

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

BY C. P. HAINES¹ and S. M. T. LYNCH²

TAXONOMY
ACARIDAE
MADAGLYPHUS
JAVA

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.

TAXONOMIE
ACARIDAE
MADAGLYPHUS
JAVA

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 acaridien, *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), *Rhyzopertha dominica* (F.) (Coleoptera, Bostrichidae), and nymphs of *Cheyletus* sp. (Prostigmata, Cheyletidae).

1. Storage Department, Tropical Development and Research Institute, London Road, Slough, Berks., SL3 7HL, U.K.

2. M.A.F.F. Slough Laboratory, London Road, Slough, Berks., SL3 7HJ, U.K.

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, 1962) and cucujid beetles (LEFKOVITCH, 1964).

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

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, *ve* finer and slightly shorter (47-51 μ) than *vi* (53-60 μ). Scapular setae notably unequal in length, *se* (113-115 μ) more than $2\frac{1}{2}$ times longer than *si* (42-45 μ). Dorsals 1st-4th short to moderate (d_1 31-34 μ , d_2 44-45 μ , d_3 60-64 μ , d_4 50-53 μ), dorsal 5th (d_5) much longer (189-194 μ) and more distinctly pectinate. Laterals 1st-3rd of moderate length (l_1 49-50 μ , l_2 47-49 μ , l_3 62-63 μ), laterals 4th and 5th much longer (l_4 202-214 μ , l_5 152-165 μ) and more distinctly pectinate. Humeral (*h*) moderately long (98-105 μ), sparsely and very finely pectinate. Sub-humeral (*sh*) short (21-23 μ), smooth, ventro-lateral but partly visible from dorsum. Last pair of anals (aP_3) long (108-122 μ), distinctly pectinate, almost entirely visible from dorsum. Idiosomal setae thus similar to *M. legendrei*, with d_1 clearly shorter than d_2 and l_2 as well as other dorsals and laterals, and with d_5 , l_4 , l_5 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 d_5 , l_4 , l_5 and aP_3 . Lateral abdominal glands distinct, between l_2 and l_3 on each side. Three pairs of pores on dorsum: one pair posterior to l_1 , one pair lateral to the abdominal glands, and one pair near l_4 .

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 (c_1 , c_2 , c_3) and coxal III setae (cx_3) 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

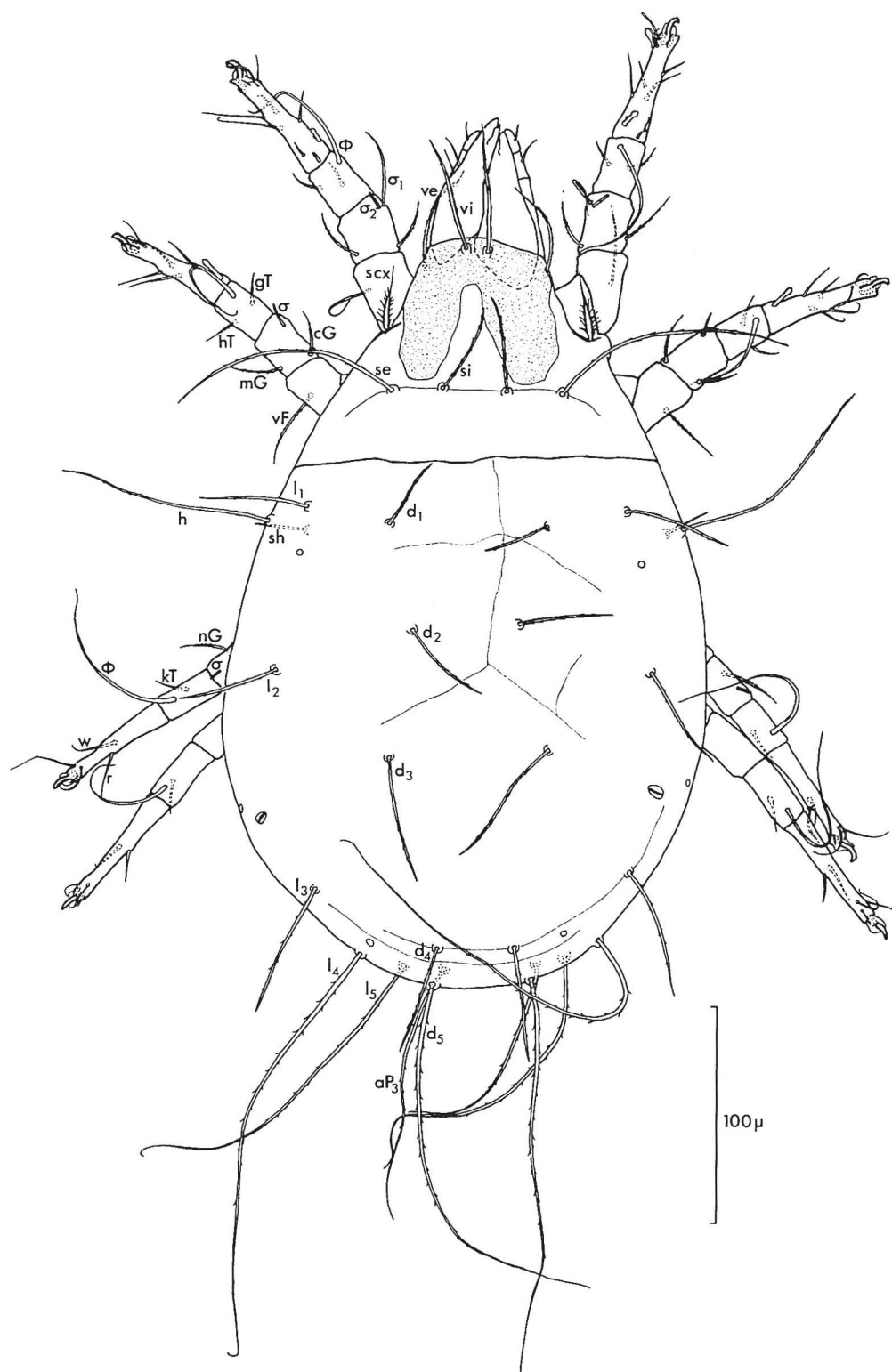


FIG. 1 : Dorsum of idiosoma of ♀ *Madaglyphus javensis* sp. n. (holotype).

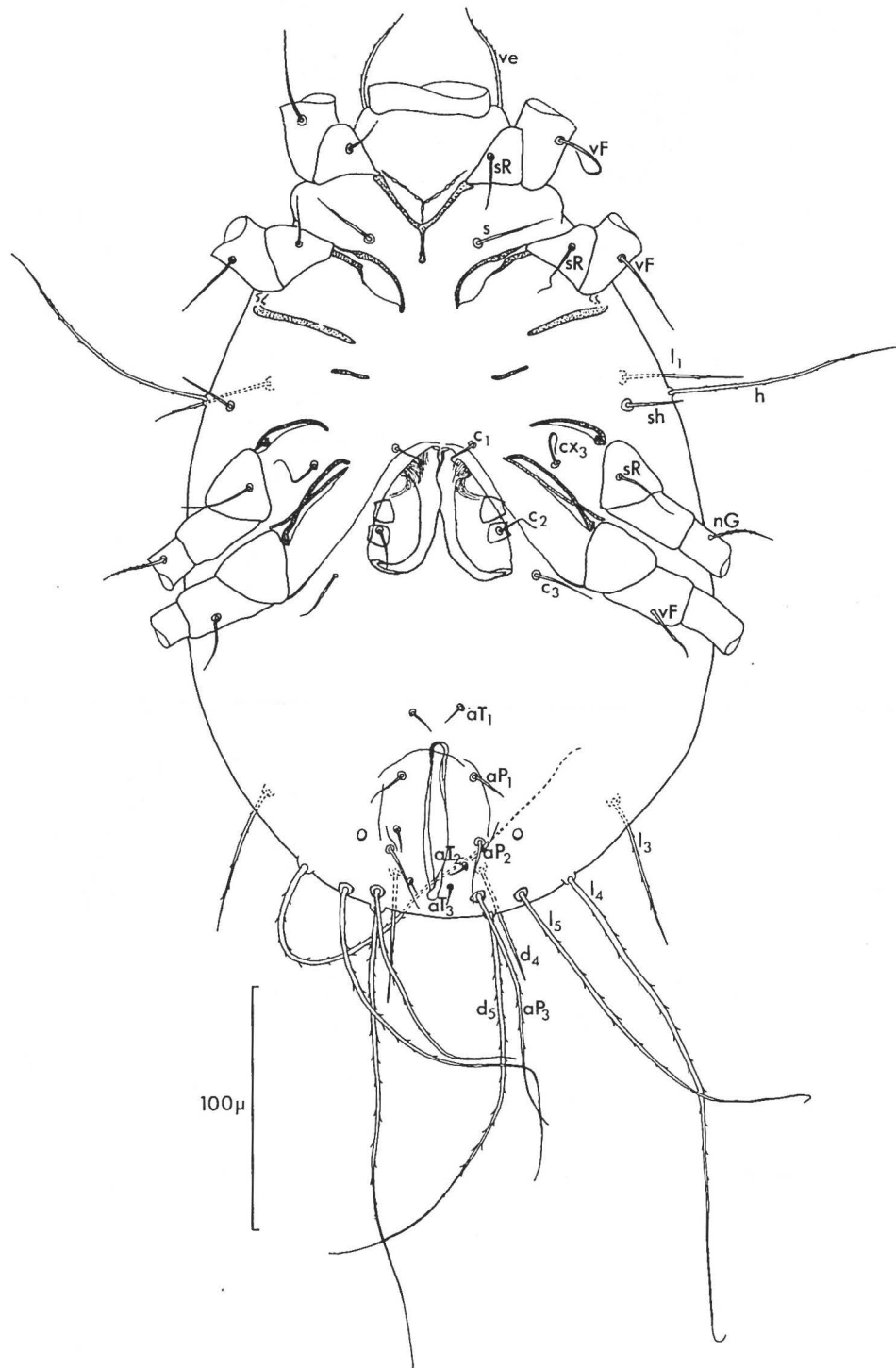


FIG. 2 : Ventrum of ♀ *Madaglyphus javensis* sp. n. (holotype).

6-7 μ), first two pairs of protonymph anal setae longer (aP_1 15-17 μ , aP_2 26-28 μ), and last pair (aP_3) much longer (108-122 μ) and distinctly pectinate. Ventrum with normal pair of pores lateral to anus.

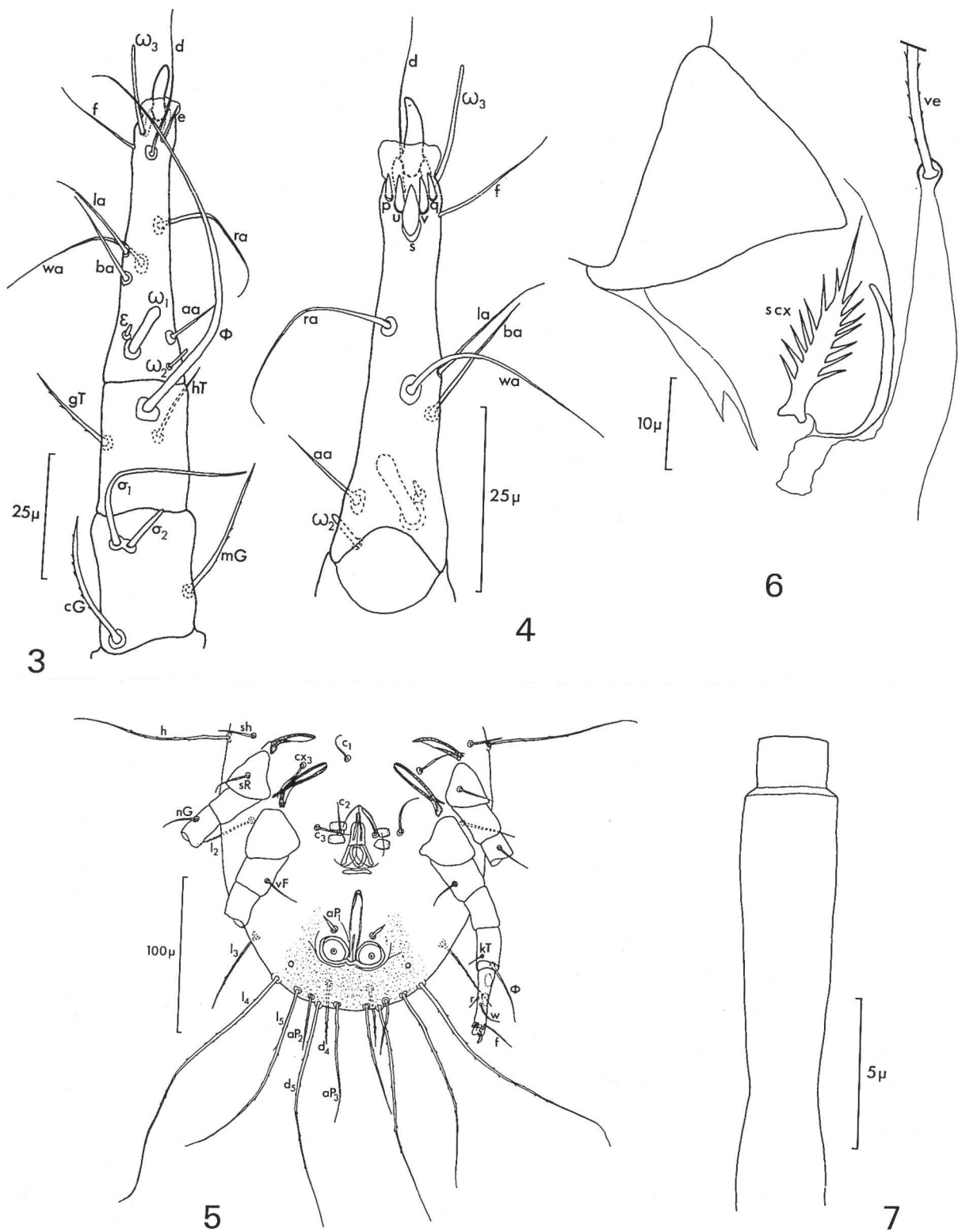
Legs as in Figs. 1 and 2, generally rather more slender than in *M. legendrei*, especially in the tarsal segments. Numbers of setae on each leg segment (tarsus, tibia, genu, femur, trochanter) typical: leg I - 13.2.2.1.1; leg II - 12.2.2.1.1; leg. III - 10.1.1.0.1; leg IV - 10.1.0.1.0. Numbers of solenidia (except famulus ϵ 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): solenidium σ_1 (34-38 μ) more than four times as long as solenidium σ_2 (8-9 μ). Solenidium ω_1 of tarsi I and II suberect, similar to that of *M. legendrei*, rather stout (10 $\mu \times 2 \mu$ in a paratype) with an expanded (2.6 μ diam.) pointed tip; famulus ϵ small and close to base of ω_1 ; seta *aa* at basal sixth of tarsus I, near level of ω_1 and ϵ . 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 post-anal 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 $2\frac{1}{2}$ times length of *si* (33-34 μ). Dorsals 1st-4th similar to female, with d_3 the longest (d_1 27-29 μ , d_2 34-36 μ , d_3 48-50 μ , d_4 38-39 μ), dorsal 5th (d_5) much longer (142-147 μ) and with distinct but fine pectinations. Laterals 1st-3rd of moderate length (l_1 36-37 μ , l_2 35-38 μ , l_3 51-54 μ), laterals 4th and 5th much longer (l_4 165-182 μ , l_5 127-131 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 (aP_3) 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. Supracoxal 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 (c_1) in normal position between coxae III and the coxal III setae (cx_3); c_1 is missing on one side in the allotype but both c_1 are present in all male paratypes. Third centrals (c_3) also in normal position between coxae IV, but second centrals (c_2) more posterior than usual (in association with the genital opening which is also more posterior than in *M. legendrei*), on a level with c_3 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 (aP_1) are short (11 μ) and lanceolate. The aP_2 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 aP_3 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 $0.5\ \mu$ diameter separated by $0.5\text{--}2.0\ \mu$.

Legs similar to those of female and with the same typical chaetotaxy. Solenidia and famulus as in female; solenidia σ_1 in poor position for viewing on allotype but in male paratypes σ_1 is between $3\frac{1}{2}$ and $4\frac{1}{4}$ times length of σ_2 . 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 $217\ \mu$ long, $113\ \mu$ 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 $2\frac{1}{4}$ times length of *si*, and σ_1 $3\frac{1}{2}$ times length of σ_2 .

PROTONYMPH. — Only one specimen, in poor condition. Length of idiosoma $154\ \mu$. Scapular setae (*se* 2 times length of *si*) and solenidia sigma on genu I (σ_1 c.3 times σ_2) 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. $125\ \mu$. 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 (σ_1 c.2 times σ_2). Differing from *M. legendrei* in having coxal rods, $15\text{--}16\ \mu$ 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 Ratih, near Tulungagung, East Java ($8^{\circ}5' S$, $111^{\circ}54' E$).

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 ovatus* (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. ovatus* 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, 1985). 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. medianensis* Oudemans), which has well-developed coxal rods (HUGHES, 1976).

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

	<i>M. legendrei</i>	<i>M. javensis</i>
ADULTS	<p>Male idiosoma two-thirds length of female's</p> <p>Propodosomal shield normal</p> <p>* <i>se</i> 1-1½ times length of <i>si</i></p> <p><i>scx</i> with narrower central stem, and long barbs on basal half</p> <p>Genital sensory organs rather small</p> <p>* Tarsi rather short and stout</p> <p>σ_1 1½-2 times length of σ_2</p> <p>ω_1 of leg I only moderately robust (ratio c.8 : 1) with rounded tip</p> <p>Famulus very small</p> <p>In tarsal spine complex, <i>s</i>, <i>u</i> & <i>v</i> moderate spines, <i>p</i> & <i>q</i> stout small setae</p>	<p>Male idiosoma five-sixths length of female's</p> <p>Propodosomal shield bilobed</p> <p>* <i>se</i> c.2½ times length of <i>si</i></p> <p><i>scx</i> with wider central stem, and long barbs on basal two-thirds</p> <p>Genital sensory organs well developed</p> <p>* Tarsi longer, not so stout</p> <p>σ_1 3½-4½ times length of σ_2</p> <p>ω_1 of leg I robust, rather stout (10 µm × 2 µm) with pointed tip</p> <p>Famulus not so small</p> <p>All setae stouter in tarsal spine complex : <i>s</i> stout and prominent, <i>u</i>, <i>v</i>, <i>p</i> & <i>q</i> spine-like but smaller</p>
FEMALE	<p>Idiosoma 405 µm long</p> <p>Very small tubercles on dorsal and ventral surfaces of posterior of hysterosoma</p> <p>* Posterior setae <i>d</i>₅, <i>l</i>₄, <i>l</i>₅ and <i>aP</i>₃ strongly and regularly bi pectinate</p> <p><i>d</i>₃ 1.65 times length of <i>d</i>₂</p> <p><i>aP</i>₃ of moderate length (c.60 µm)</p>	<p>Idiosoma 347 µm long</p> <p>No such tubercles visible</p> <p>* Posterior setae <i>d</i>₅, <i>l</i>₄, <i>l</i>₅ and <i>aP</i>₃ clearly but irregularly bipectinate</p> <p><i>d</i>₃ 1.4 times length of <i>d</i>₂</p> <p><i>aP</i>₃ longer (c.110-120 µm)</p>
MALE	<p>Idiosoma 261-270 µm long</p> <p>No tubercles indicated on idiosoma</p> <p><i>d</i>₃ 1.6 times length of <i>d</i>₂</p> <p>Penis S-shaped (with double curve)</p> <p><i>aP</i>₂ close to postero-lateral edge of anal suckers</p> <p><i>aP</i>₃ short and smooth, and close to anal suckers</p>	<p>Idiosoma 293 µm long</p> <p>Minute tubercles on ventral hysterosoma lateral and posterior to anus</p> <p><i>d</i>₃ 1.4 times length of <i>d</i>₂</p> <p>Penis singly curved towards ventrum</p> <p><i>aP</i>₂ remote from suckers, close to posterior of hysterosoma, lateral to <i>aP</i>₃</p> <p><i>aP</i>₃ moderately long and pectinate, and remote from suckers</p>
LARVA	<p>* No coxal rods (Claparède's organ)</p>	<p>* Coxal rods present</p>

* 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 σ_1 and σ_2 , except by the general comment "Solenidions comme pour *Tyrophagus*". However, in *Tyrophagus* σ_1 and σ_2 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* σ_1 and σ_2 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.

REFERENCES

- ATYEO (W. T.) & GAUD (J.), 1966. — The chaetotaxy of sarcoptiform feather mites (Acarina : Analgoidea). — J. Kans. ent. Soc., **39** : 337-346.
- ATYEO (W. T.) & GAUD (J.), 1971. — Comments on nomenclatural systems for idiosomal chaetotaxy of sarcoptiform mites. — J. Kans. ent. Soc., **44** : 414-419.
- FAIN (A.), 1971. — *Madaglyphus legendrei* g. n., sp. n. de Madagascar. — Bull. Ann. Soc. R. ent. Belg., **107** : 272-278.

- FAIN (A.), 1985. — Observations sur les genres *Suidasia* Oudemans, 1905, *Tyrophagus* Oudemans, 1924 et *Madaglyphus* Fain, 1971 (Acari, Acaridae). — Rev. Zool. afr., **99** : 159-164.
- FAIN (A.) & PHILIPS (J. R.), 1978. — Notes on the genus *Suidasia* Oudemans, 1905 with descriptions of a new species from Australia (Acari, Astigmata, Saprogllyphidae). — Int. J. Acarol., **4** : 115-123.
- GRIFFITHS (D. A.), 1977. — A new family of astigmatid mites from the Iles Crozet, sub-Antarctica ; introducing a new concept relating to ontogenetic development of idiosomal setae. — J. Zool., Lond., **182** : 291-308.
- HAINES (C. P.) & PRANATA (R. I.), 1982. — Survey on insects and arachnids associated with stored products in some parts of Java. — Progress in Grain Protection : Proceedings of the 5th Annual Workshop on Grains Post-Harvest Technology ; SEARCA, Philippines, p. 17-47.
- HUGHES (A. M.), 1976. — The mites of stored food and houses. — Tech. Bull. Minist. Agric. Fish. Fd., No. 9, (2nd Edn.), H.M.S.O., London, 400 p.
- LEFKOVITCH (L. P.), 1964. — A review of Laemophloeinae (Coleoptera : Cucujidae) from Réunion and Mauritius. — Proc. R. ent. Soc. Lond. (B), **33** : 125-130.
- MATTINGLY (P. F.), 1962. — Towards a zoogeography of the mosquitoes. — Publs. Syst. Ass., **4** : 17-36.
- RIDD (M. F.), 1971. — South-east Asia as a part of Gondwanaland. — Nature, **234** : 531-533.
- SCHLINGER (E. I.), 1974. — Continental drift, *Nothofagus*, and some ecologically associated insects. — Ann. Rev. Entomol., **19** : 323-343.

Paru en Septembre 1987.