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Dedicated to Professor Dr. H. Engel

Rhizoglyphus engeli nov. spec., with notes on the genus
Rhizoglyphus (Acari, Acaridae)

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ABSTRACT

A new species of *Rhizoglyphus*, *Rh. engeli* nov. spec., is described. Some notes on the genus *Rhizoglyphus* deal with the morphological characters of *Rh. robini*, *echinopus* and *solani*, and describe in detail the differences in the genital system. Some inaccuracies in literature are discussed and the correct concept of the type species (*Rh. robini*) is given.

In the year 1961 I published a paper on the characters which allow us to split up the traditional concept of the bulb mite "*Rhizoglyphus echinopus* (Fumouze & Robin, 1868)" in at least two species or perhaps even groups of species. Since that date I have studied many more samples of *Rhizoglyphus* and the differential characters which I indicated on page 276 (1961) for the two groups are still in force.

At that time I had discovered useful differential genital characters in the males only. In the meantime, however, I have observed that the females also show an important difference in the genital system, which enables us to distinguish immediately between the two groups in this sex as well (see below).

It may be remarked here that the results of my investigations published in 1961 are nomenclatorally contrary to those published in the same year by Mrs. A. M. Hughes in her book "The Mites of Stored Food" (1961: 74—78). This is due to the fact that Mrs. Hughes supposed that Fumouze & Robin had been working with the species with very short setae scapulares internae (sci) (= *solani* in my 1961 paper), because they had not drawn these hairs in their very detailed figure (1868, pl. 20 fig. 1). For the species with long sci she chose the name *Rhizoglyphus callae* Oudemans, 1924, indeed a species with long sci. This opinion cannot be maintained, because (1) Fumouze & Robin show in their figure pl. 21 fig. 6, the rounded penis structure insepar-

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ably belonging to mites with long sci, and (2) these authors worked with mites from hyacinth (*Hyacinthus*), which actually have such long sci. Therefore "*Rhizoglyphus callae*" (in the sense of Hughes) has to bear the name "*Rhizoglyphus echinopus*", and "*Rhizoglyphus echinopus*" (in the sense of Hughes) with short sci and with a conical penis structure is "*Rhizoglyphus robini* Claparède, 1869" (= *Rh. solani* Oudemans, 1924). On writing her book, Mrs. Hughes could not yet know the conclusions of my 1961 paper.

By macerating and mounting the long sci of *Rh. echinopus* (and other hairs as well) often get loose and go astray, and this will most probably be the reason why Fumouze & Robin did not observe and draw them.

That the "*Rhizoglyphus robini*" of Claparède, 1869, was not the same species as the original "*Tyroglyphus echinopus*" of Fumouze & Robin, 1868, is proved by (1) the short sci of Claparède's drawing pl. 38 fig. 7, (2) the conical penis structure of pl. 38 fig. 10, and (3) the host plants, potato and "Georgine" (*Dahlia*).

I did not discuss Claparède's paper in 1961, but it is necessary now, as it contains various mistakes and inaccuracies.

1. Claparède worked with material from potato and *Dahlia* from the region of Genève (Geneva), Switzerland, and his descriptions and drawings were at least mainly made after this material. So his species *Rh. robini* is definitely the one with short sci. But at some time he had also mites from hyacinth at his disposal (1869: 499) and a few details of his drawings *may* have been influenced by such mites, for instance:

- a. the very marked copulatory opening just behind the anal slit (pl. 35 fig. 1), which is a character of *Rh. echinopus* (cf. also Fumouze & Robin, pl. 21 fig. 5);
 - b. the slender solenidion $\omega 1$ of pl. 35 fig. 1 (*echinopus*);
 - c. the stout solenidion $\omega 1$ of pl. 35 fig. 13 (*robini*);
 - d. the stout $\omega 1$ on the left hand leg (= right leg) and the slender $\omega 1$ on the right hand leg (= left leg) of pl. 38 fig. 9.
2. Some details of his description clearly indicate *Rh. robini*:
- a. $\omega 1$ thick, short and cylindrical (p. 497) (he did not mention it from leg II!);
 - b. hairs proportionately short (p. 497);
 - c. the short genital hairs of pl. 35 fig. 1, and pl. 38 fig. 8.

3. Claparède worked with hypopoda, females, homoiomorph males, and heteromorph males. Whilst fiercely criticizing the observations of other acarologists, he himself made an entirely wrong interpretation of these four forms, supposing that they were two different species each with males and females. So he made the following wrong combinations:

- a. *Hypopus dujardinii* = the hypopus considered as male; the normal female as a female;
- b. *Rhizoglyphus robini* = the homoiomorph male as male; the heteromorph male as female. It is curious that he did not observe the penis structure in the heteromorph male. He did not recognize the anal suckers as a male character and overlooked the two copulatory



Figs. 1—7. *Rhizoglyphus engeli* nov. sp. 1, male, dorsal aspect; 2, male, ventral aspect; 3, nuchal seta; 4, propodosomatic shield and pseudostigmatic organs; 5, penis structure; 6, mandible; 7, bursa copulatrix and receptaculum seminis. — B. Weijde del.

suckers on the male tarsus IV, which are also present in heteromorph males.

4. Claparède mentioned an unpaired "sucker" (which is the copulatory opening) just behind the anal slit and said that it is lacking in juvenile stages (which is logic). This "sucker" is described as being very conspicuous and situated immediately behind the anal slit. This is pointing to the mites from hyacinth; in the true *Rhizoglyphus robini* the copulatory opening is less conspicuous and situated at some distance from the anal slit (see below). So we may suppose that his figure pl. 35 fig. 1 has been drawn after a female of *Rhizoglyphus echinopus*. This is also indicated by the slender solenidion $\omega 1$ of the tarsi I and II.

5. The genital opening between legs III and IV is considered by Claparède to be also the copulatory opening.

At all events Claparède has described and pictured a mite with short sci and with a conical penis structure, which he named *Rhizoglyphus robini* nov. gen., nov. spec. Therefore this is the type species by monotypy of the genus *Rhizoglyphus*.

This fact has been wrongly interpreted up to now by most authors and I omitted to mention it in my 1961 paper. So, in every list we find "*Tyroglyphus echinopus* Fumouze & Robin, 1868" indicated as the type species of the genus *Rhizoglyphus*, and this is not correct (cf. for instance Vitzthum, 1942 : 879; Radford, 1950 : 151; Baker & Wharton, 1952 : 330; Zakhvatkin, 1959 : 246). *Rhizoglyphus robini* has been published as the type species in the Official List of Generic Names in Zoology, First Instalment, 1958 : 53, no. 514.

As *Rhizoglyphus robini* is a *typus generis* and has been described from potato, *Dahlia*, and partly from hyacinth, a type host has to be selected and I have chosen for this purpose the potato (*Solanum tuberosum* L.).

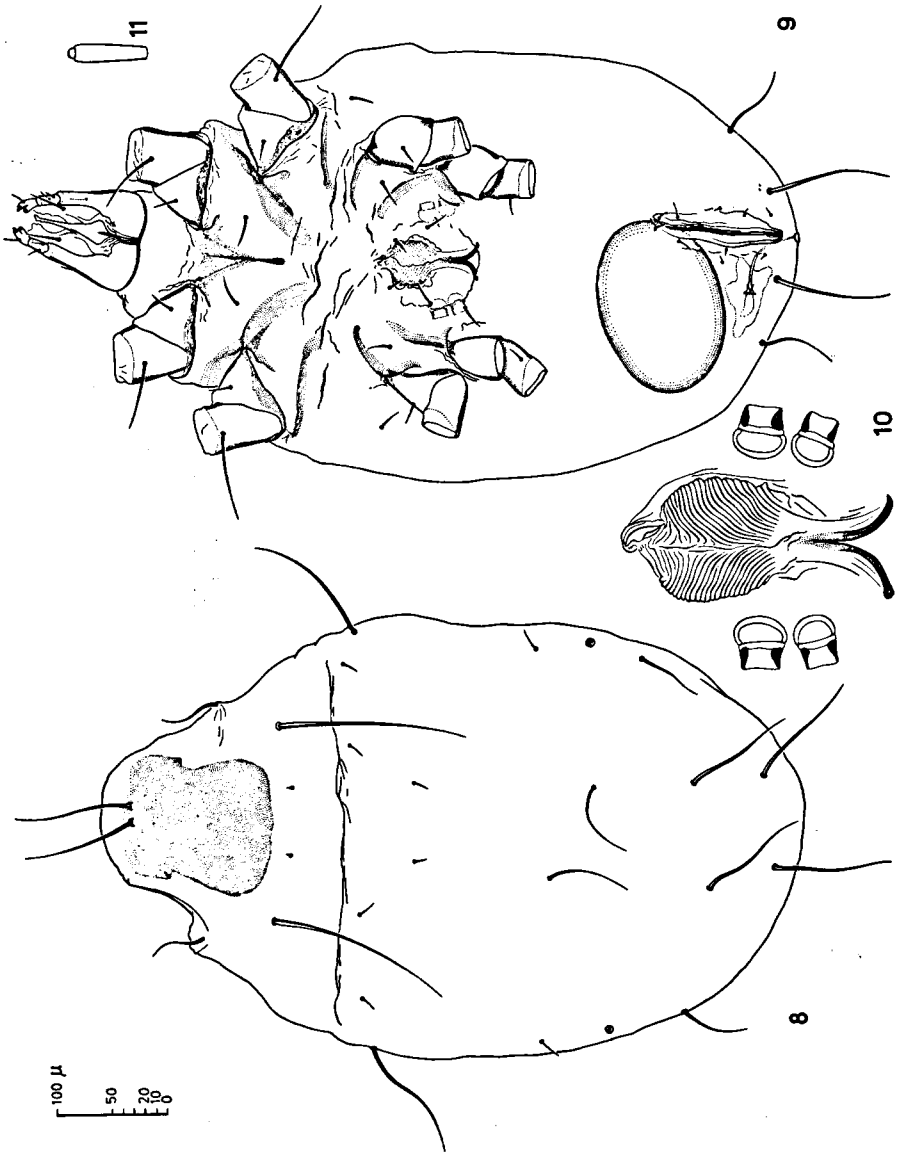
This means that as long as it cannot be proved that *Rhizoglyphus robini* Claparède, 1869, and *Rh. solani* Oudemans, 1924, are different species, the latter name has to be rejected as a junior synonym.

Some years ago my regretted colleague, the late Dr. H. Gisin, Genève, informed me that no specimens exist any more of Claparède's material. Therefore I select as lectotype of *Rhizoglyphus robini* Claparède, 1869, the drawing of the male, plate 38, no. 8.

Strictly spoken, as stated above, this mite was given by Claparède a second name: *Hypopus dujardinii*, but this name has to be rejected as a synonym of *Rhizoglyphus robini*.

FEMALE GENITAL SYSTEM

The females of *Rhizoglyphus robini* (and of *Rh. solani*) have the usual type of morphology. The copulatory opening is just a pore, surrounded by a weakly chitinized area, and is therefore not very conspicuous. It is situated at some distance from the anal slit and is the starting point of a rather long, narrow ductus (bursa copulatrix) which leads to the receptaculum seminis.



Figs. 8—11. *Rhizoglyphus engelii* nov. sp. 8, female, dorsal aspect; 9, female, ventral aspect; 10, female genital opening; 11, larval chest rod ("Bruststiel"). — B. Weijde del.

The latter shows two V-shaped apertures close together which open on the ovaria.

The females of *Rhizoglyphus echinopus* have quite a different morphology. Here the copulatory opening is situated immediately behind the anal slit. It is very conspicuous, as the opening is surrounded by a heavily sclerotized ring. Inside the opening, in its centre, is a small chitinous cone which may be the bursa copulatrix. No ductus is observed; the receptaculum seminis starts here at once. The latter is large and wide, of an irregular form, and the two V-shaped apertures are at great distance from each other. The lack of a tube between the copulatory opening and the receptaculum seminis is a quite unusual, perhaps unique, construction in Acaridae.

When maintained in its present conception, the genus *Rhizoglyphus* is peculiar in that it contains mites showing at least two entirely different structures in their genital morphology.

In addition to my remarks of 1961 I can say that the penis structure of the *robini*-group consists of a truncate conical foundation with a hollow, pointed appendix for copulation, pointing forward in its inactive position (fig. 5). In this position it is at the internal side, pressed against the venter.

It is my intention to discuss the genitalia of *Rhizoglyphus* more in detail in a future publication. The present paper is mainly meant to describe a new species of *Rhizoglyphus*, collected from *Freesia* and belonging to the *robini*-group. I am happy to call it *Rhizoglyphus engeli* nov. spec. in honour to Prof. Dr. H. Engel, director of the Zoological Museum of the University of Amsterdam, on the occasion of his 70th birthday and as an acknowledgement of the great interest he has always shown in my work on acarology.

The main differences between *Rhizoglyphus robini* and *Rh. engeli* are listed below. I have chosen for comparison the *robini*-form living on *Narcissus*-bulbs, which seems to be slightly different from that on potato.

<i>Rh. robini</i> from <i>Narcissus</i>	<i>Rh. engeli</i> nov. spec.
Female about 700 μ long	Female about 560 μ long
♀ body cavity large, apt to contain 6 and more eggs at one moment	♀ body cavity small, but eggs same size, therefore not more than 1, 2, or sometimes 3 eggs at one moment
nuchal hair entire, seldom slightly bifurcated	nuchal hair clearly bifurcated (fig. 3)
pseudostigmatic hair short and stiff, 23 μ , tip distinctly pectinated	pseudostigmatic hair long and slender, up to 65 μ , tip almost smooth (fig. 4)
ductus (bursa copulatrix) long and narrow, 60—110 \times 1½—2 μ	ductus (bursa copulatrix) shorter and wider, 40—70 \times 2—3 μ
genital sensory organs about circular, top thinwalled	genital sensory organs oval, broader than high, top thickwalled (figs. 5, 10)

DESCRIPTION

Rhizoglyphus engeli nov. sp.

General aspect: A *Rhizoglyphus* of medium size.

Male (figs. 1—2).

Average size of idiosoma (mounted specimens) $500 \times 280 \mu$.

Dorsum. — Propodosomatic shield present, $100 \times 80 \mu$; setae verticales internae (vi) $80\text{--}100 \mu$, setae verticales externae (ve) minute but present, 10μ , at 40μ from top of shield; setae scapulares internae (sci) minute, $10\text{--}12 \mu$, setae scapulares externae (sce) long, $140\text{--}180 \mu$. Other dorsal bristles according to fig. 1. All hairs smooth, only vi may have some indication of pectination towards the tip.

Nuchal seta (Grandjean's organ) (fig. 3) a hornlike process, conspicuous, 30μ , mostly clearly bifurcated.

Pseudostigmatic organ (fig. 4) arising from a well chitinized area, up to 65μ long, slender, flexible and tapering, rarely bifurcated, smooth with some indication of pectination towards the tip.

Venter. — Setae according to fig. 2, all smooth. Anal copulatory suckers with a short, thick, conical male anal bristle in front of them. Anal slit rather short, contacting the genital slaps covering the penis structure.

Penis structure (fig. 5) strongly chitinized, conical and truncated, thick, at the inner side with a short, pointed penis as an appendix, the inactive penis thus pressed against the venter; this whole structure can turn, thus allowing the penis to contact the female copulatory aperture. Genital organization between coxae IV. Genital sensory organs (fig. 5) large, somewhat elliptical, broader than high, top thickwalled.

Apodemes I forming a short sternum; other apodemes free.

Legs. — Legs I and IV according to fig. 12—13 and 16—17. Sensory rods of tarsus I (fig. 20): Solenidion $\omega 1$ rather thick and stout, 21μ long, $3\text{--}4 \mu$ thick, starting broadly, widening slightly, widest in the middle, than slightly narrowing and wider again at the tip; famulus ϵ thick, conical, 7μ , basis $2\frac{1}{2} \mu$; solenidion $\omega 2$ slender and cylindrical, 13μ long, 1μ wide, blunt tip. Copulatory suckers of tarsus IV (fig. 21) 18μ diameter.

No heteromorph males observed.

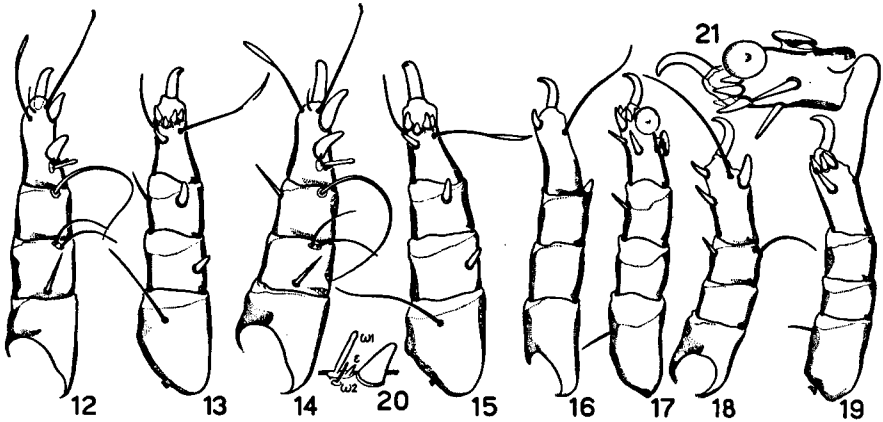
Female (figs. 8—9).

Average size of idiosoma (mounted specimens) $560 \times 300\text{--}475 \mu$.

Dorsum. — Same aspect as male, setae about same length (sce up to 200μ).

Venter. — Apart from genital and anal areas same aspect as male.

The genital system consists of the usual two openings. The copulatory opening is situated at a short distance behind the anal slit, and is about terminal. It is nothing but an aperture, surrounded by a small, weakly chitinized area. The bursa copulatrix, sometimes with a few small warts, is a tube leading to the receptaculum seminis which is of an irregular form (fig. 7). At the end the two inside apertures can be observed, opening on the ovaria. The tube is rather short, $40\text{--}70 \mu$, and rather wide, $2\text{--}3 \mu$.



Figs. 12—21. *Rhizoglyphus engelii* nov. sp. 12, ♂ leg I, dorsal; 13, ♂ leg I, ventral; 14, ♀ leg I, dorsal; 15, ♀ leg I, ventral; 16, ♂ leg IV, lateral, exterior; 17, ♂ leg IV, lateral, interior; 18, ♀ leg IV, dorsal; 19, ♀ leg IV, ventral; 20, tarsus I, sensory rods; 21, ♂ tarsus IV. — B. Weijde del.

The large genital opening (fig. 10) is indented for egg-laying. It is closed by two well-developed genital folds. The genital sensory organs are of the same type as those of the male.

Body cavity. — The body cavity is proportionately small and the eggs are large. It seems that never more than one, two or sometimes 3 eggs are present at the same moment. In *Rhizoglyphus robini* and *Rh. echinopus* the number of eggs is frequently much larger.

Legs (figs. 14—15 and 18—19). — The legs are similar to those of the male. Leg IV, of course, lacks the two copulatory suckers.

Tritonymph. Similar to female. There is no copulatory opening and the genital slit is rudimentary. The two pairs of genital sensory organs are small and less developed.

Hypopus. Not yet observed.

Protonymph. The genital slit is still more rudimentary and there is only one pair of genital sensory organs.

Larva. Three-legged and lacking the genital organization. It has the usual two chest rods ("Bruststiele") (fig. 11).

Host plant. — *Freesia* spec., decaying tubers, cultivated.

Material. — Cultivated tubers from The Netherlands, sent by Plant Protection Service, Wageningen, 1957.

Cultivated tubers from The Netherlands, sent by Plant Protection Service, Wageningen, 1958.

Type locality. — The Netherlands.

Holotype. — In Zoölogisch Museum, Amsterdam, one specimen, adult male, labelled: "*Rhizoglyphus engelii* van Eyndhoven 1968, ad. ♂, det. G. L. van Eyndhoven, 1968; Zoöl. Mus. Univ. Amsterdam, G. L. van Eyndhoven, loc. 958120, *Freesia*, Nederland, P.D. Wageningen, 1958".

Paratypes. — Various slides from both samples.

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