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Subscriptions: Year 2021 (Volume 61): 450 €
http://www1.montpellier.inra.fr/CBGP/acarologia/subscribe.php
Previous volumes (2010-2020): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France
ISSN 0044-586X (print), ISSN 2107-7207 (electronic)

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)

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A NEW SPECIES OF MADAGLYPHUS FAIN (ACARINA : ACARIDAE) FROM A RICE MILL IN JAVA, INDONESIA

BY C. P. HAINES 1 and S. M. T. LYNCH 2

ABSTRACT: A new species of acarid mite was collected in 1980 from rice bran residues and broken rice in a cooperative rice mill at Dewi Ratih, Tulungagung, East Java. The female and male of the new mite, Madaglyphus javensis, are described, and notes are given on the tritonymph, protonymph and larva. The definition of the previously monotypic genus Madaglyphus is modified slightly to accommodate this second species. The main characters differentiating M. javensis sp. n. from M. legendrei Fain are tabulated.

RÉSUMÉ : Une nouvelle espèce d’acaride a été découverte en 1980 dans des résidus de son de riz et dans du riz cassé d’une coopérative de Dewi Ratih, Tulungagung, Java oriental. La femelle et le mâle du nouvel acarien, Madaglyphus javensis, sont décrits, et des notes sont apportées sur la tritonymphe, la protonymph et la larve. La définition du genre Madaglyphus, auparavant monotypique, est légèrement modifiée pour accommoder cette seconde espèce. Les principaux caractères séparant M. javensis n. sp. et M. legendrei Fain sont mis en table.

INTRODUCTION

In the course of a survey of insects and mites from food stores in East and Central Java in April 1980 (HAINES & PRANATA, 1982), samples were taken from the rice mill of a village cooperative unit (KUD — Koperasi Unit Desa) at Dewi Ratih, near Tulungagung, East Java, on 15 April. Two of these samples were found to contain specimens of an unusual acarid mite as well as other mites and insects. The first sample was of rice bran residues around the milling machinery; this sample was infested with Tribolium castaneum (Herbst) and Palorus sp. (Coleoptera, Tenebrionidae), Oryzaephilus surinamensis (L.) (Coleoptera, Silvanidae), a dolichoderine ant, and Tyrophagus putrescentiae (Schrank) (Astigmata, Acaridae). The second sample was of broken rice stored in gunny sacks; this sample also contained many Tribolium castaneum and some Tyrophagus putrescentiae, together with Alphitobius diaperinus (Panzer) (Coleoptera, Tenebrionidae), Rhizopertha dominica (F.) (Coleoptera, Bostrichidae), and nymphs of Cheyletus sp. (Prostigmata, Cheyletidae).

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The unusual acarid corresponds closely to the previously monotypic genus Madaglyphus Fain, but differs in several respects from the type-species M. legendrei Fain, which was collected in Madagascar together with numerous T. putrescentiae in the stomach of a tree-frog (FAIN, 1971, 1985). The two samples from the rice mill contained a total of 8 females, 15 males, 3 tritonymphs, 1 protonymph and 1 larva, which form the type series for the new species of Madaglyphus described below.

The specimens, after preservation in Pampel's fluid between extraction in 1980 and examination in 1985, were cleared and mounted in Heinz's medium and examined by phase-contrast microscopy. The drawings were prepared by direct projection from the microscope.

The finding of this second species of Madaglyphus in Java is of especial interest because of the suggested proximity of Java and Sumatra to Madagascar in the ancient southern continent (RIDD, 1971; SCHLINGER, 1974); faunistic links between Madagascar and Southeast Asia have also been noted, for example, for mosquitoes (MATTINGLY, 1971; SCHLINGER, 1974); faunistic links between other dorsal idiosomal setae finely pectinate, posterior ones more clearly so. Vertical externals almost level with vertical internals, w. finer and slightly shorter (47-51 μ) than vi (53-60 μ). Scapular setae notably unequal in length, se (113-115 μ) more than 2½ times longer than si (42-45 μ). Dorsals 1st-4th short to moderate (d1 31-34 μ, d2 44-45 μ, d3 60-64 μ, d4 50-53 μ), dorsal 5th (d5) much longer (189-194 μ) and more distinctly pectinate. Laterals 1st-3rd of moderate length (l1 49-50 μ, l2 47-49 μ, l3 62-63 μ), laterals 4th and 5th much longer (l4 202-214 μ, l5 152-165 μ) and more distinctly pectinate. Humerals (h) moderately long (98-105 μ), sparsely and very finely pectinate. Sub-humerals (sh) short (21-23 μ), smooth, ventro-lateral but partly visible from dorsum. Last pair of analis (aP 1) long (108-122 μ), distinctly pectinate, almost entirely visible from dorsum. Idiosomal setae thus similar to M. legendrei, with d1 clearly shorter than d2 and l2 as well as other dorsals and laterals, and with d4, l1, l3 and aP 3 forming a caudal train of long setae, but differing from M. legendrei in the greater inequality of si and se and the irregular pectinations of d5, l1, l2 and aP 3. Lateral abdominal glands distinct, between l1 and l2 on each side. Three pairs of pores on dorsum: one pair posterior to l1, one pair lateral to the abdominal glands, and one pair near l4.

Supracoxal seta (Fig. 1, and as shown for the male in Fig. 6) with a robust central stem, slightly constricted near the base, tapering to a long fine point in its distal third, bearing seven or eight pointed barbs in the basal two-thirds on each side, each barb clearly longer than the width of the central stem.

Ventrum as shown in Fig. 2. Apodemes I uniting in the mid-line to form a short sternum, apodemes II-IV free. Genital opening between coxae III and IV, genital folds forming an inverted Y, with two pairs of well developed sensory organs (genital suckers). Sternal setae (s), central setae (c1, c2, c3) and coxal III setae (cx3) in normal position (Fig. 2), all with very finely tapered ends. The three pairs of tritonymph anal setae all very short (aT 1 9-11 μ, aT 2 8-9 μ, aT 3 similar to M. legendrei, but legs generally more slender and tarsi less stout (Fig. 1).

Propodosomal shield weakly defined, finely textured, bilobed (see Fig. 1). Sejugal furrow distinct. All dorsal idiosomal setae finely pectinate, posterior ones more clearly so. Vertical externals almost level with vertical internals, w. finer and slightly shorter (47-51 μ) than vi (53-60 μ). Scapular setae notably unequal in length, se (113-115 μ) more than 2½ times longer than si (42-45 μ). Dorsals 1st-4th short to moderate (d1 31-34 μ, d2 44-45 μ, d3 60-64 μ, d4 50-53 μ), dorsal 5th (d5) much longer (189-194 μ) and more distinctly pectinate. Laterals 1st-3rd of moderate length (l1 49-50 μ, l2 47-49 μ, l3 62-63 μ), laterals 4th and 5th much longer (l4 202-214 μ, l5 152-165 μ) and more distinctly pectinate. Humerals (h) moderately long (98-105 μ), sparsely and very finely pectinate. Sub-humerals (sh) short (21-23 μ), smooth, ventro-lateral but partly visible from dorsum. Last pair of analis (aP 1) long (108-122 μ), distinctly pectinate, almost entirely visible from dorsum. Idiosomal setae thus similar to M. legendrei, with d1 clearly shorter than d2 and l2 as well as other dorsals and laterals, and with d4, l1, l3 and aP 3 forming a caudal train of long setae, but differing from M. legendrei in the greater inequality of si and se and the irregular pectinations of d5, l1, l2 and aP 3. Lateral abdominal glands distinct, between l1 and l2 on each side. Three pairs of pores on dorsum: one pair posterior to l1, one pair lateral to the abdominal glands, and one pair near l4.

Supracoxal seta (Fig. 1, and as shown for the male in Fig. 6) with a robust central stem, slightly constricted near the base, tapering to a long fine point in its distal third, bearing seven or eight pointed barbs in the basal two-thirds on each side, each barb clearly longer than the width of the central stem.

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Madaglyphus javensis sp. n.  
(Figs. 1-7)

A female from the first sample has been selected as the holotype and a male from the second sample has been chosen as the allotype. Both are mounted on the same slides as some of the paratypes. Measurements given in the descriptions of female and male are for holotype and allotype, respectively, unless otherwise indicated. The nomenclature of the body setae follows the system proposed by GRIFFITHS (1977) as a modification of that introduced by ATYEO & GAUD (1966, 1971).

FEMALE. — (Figs. 1-4). Body size small, similar to T. putrescentiae and slightly less than M. legendrei. Idiosoma 347 μ long, 222 μ wide at maximum. Total body length 402 μ. Cuticle of idiosoma smooth, except for dorsal propodosomal shield. Cuticle of legs faintly textured (like propodosomal shield), with pattern of smooth areas. Body shape
Fig. 1: Dorsum of idiosoma of ♀ Madaglyphus javensis sp. n. (holotype).
Fig. 2: Ventrum of ♀ Madaglyphus javensis sp. n. (holotype).
6-7 μ), first two pairs of protonymph anal setae longer (aP1, 15-17 μ, aP2, 26-28 μ), and last pair (aP3) much longer (108-122 μ) and distinctly pectinate. Ventrum with normal pair of pores lateral to anus.

Legs as in Figs. 1 and 2, generally rather more slender than in *M. legendrei*, especially in the tarsal segments. Numbers of setae on each leg segment (tarsus, tibia, genu, femur, trochanter) typical: leg I - 13.2.2.1.1; leg II - 12.2.2.1.1; leg III - 10.1.1.0.1; leg IV - 10.1.0.1.0. Numbers of solenidia (except famulus e on tarsus I) also typical: leg I - 3.1.2.0.0; leg II - 1.1.1.0.0; leg III - 0.1.1.0.0; leg IV - 0.1.0.0.0. Setae slightly and finely barbed on tibia, genu and femur of legs I and II, and on genu of leg III, other leg setae smooth. Solenidia on genu I, unlike those of *M. legendrei*, very unequal (Fig. 3): solenidion a1 (34-38 μ) more than four times as long as solenidion a2 (8-9 μ). Solenidion o1 of tarsi I and II suberect, similar to that of *M. legendrei*, rather stout (10 μ × 2 μ in a paratype) with an expanded (2.6 μ diam.) pointed tip; famulus e small and close to base of o1; seta aa at basal sixth of tarsus I, near level of o1 and e. Ventral spine complex of tarsus (Fig. 4) with a robust spine s, two smaller spines u and v, and with spines p and q narrower, shorter and rather difficult to see. Claws robust.

**Male.** (Figs. 5-6). Similar in shape and chaetotaxy to female. Body smaller than in the female, but slightly longer than the male of *M. legendrei*; female-to-male ratio of idiosomal lengths less (1.18 : 1) in this species than in *M. legendrei* (1.55 : 1). Idiosoma 293 μ long, 170 μ wide at maximum. Total body length 329 μ. Cuticle of idiosoma smooth, except for dorsal propodosomal shield and minute tubercles in the anal and postanal region. Cuticle of legs faintly textured (like propodosomal shield), with pattern of smooth areas. Leg proportions similar to female, generally more slender than in *M. legendrei*, especially in the tarsal segments. Most dorsal idiosomal setae shorter than in the female (between three-quarters and seven-eighths of the length), but in relation to the idiosomal length these setae are proportionally as long as in the female or only slightly less: this applies to the verticals, scapulars, dorsals and laterals. Humerals and sub-humerals as long as in the female, and thus longer in proportion to the idiosoma and other setae.

Propodosomal shield as in female (see Fig. 1). Sejugal furrow distinct. Posterior dorsal setae only finely pectinate, remainder with extremely fine pectinations, sparse and scarcely visible. Verticals as in female, ve finer and slightly shorter (38-39 μ) than vi (41-44 μ). Scapular setae notably unequal, se (83-90 μ) more than 2½ times length of si (33-34 μ). Dorsals 1st-4th similar to female, with d5 the longest (d1, 27-29 μ, d2, 34-36 μ, d3, 48-50 μ, d4, 38-39 μ), dorsal 5th (d5) much longer (142-147 μ) and with distinct but fine pectinations. Lateral 1st-3rd of moderate length (l1, 36-37 μ, l2, 35-38 μ, l3, 51-54 μ), laterals 4th and 5th much longer (l4, 165-182 μ, l5, 127-131 μ) and with distinct fine pectinations. Humerals (h) long (96-103 μ) and sparsely pectinate, proportionally longer than in female (see Fig. 5). Sub-humerals (sh) short (20-22 μ) and smooth. Last pair of anals (aP3) much shorter (71-76 μ) than in female, finely pectinate, almost entirely visible from dorsum, and forming part of caudal train of long setae. Lateral abdominal glands and three pairs of dorsal pores positioned as in female. Suprapodal seta (Fig. 6) as described for the female.

Ventrum as shown in Fig. 5. Genital opening between coxae IV, with two pairs of well-developed sensory organs (genital suckers); penis quite strongly curved ventrally near apex (but not S-shaped as described for *M. legendrei*). Sternal setae (s) as in female. First central setae (c1) in normal position between coxae III and the coxal III setae (cx3); c1 is missing on one side in the allotype but both c1 are present in all male paratypes. Third centrals (c3) also in normal position between coxae IV, but second centrals (c2) more posterior than usual (in association with the genital opening which is also more posterior than in *M. legendrei*), on a level with c1 in most specimens. Anal region with a pair of large well-developed anal suckers, and the ventral pair of pores postero-lateral to these. The first anal setae (aP1) are short (11 μ) and lanceolate. The aP2 are of moderate length (34-35 μ), longer than in the female, very finely pectinate, and positioned well behind the posterior of the anus (unlike *M. legendrei*). The aP3 are shorter than in
Figs. 3-7: *Madaglyphus javensis* sp. n.

3. — Dorsum of right leg I (tarsus to genu) of ♀ paratype. 4. — Ventrum of tarsus of right leg I of ♀ paratype. 5. — Ventrum of hysterosoma of ♂ allotype, (drawn as dorsal projection). 6. — Dorsolateral view of left supracoxal seta of ♂ paratype. 7. — Coxal rod of larva.
the female but still form part of the caudal train of long setae and are thus much longer and more posterior than in male *M. legendrei*. Posterior of ventral cuticle (see Fig. 5) with numerous minute tubercles of less than 0.5 µ diameter separated by 0.5-2.0 µ.

Legs similar to those of female and with the same typical chaetotaxy. Solenidia and famulus as in female; solenidia σ₁ in poor position for viewing on allotype but in male paratypes σ₁ is between 3½ and 4⅓ times length of σ₂. Tarsus IV with a pair of distinct suckers: one close to the base, the other only just distal to the mid-point of the tarsus (see Fig. 5).

TRITONYMPH. — Of the three tritonymphs in the type-series, only one is in good condition. This specimen resembles the female but is considerably smaller (idiosoma 217 µ long, 113 µ wide at maximum), has only a vestigial genital opening with two pairs of sensory organs, and has a narrower hysterosoma (body width greatest just behind sejugal furrow rather than at level of legs IV). Because of the smaller hysterosoma, several of the idiosomal setae proportionally longer than in the adult. Setae and solenidia of legs normal for an acarid tritonymph, i.e. as in adult female.

Scapular setae and solenidia sigma on genu I with similar characteristics to adult: se about 2⅓ times length of si, and σ₁ 3½ times length of σ₂.

PROTONYMPH. — Only one specimen, in poor condition. Length of idiosoma 154 µ. Scapular setae (se 2 times length of si) and solenidia sigma on genu I (σ₁ c.3 times σ₂) with inequality of length, as in adults and tritonymphs but less extreme.

LARVA. — (Fig. 7). Only one specimen, in poor condition. Length of idiosoma c.125 µ. Scapular setae unequal but not as much as in adults and tritonymphs: se about twice length of si. Solenidia sigma on genu I unequal but less so than in adults and nymphs (σ₁ c.2 times σ₂). Differing from *M. legendrei* in having coxal rods, 15-16 µ long, shaped as in Fig. 7.

TYPE LOCALITY. — All specimens collected, on 15 April 1980, from rice bran residues and from broken rice in the rice mill of a village cooperative unit (KUD) in Dewi Ratuhi, near Tulungagung, East Java (8°5' S, 111°54' E).

TYPE MATERIAL. — The holotype female (with 6 paratype females and 3 paratype males on the same slide) and the allotype male (with 5 paratype males, 1 paratype female, 3 tritonymphs and 1 protonymph on the same slide) will be deposited at the British Museum (Natural History).

COMPARISON WITH *M. legendrei*

The important characters differentiating *Madaglyphus javensis* sp. n. from *M. legendrei* Fain are summarized in Table 1. As is inevitable when a new species is found in a previously monotypic genus, some characters of *M. javensis* require slight modifications to the original description of the genus. In general, *M. javensis* agrees very well in all important aspects with *Madaglyphus* as defined by Fain (1971, 1985), and is clearly related to *M. legendrei*. However, the features marked with an asterisk in Table 1 are ones where the characteristics originally defined as generic now appear to be specific to *M. legendrei*.

Most noticeably, the legs and especially the tarsi of *M. javensis* are of normal length and form (similar to *Aleuroglyphus oculatus* (Troupeau)) whereas those of *M. legendrei* are rather stout and short. The ratio of se to si is much greater in *M. javensis*, thus approaching the proportions seen in *A. oculatus* rather than in *M. legendrei*; the lengths of ve and, more importantly, the arrangement of the tarsal spine complex, however, still clearly differentiate *Madaglyphus* and *Aleuroglyphus*. The description of *Madaglyphus* implies that the very regularly bipectinate posterior setae of the female are a generic feature; *M. javensis* clearly also has bipectinate setae but the pectinations are not as strong or as regularly paired as in *M. legendrei*. The larva of *M. javensis* has coxal rods; these are absent from the larva of *M. legendrei* and this absence was taken as a generic character by Fain (1971, 1983). Although unusual, the presence in the same genus of species
with and without larval coxal rods is not unknown: the coherent and distinctive genus Suidasia contains both types (Fain & Philips, 1978), e.g. S. nesbitti Hughes, which has no coxal rods, and S. pontifica Oudemans (= S. medensis Oudemans), which has well-developed coxal rods (Hughes, 1976).

Table 1: Main differences between M. javensis sp. n. and M. legendrei Fain.

<table>
<thead>
<tr>
<th>Character</th>
<th>M. legendrei</th>
<th>M. javensis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adults</strong></td>
<td>Male idiosoma two-thirds length of female's</td>
<td>Male idiosoma five-sixths length of female's</td>
</tr>
<tr>
<td></td>
<td>Propodosomal shield normal</td>
<td>Propodosomal shield bilobed</td>
</tr>
<tr>
<td></td>
<td>* xe 1-1.5 times length of si</td>
<td>* xe 1.2 times length of si</td>
</tr>
<tr>
<td></td>
<td>axc with narrower central stem, and long barbs on basal half</td>
<td>axc with wider central stem, and long barbs on basal two-thirds</td>
</tr>
<tr>
<td></td>
<td>Genital sensory organs rather small</td>
<td>Genital sensory organs well developed</td>
</tr>
<tr>
<td></td>
<td>* Tarsi rather short and stout</td>
<td>* Tarsi longer, not so stout</td>
</tr>
<tr>
<td></td>
<td>* ds into only moderately robust (ratio c. 8: 1) with rounded tip</td>
<td>* ds into 1.4 times length of ds</td>
</tr>
<tr>
<td></td>
<td>Famulus very small</td>
<td>Famulus not so small</td>
</tr>
<tr>
<td></td>
<td>In tarsal spine complex, s, u &amp; v moderate spines, p &amp; q stout small setae</td>
<td>All setae stout in tarsal spine complex: s stout and prominent, u, v, p &amp; q spine-like but smaller</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>Idiosoma 405 μm long</td>
<td>Idiosoma 347 μm long</td>
</tr>
<tr>
<td></td>
<td>Very small tubercles on dorsal and ventral surfaces of posterior of hysterosoma</td>
<td>No such tubercles visible</td>
</tr>
<tr>
<td></td>
<td>* Posterior setae ds, d2, l1, and aP, strongly and regularly bipectinate</td>
<td>* Posterior setae ds, d2, l1, and aP, clearly but irregularly hipectinate</td>
</tr>
<tr>
<td></td>
<td>d1, 1.65 times length of ds</td>
<td>d1, 1.4 times length of ds</td>
</tr>
<tr>
<td></td>
<td>aP, of moderate length (c. 60 μm)</td>
<td>aP, longer (c. 110-120 μm)</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>Idiosoma 261-270 μm long</td>
<td>Idiosoma 293 μm long</td>
</tr>
<tr>
<td></td>
<td>No tubercles indicated on idiosoma</td>
<td>Minute tubercles on ventral hysterosoma lateral and posterior to anus</td>
</tr>
<tr>
<td></td>
<td>d1, 1.6 times length of ds</td>
<td>d1, 1.4 times length of d1</td>
</tr>
<tr>
<td></td>
<td>Penis S-shaped (with double curve)</td>
<td>Penis singly curved towards ventrum</td>
</tr>
<tr>
<td></td>
<td>aP, close to postero-lateral edge of anal suckers</td>
<td>aP, remote from suckers, close to posterior of hysterosoma, lateral to aP</td>
</tr>
<tr>
<td></td>
<td>aP, short and smooth, and close to anal suckers</td>
<td>aP, moderately long and pectinate, and remote from suckers</td>
</tr>
<tr>
<td><strong>Larva</strong></td>
<td>* No coxal rods (Claparède's organ)</td>
<td>* Coxal rods present</td>
</tr>
</tbody>
</table>

* Characters in which M. javensis differs from the original definition of the genus Madaglyphus.

The formal definition of Madaglyphus by Fain (1971) does not refer to the relative lengths of solenidia d1 and d2, except by the general comment “Solenidions comme pour Tyrophagus”. However, in Tyrophagus d1 and d2 are only slightly unequal, and in the introduction to the formal definition Fain (1971) distinguishes the new genus from Acarus by this character — “Ce nouveau genre se distingue de Acarus... par les dimensions seulement légèrement inégales des deux solénidions géniaux du tarse I”. It should therefore be noted that in M. javensis d1 and d2 are very unequal, and thus resemble Acarus, though Madaglyphus is still distinguished from Acarus by the other characters listed by Fain (1971).

Acknowledgments

The survey samples containing these specimens were collected by the first author (C.P.H.) and Mr. R. I. Pranata in the course of the TDRI-BIOTROP project supported by the U.K. Overseas Development Administration, the Indonesian Department of Education and Culture, and the South-East Asian Ministers of Education Organization. The survey work would not have been possible without the assistance and cooperation of BULOG (Badan Urusan Logistik — National Grain Logistics Agency), the Indonesian Department of Agriculture, and the individual store managers — in this case the manager of the KUD rice mill at Dewi Ratih. The detailed examination of the specimens forms part of the research programme of the Tropical Development and Research Institute. The authors are grateful to Dr. D. A. Griffiths and Dr. D. G. H. Halstead (M.A.F.F. Slough Laboratory) for their interest and advice.

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*Paru en Septembre 1987.*