</tr>
</tbody>
</table>
In the male, the bifid anal setae are distinctive, as well as legs III and IV. There is some confusion in the literature regarding the claw and spine-like structures on tarsus III. Sasa and As numa (1951) stated that tarsus III had two separate terminal claws in L. konoi. According to Hughes (1956), the ambulacrum of leg III is replaced by two spine-like structures in L. zacheri. We examined males of L. zacheri under polarized light and found that the larger spine is derived from the claw; the smaller spine is a hypertrophied seta. This is the case in all three species of Lardoglyphus. In L. falconidus, the larger spine is curved and more claw-like than in the other two species, and seta is a much smaller spine. On tarsi III and IV, seta r is a wider, shorter spine than in the other two species. The suckers of tarsus IV are more distally placed in L. falconidus than in L. zacheri and L. konoi.

The hypopus also possesses distinctive bifid anal setae. We have examined many hypopi and only found one in which these setae were not bifid. In that case, the setae were each trifid, with a very thin central branch. The tarsal setae also differentiate this hypopus from the other species. L. zacheri has none which are leaf-or paddle-like. L. konoi has only one leaf-like seta (f) on tarsi I and II, and only two paddle-like setae on tarsus IV.

**Type material**

Type series from the nest of an American kestrel (Falco sparverius L.), Jamesville, N.Y., 24 June 76, collected by J. R. Phillips. Holotype female, allotype male, and paratype hypopus, protonymph and larva deposited in the United States National Museum (Washington, D.C.). Paratypes deposited at the Harvard Museum of Comparative Zoology (Cambridge, Mass.), the Acarology Laboratory (Columbus, Ohio), the Hungarian Natural History Museum (Budapest) and the Prince Leopold Institute for Tropical Medicine (Antwerp).

**Keys to the described species of Lardoglyphus**

(modified from Hughes, 1961)

**Females**

1. Dorsal opisthosoma striate, with spines and scales......................... [falconidus] n. sp.
   Dorsal opisthosoma smooth.................................................. 2
2. Setae d₄ approximately equal to d₃........................................... [konoi] (S. & A.)
   Setae d₄ longer than twice d₃.............................................. [zacheri] Ouds.

**Males**

   Legs I and II with undivided claws........................................ 2
   Anal setae simple, anterior idiosoma smooth................................ [konoi] (S. & A.)

**Hypopi**

   Some leaf-like tarsal setae.............................................. 2
   Anal setae simple.......................................................... 3
Biology of *LardoGlyphus* species

According to Hughes (1956) the life cycles of *L. zacheri* and *L. konoi* may be completed in 10-11 days at 23°C. Both species possess a tritonymph stage, and neither is parthenogenetic. No tritonymphs of *L. falconidus* have been found, and this stage appears to be lacking in this species.

Hughes cultured *L. zacheri* and *L. konoi* on dried heart muscle, whereas Vijayambika and John (1974a) cultured *L. konoi* on dried anchovy. *L. konoi* has been collected from butchers’ offal, dried fish and dried shellfish, while *L. zacheri* is known from butchers’ offal, bones, hides and sheepskin (Hughes, 1961). Radovsky’s undescribed species represents an additional carrion record.

*L. falconidus* was collected from a nest-box 6 m high in a dead tree. The kestrels fledged four young (D. Crumb, pers. comm.) and the nest was collected the day after the last young left the nest. The nest was composed mainly of small bits of grass, wood, and leaves, with sawdust. Eggshell fragments, excreta and a few bones and feathers were present, as well as some regurgitated pellets consisting mainly of indigestible hair and chitin from prey. A pellet sample, extracted separately from other nest material in Tullgren funnels, also contained many specimens of *L. falconidus*.

The nest material weighed 705 g dry weight; water content was 28% of dry weight. We estimated the total nest population of *L. falconidus* to be in excess of 8,000, in the following proportions: larvae 8%, protonymphs 39%; hypopi 41%; males 5%; females 7%. Among females, 14% contained three eggs, 37% contained two eggs, 26% contained one egg, and 23% contained no eggs. We have observed fungal spores (probably *Aspergillus* sp.) in the guts of all feeding stages.

*L. falconidus* was by far the numerically dominant mite in this nest. It likely served as prey for such predators as Staphylinidae, Histeridae, *Cheyletus trouessarti* Ouds., *Macrocheles muscae-domesticae* (Scopoli), *Dendrolaelaps* sp. and *Poecilochirus necrophori* Vitzthum, also found in this nest. None of the above predators have previously been reported from American kestrel nests (Hicks, 1959, 1962, 1971).

Hughes (1956, 1961) found that food shortage caused hypopus formation in *L. zacheri*. In contrast, Vijayambika and John (1974a) found that overcrowding and food scarcity were not responsible for hypopus formation in this species. In addition, no significant correlations were found between humidity, temperature and counts of hypopi. They believed that the ability of protonymphs to transform to deutonymphs may be hormone-controlled.

Hypopi of *L. zacheri* are known to be phoretic on larvae of *Dermestes maculatus* DeGeer, *D. lar-darius* L., *D. frischii* Kugelann, and *Necrobia rufipes* DeGeer, and even adults of their own species (Hughes, 1956). Hughes isolated a dermestid larva carrying 25 hypopi; nymphs appeared in three days, but one hypopus remained attached for 13 days. Hypopi showed no inclination to attach to dermestid adults, although they would seem to be far more effective dispersal hosts. Sasai and Asanuma (1951) found *L. konoi* hypopi attached to hairs of larvae of *Dermestes* sp. We have found hypopi of *L. falconidus* attached to the abdomen and thorax of larvae of *Dermestes pulcher* Lec. from the nest. Up to 21 hypopi per larva were attached mainly at inter-segmental crevices and skin folds.
Balgooyen (1976) found dermestid beetles, usually in high numbers, in every kestrel nest he examined in the Sierra Nevadas. More nests of kestrels and other birds need to be examined to determine the distribution of *L. falconidus* and whether it uses adult dermestids as a dispersal agent for nest colonization.

**Acknowledgements**

We are very grateful to D. Crumb for notifying us of the nest and allowing us to collect it, D. Merrill for assisting in collecting the nest, and D. L. Dindal, College of Environmental Science and Forestry, Syracuse, N.Y. for advice and assistance. G. S. Ide, Acarology Laboratory, Columbus, Ohio, kindly loaned us specimens of *L. zacheri* and *L. konoi*.

**Literature Cited**


Vijayambika (V.) and John (P. A.), 1973. — Internal morphology of the hypopus of *Lardoglyphus konoi*, a tyroglyphid pest on dried stored fish. — Acarologia, 15 : 342-348.


*Paru en Janvier 1979.*