

POSTERS

A new species of the genus *Ripersiella* Tinsley (Hemiptera: Coccoidea: Pseudococcidae) from import interceptions in The Netherlands

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Abstract: *Ripersiella multiporifera* is described as a new species from *Sansevieria* sp. originating from Indonesia and *Hoya kerrii* originating from Thailand. The immature female stages are described as well based on microscopic features and a key is provided for the separation of these stages. The differences with the morphological characters with those of *R. hibisci* (Kawai & Takagi) are given. A key to the species which have been found during import interceptions and in greenhouses in The Netherlands is given. All female stages are illustrated.

Key words: *Ripersiella multiporifera*, *Ripersiella hibisci*, taxonomy, Pseudococcidae, new species, root mealybugs, greenhouses.

Introduction

Bonsais and potplants are regularly imported products into the Netherlands. During the last decennia there has been an increase in trade and transport of plant material resulting in increased risk of introduction of species. These might be quarantine species or species which look very much alike. Because all root mealybugs look very similar to the naked eye when present on the roots of plants, a study of the microscopic structures has to be made for accurate identification. Most of them are exotic species not occurring in the Netherlands or in Europe but whose introduction might be a risk for crops or a threat for the native fauna in the public green and nature conservation areas. Each year there are new introductions of insect species. As a result the number of subterranean mealybug species is growing as well. In this paper a new species is described from *Hoya kerrii* imported from Thailand in 2003 and *Sansevieria* plants imported from Indonesia in 2005.

Materials and methods

Specimens found on *Sansevieria* and *Hoya* plants were collected by inspectors of the Dutch Plant Protection Service and submitted for identification in the framework of regular quarantine inspections during import inspections or phytosanitary inspections in commercial greenhouses of retailers and growers. In 2003 only a few nymphs and the remnants of ovisacs were found on the roots of the *Hoya* plants and there was no trace of an adult specimen. Therefore several of these potted plants were stored in a greenhouse to rear the species hoping it would survive the greenhouse climate. After several months the population on the *Hoya* plants started growing and later slides were made from adults. Males were observed as well.

Taxonomy

Jansen (2003) published a key to the females of the genus *Rhizoecus* Künckel d'Hercule s.l. found in The Netherlands. However, additional species were identified the last several years and therefore a new key needs to be set up to the subterranean mealybugs. They are,

with the exception of one, all introduced by trade. Due to recent research on the Pseudococcidae of South-east Asia (Williams, 2004) and on the tribe Rhizoecini (e.g. Kozár & Foldi, 2004; Kozár & Konczné Benedicty, 2004) the recognition of undescribed species from that region has become easier.

The first instar nymph and all female stages of the new species *R. multiporifera* are described and illustrated. Descriptions of pre-adult stages are useful for identification when only nymphs are present in samples. The related *R. hibisci* (Kawai & Takagi) is a quarantine species in Europe and at the moment no reliable identifications can be made from samples consisting only of prematures. Kozár & Konczné Benedicty (2004) recognized 162 species which belong to the Rhizoenini tribe including 73 species of the genus *Ripersiella*. This genus is separated from the related genus *Rhizoecus* s.s. by the presence of bitubular pores and this concept is followed here as well. Type material is deposited in the collection of the Plant Protection Service (Wageningen, The Netherlands), the Natural History Museum (London, UK) and in the Plant Protection Institute (Budapest, Hungary).

Ripersiella multiporifera sp. n. (Fig. 1)

Type-material, all collected in The Netherlands:

HOLOTYPE: left female of two on a slide containing two specimens. Left label: PD Boskoop leg. R. van Donk, 19.viii.2005, PD1783190 (1 slide), Nieuwerkerk, *Sansevieria*, import Indonesië, reared in PD-greenhouse, 14.iv.2006. Right label: *Ripersiella multiporifera*; Left: Holotype (marked with red), PD 1738349. The slide is deposited in the collection of the Plant Protection Service, Wageningen.

PARATYPES: PD Boskoop leg. W. den Hartog, 25.iv.2006, Nieuwerkerk, *Sansevieria* import Indonesia PD 3084916 (6 slides: 5x first instar nymphs, 3x second instar ♀, 2x third instar ♀ and 1 adult ♀); PD Boskoop leg. R. van Donk, 19.viii.2005, Nieuwerkerk aan de IJssel, *Sansevieria*, import Indonesia, PD1738349, reared in PPS greenhouse 14.iv.2006 (20 slides: 13x first instar nymphs, 2x second instar ♀, 1x third instar ♀ and 15 adult ♀♀); PD Boskoop leg. P. Miedema, 10.v.2006, import Indonesië, *Sansevieria*, PD3081432 (2 slides: 1x first instar nymph, 1x second (?) instar ♀, 2 adult ♀♀); PD Boskoop leg. R. van Donk, import Indonesië, Nieuwerkerk, *Sansevieria*, 15.vi.2005 PD1783190 (3 slides: 2x second instar ♂, 1x second instar ♀, 1x third instar ♀ moulting to adult, 2x adult ♀♀); PD Boskoop leg. W. den Hartog, 30.x.2006, *Sansevieria*, Nieuwerkerk aan de IJssel PD3414479 (7 slides: 1x second instar ♂, 11x adult ♀♀); PD Aalsmeer leg. M. Vroom, 27.iii.2003, import Thailand, *Hoya kerrii*, larvae reared in greenhouse PD Wageningen PD 23001511 (18 slides: 2x first instar nymphs, 2x second instar ♀, 5x third instar ♀, 3 adult ♂♂ and 19 adult ♀♀).

Etymology

The species epithet means “bearing many pores” containing the Latin words “multi”, “pori” and the verb “fero” which means “bearing”.

Description of the adult female (measurements based on 20 specimens) (Fig. 1)

The description is based on slide mounted adults only including all type material and the measurements are given as ranges. The characters of the holotype fall within the range of the characters as given.

Field characters: The body of the adult female is elongate to broadly oval depending at the age of the specimen, flattened ventrally and convex dorsally. Normally they are very active,

walking around. The body is lightly covered with a white powdery, mealy, wax secretion; legs and antennae are pale brown.

Slide mounted characters: The adult female holotype is elongate-oval with almost parallel sides, length 1.1 mm, width 0.39 mm. Paratypes 1.27 and 1.3 mm long resp. 0.41 and 0.7 mm wide.

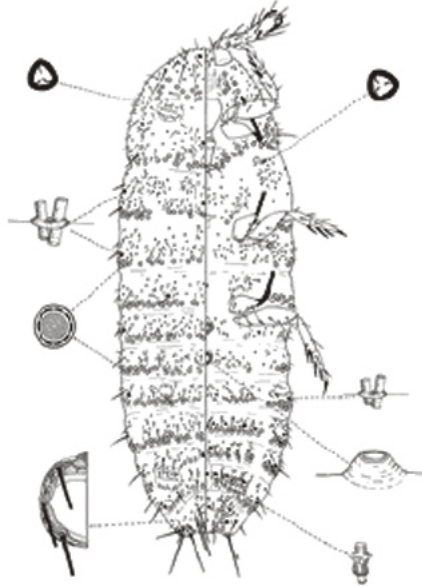


Figure 1. *Ripersiella multiporifera*, adult female. Left side detail drawings from above to below: trilocular pore, big type bitubular pore; multilocular pore, anal ring; right side detail drawings: trilocular pore, small type bitubular pore; circulus, internal female genitalia.

Dorsum: Posterior end of body with well developed, slightly projecting anal lobes on a heavily sclerotized plate; each lobe with 7 apical setae of varying length: usually one short seta 10 μm long near the edge and the other up to 90 μm long accompanied by a group of 8-9 trilocular pores. Anal ring about 60 μm in diameter with 6 setae 65-80 μm long and with an outer row of up to 20 cells; up to eighteen spicules in outer row of cells very small, hardly visible. Flagellate setae in bands across the segments but absent from intersegmental areas; lateral setae around the entire body: many around the head, all up to 12 μm , setae alongside the rest of the thorax up to 25-30 μm and the abdominal marginal setae with length up to 50 μm . On each abdominal segment usually 4-5 long setae up to 35 μm long, many short setae the shortest 9 μm long (including basal-socket) 6-10 μm long and several in between these two categories but most much shorter. Trilocular pores evenly distributed among the setae, about 3.5 μm wide. Small type bitubular pores absent. Large-type bitubular pores 6-7 μm wide and 7-8 μm high. Position and number of bitubular pores are as follows:

head 1 on submargin between basal antennal segments; prothorax and mesothorax: one on each margin and one median; metathorax one on each margin; abdominal segments: I two submedial, II, IV and VII two on each margin one, III, V and VIII without ducts, VI two marginal ones next to ostioles and one median. Ostioles well developed with edges weakly sclerotized; anterior pair anteriorly with 3 triloculars and 4 setae, posteriorly with 5 triloculars and 3 setae in two irregular rows; posterior pair posteriorly with 4 triloculars and 3 setae in one alternating row; anterior side with 6 triloculars and 3 setae in two alternating but slightly irregular rows. Trilocular pores 2.5-3.5 μm wide, evenly scattered on surface. Tubular ducts absent. Multilocular pores 7-8 μm wide, more than 30 present in loose groups on posterior half of head; thorax: numerous in loose groups forming one to two irregular rows on the posterior edge of each segment and single ones on the rest of the three segments; abdominal segments with up to 45 multiloculars on the posterior margin and occasionally single to several on other parts: I-III in an irregular row on posterior margin, IV-V: a double row, VII: one interrupted row, VIII: absent.

Venter: Trilocular pores numerous, 3.5 μm wide. Only small type bitubular pores present, each about 3.5 μm wide and 5 μm high which is 2/3- 3/4 from those of dorsum. The number on abdominal segments as follows: IV, 6; V, 8; VI, 10; VII, 9; VIII, 6. Flagellate setae in bands across the segments but absent from intersegmental areas; lateral setae present around the entire body: one pair near the prothorax 40-45 μm long, many around the head, all up to 10-12 μm , setae alongside the rest of the thorax up to 25-30 μm and the abdominal marginal setae with length up to 50 μm . On each abdominal segment are usually 4-6 setae up to 30 μm long and smaller setae of up to 15 μm long of varying length. Multilocular disc pores 7-8 μm in diameter, present on the head: 10-12 around cephalic plate; on the thorax I: a loose group along the body margin and one irregular row on posterior margin, II: a few on both sides of sternal apophyses and a loose group on margin and submargin, III: a few near the margin; on the abdomen I: a few on the margin and submargin on both sides of the coxae, II: absent or a single submedial one, one or two on the margin, III: one interrupted row, IV: one row, partly double near the body margin, V-VI: a double row, VII: three rows, VIII: covered with multiloculars except on the anterior margin and the body (sub) margin. Width of mesothoracic sternal apophysis 60-75 μm , very elongated, ending flagellate. Spiracles about 35 μm long, peritreme about 15 μm wide. Antennae relatively slender and 5-segmented, 175-200 μm long, the apical segment has three long and one short sensory falcate setae, there is one sensory pore on the second segment. Cephalic plate variably developed, variable in shape; with 0-5 setae alongside the edges and one seta near center. Legs well developed: hind trochanter + femur 138-168 μm long; hind tibia + tarsus 138-173 μm long, hind claw slender, 25-30 μm long with a few short digitules of about 8-10 μm long. Ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.0-1.05. Tibia 73-95 μm long, tarsus 63-78 μm long. Ratio of lengths of hind tibia to tarsus 1.19-1.32. Setae on inner distal end of tibia stouter than others. Lip-like triangular structure posterior to vulva absent. Labium (three segments combined) 85-100 μm long, length of clypeolabral shield 68-88 μm . Two circuli present, without cell like reticulations, one on posterior side of abdominal segment III and one on segment II, width of the anterior 3/4 from the other, however both are variable; a few specimens having the posterior circulus with two sclerotized rings. Width of circulus on segment II 10-40 μm and width of circulus on segment III 23-40 μm ; shape truncate-conical, about same length as basal diameter. Eyes not present. Anal ring 53-60 μm wide with six setae which are 65-80 μm long with two rows of very longitudinal and narrow shaped cells. Tubular ducts absent. Internal genital organ chitinized, elongated, as long as width of one segment.

Diagnosis of adult female

R. multiporifera can be diagnosed from adults of the other members of the genus by the following combination of characters: bitubular pores present, multilocular pores present on venter and dorsum and not confined to the last few segments, two circuli present, tubular ducts absent and bitubular ducts of two sizes. The related *R. saintpauliae* (Williams) possesses multiloculars on thoracic and first to sixth abdominal segments in small numbers up to ten per segment whereas *R. multiporifera* has up to 45 multiloculars in one to occasionally partly two rows on the posterior edge of each segment and single ones on the rest of the segment. Besides multiloculars are present on head and seventh abdominal segment as well. Several characters of *R. multiporifera* tend to be smaller: the antennae of *R. saintpauliae* are 200-220 µm, the trochanter + femur 165-180 µm, the labium 110 µm and the hind claw 40 µm (Williams, 1985) whereas those from *R. multiporifera* are 175-220 µm, 138-168 µm, 85-100 µm and 25-30 µm respectively.

Studied specimens of *R. multiporifera* of the two investigated populations did not vary in the number of circuli as is often the case in *R. hibisci* where 0-2 circuli are common numbers, even in the same population. Adults of *R. hibisci* with 1-2 circuli differ by the absence of multiloculars on the head whereas those on the thorax and first two abdominal segments are only represented by single ones. Adults of *R. multiporifera* can be distinguished from the last nymphal stage by the presence of a vulva, multilocular disc pores, two circuli, bitubulars of two sizes and bitubulars on the ventral side. On the dorsum there are additional bitubulars on the margin of the prothorax and metathorax and the margin of the abdominal segments II, IV and VI and on the median of segment VI. No bitubular is present on the margin of abdominal segment III.

Description of first-instar female (measurements based on 10 specimens) (Fig. 2).

Slide mounted characters: Dorsoventrally flat, oval, membranous, 465-495 µm long and 200-235 µm wide; ratio width of clypeus to body width 4-5. Marginal setae on head 11-15 µm long, on thorax up to 23 µm long and on abdomen VII up to 20-25 µm long.

Dorsum: Multilocular disc pores and tubular ducts absent. Bitubular pores absent. One pair of tritubercular pores on the margin of abdominal segment I, 6-7 µm wide. Posterior ostiole with no trilobular pores and no setae in posterior margin, inner edges of lips not sclerotized. Anterior ostiole often barely perceptible. Anal ring 28-32 µm wide with six setae, each 30-33 µm long; anal lobe setae 42-57 µm long. Abdomen with slender setae in six rows, on segment I-VI 11-15 µm long; segment VII-VIII 13-16 µm long. Thoracic setae 5-13 µm long; setae on head 13-15 µm long. Trilobular pores on abdominal segment I, III, IV, V, VII: 4; on abdominal segment II, VI and VIII: 2. **Venter:** Circulus present on abdominal segment III, width 7-8 µm. Interantennal width 17-22 µm. Antennae with five segments and total length including falcate sensory setae 85-100 µm, length of segment I: 20-23 µm; length segment V: 45-50 µm, total length of segment II-IV 17-25 µm, each segment can be recognized by a weak sclerotization but whereas the outward side is clearly divided, the inward side is more or less undivided; one sensory pore on the second segment, the apical segment has three long and one short sensory falcate setae. Legs well developed, without tibiotarsal sclerosis; measurements of hind leg: length 165 µm; hind femur 45-48 µm long; hind tibia 35-40 µm long; hind tarsus 30-33 µm long; hind claw 17-20 µm long; hind coxa diagonally about 37-40 µm long; hind trochanter + femur 60-65 µm long, hind tibia + tarsus 70-73 µm long; ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.12 - 1.16 ratio of lengths of hind tibia to tarsus 1.1 - 1.3; ratio of lengths of hind tibia to femur 0.77-0.88.

Setae on abdomen in six rows; on segment I-VI 11-14 μm long, on segment VII 16-19 μm long. Labium 50-53 μm long. Clypeus 46-50 μm wide. Ratio of body width to width of clypeus 4.0-5.1. Cephalic plate present but occasionally invisible, with 3-4 setae. Trilocular pores present on the margins or submargins of abdominal segments. Posterior spiracle with long muscle plate; length 20-22 μm , peritreme 3-3.5 μm wide. Tubular ducts, bitubular ducts, multilocular disc pores and eyes absent.



Figure 2. *Ripersiella multiporifera* first-instar nymph.

Diagnosis: The first-nymphal stage of *R. hibisci* can be distinguished from those of *R. multiporifera* by the absence of a circulus, the dorsal setae on abdominal segment VII-VIII segment are 18-21 μm , the longer thoracic marginal setae which are 40-58 μm long and the longer abdominal setae on segment VII which are 22-38 μm long, normally 26-38.

Description of second-instar female (measurements based on 5 specimens) (Fig. 3).

Slide-mounted characters: Dorsoventrally flat, oval, membranous, 465-700 μm long and 188-270 μm wide. Marginal setae of head up to 18 μm . With two irregular rows of long marginal setae on the margin of thorax, one striking seta on prothorax 23-28 μm long, on the rest of the margin of the thorax up to 15 μm ; length of marginal abdominal setae are as follows: segment I-V up to 18 μm , VI: 25 μm ; VII: 33. Ratio of width of clypeus to body width 4.2-5.7.

Dorsum: Anterior and posterior ostioles present, with unsclerotized inner edges and these without pores and setae although one or two setae and triloculars usually are present next to the border of the upper and lower lip. Multilocular disc pores and tubular ducts absent. Anal ring about 33-35 μm wide with six setae, each 32-35 μm long; anal lobe setae 50-53 μm long. Abdomen with slender (sub)median setae, on segment I-VI maximal 15 μm long; on segment VII-VIII about 18 μm long. Setae on head up to 18 μm long and thoracic setae up to 15 μm long. Number and position of bitubular ducts are as follows: one in midfrontal position on head, two on the margin of mesothorax, two on margin of both sides of segment

II and segment VII of the abdomen. Abdominal segment I with 11-14 setae and 9-12 triloculars; segment III with 10-14 setae and 9-12 triloculars, segment VI with 7-9 setae and 4-9 triloculars.



Figure 3. *Ripersiella multiporifera*, second-instar female.

Venter: Antennae with five segments and total length including falcate sensory setae 107-113 μm long; segment I: 23-25 μm ; length segment V: 51-58 μm , segment II-IV 29-30 μm , each segment can be recognized by a weak sclerotization but whereas the outward side is clearly divided, the inward side is more or less undivided; one sensory pore on the second segment, the apical segment has three long and one short sensory falcate setae, interantennal width 20-25 μm . Legs well developed, without tibiotarsal scleriosis, total length 205-259 μm ; hind femur 60-65 μm long; hind tibia 47-50 μm long; hind tarsus 40-43 μm long; hind claw 15-18 μm long; diagonal length hind coxa 45-50 μm ; hind trochanter + femur 82-85 μm long, hind tibia + tarsus 82-88 μm long. Ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.99-1.03. Ratio of lengths of hind tibia to tarsus 1.12-1.25. Ratio of lengths of hind tibia to femur 0.67-0.77. Median and submedian setae on abdominal segments I-VI 14-18 μm long, on segment VII 20-25 μm ; on segment VIII 14-18 μm long. Labium including unsclerotized part 50-63 μm long; width of clypeus 48-55 μm . Cephalic plate weak developed, waved triangular. Posterior spiracle with long muscle plate; 20-24 μm long, peritreme 9 μm wide. One circulus present on segment III, 10-14 μm wide, more or less bullet-shaped. Tubular ducts, bitubular ducts, multilocular disc pores and eyes absent.

Diagnosis: The second-instar nymph can be distinguished from the first-instar nymph by the presence of bitubular ducts and from the third instar nymph by the presence of a bitubular duct on the submargin of the second abdominal segment. The gender of the second-instar nymph however remains problematic. There are two types: one without common ducts and one with microducts present in small numbers on the margin and submedially and submarginally on most segments of the entire body, their width being $\frac{1}{2}$

to 1/3 of the width of trilocular pores. No observations of the pharate third-instar female or the prepupal male could be made. However, in other species the common ducts are lacking in the female second stage (Gullan, 2000; Kondo *et al.*, 2004; Miller & Miller, 2002). The second-nymphal stage of *R. hibisci* can be recognized from those of *R. multiporifera* by the absence of a circulus and the longer marginal and body setae. The longest prothoracic marginal seta is 40-55 μm long. On the contrary *R. multiporifera* always has a circulus and most of its setae are on average shorter e.g. the longest prothoracic marginal seta is 20-28 μm .

Description of third-instar female (measurements based on 8 specimens) (Fig. 4).

Slide-mounted characters: Dorsoventrally flat, oval, membranous, 650-1040 μm long and 240-580 μm wide. Ratio of clypeus width to body width 3.8-6.2. Marginal setae of head up to 20-22 μm . On the margin of head and thorax an irregular row of slightly longer setae is present which are 18-25 μm long, the rest of the setae is up to 18 μm long. Length of marginal abdominal setae are as follows: segment I-V up to 18 μm , VI: 30 μm ; VII: up to 38 μm .

Dorsum: Anterior ostiole with a variable number of setae and triloculars on both margins, with up to five of these elements on the upper and lower lip. The number of setae and triloculars on each lip normally the same or differs only one element. Multilocular disc pores and tubular ducts absent. Posterior ostiole with unsclerotized inner edges, both lips with 1-2 triloculars and 1-2 setae. Anal ring 38-43 μm wide with six setae, each about 45-48 μm long; longest anal lobe setae up to 55 μm long. Abdominal surface with slender setae; on head up to 28 μm long; on thorax 13-20 μm long; on abdominal segment I-VI 15-20 μm long and on VII-VIII up to 28-36 μm long. Abdominal segment I with 19-24 trilocular pores and 18-21 setae; segment III with 19-20 triloculars and 18-21 setae; segment VI with 12-21 triloculars and 17-20 setae. Number and position of bitubular ducts are as follows: one in midfrontal position on head, 1 on median position of prothorax, 2 on the margin of the mesothorax, rarely one on the margin of the metathorax, on abdomen: one or two in submedian position of segment I, two in the margin of segment III, occasionally one or two in the margin or rarely one in the median of segment VI and two in submargin of segment VII. **Venter:** Antennae with five segments; length of segment I: 29-33 μm ; length segment V: 65-75 μm , segment II-IV 41-50 μm , total length including falcate sensory setae 130-145 μm ; the apical segment has three long and one short sensory falcate setae, there is one sensory pore on the second segment; interantennal width 35-43 μm . Legs well developed, without tibiotarsal scleriosis; femur 73-85 μm long; tibia 58-61 μm long; tarsus 50-55 μm long; claw 23-25 μm long; hind coxa 60-70 μm long; hind trochanter + femur 105-112 μm long, hind tibia + tarsus 108-123 μm long. Ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.03-1.1. Ratio of lengths of hind tibia to tarsus 1.15-1.25; ratio of lengths of hind tibia to femur 0.72-0.76. Cephalic plate weakly developed, broadly waved, triangular, regularly with one seta in center. Length median and submedian setae on abdomen as follows: on segment I-VI 15-20 μm long, on segment VII-VIII 25-40 μm long. Labium 73-80 μm long, clypeus 58-70 μm wide. One circulus present, 10-14 μm wide. Posterior spiracle 23-28 μm long, peritreme with long muscle plate; 9-10 μm wide. Tubular ducts, bitubular ducts, multilocular disc pores and eyes absent.



Figure 4. *Ripersiella multiporifera* third-instar nymph.

Diagnosis: The third-instar female can be distinguished most easily from the adult female by lacking a vulva and multilocular disc pores, from the first instar by the presence of dorsal bitubular ducts, and from the second-instar nymph by the presence of several setae and triloculars on the sclerotized lips of the ostioles and the number and position of dorsal bitubulars.

Notes on host plants and geographical distribution:

Hoya kerrii Craib belongs to the family Asclepiadaceae and is an evergreen climbing plant up to one meter, with heart shaped leaves which have notches at the apexes of the leaves instead of at the bases. It is the most succulent species of the genus and originates from Thailand, Cambodia and Laos and is cultivated in Laos, Malaysia, Thailand and Vietnam. *Sansevieria* sp. belongs to the family Dracaenaceae. Both genera contain several popular houseplants in temperate areas. At present, *Ripersiella multiporifera* sp.n. is only known from a few import interceptions and found in a greenhouse of a trader and importer in The Netherlands. This subterranean species lives hidden on root hairs and detection of small populations is difficult. As a result spread is easy through international trade. It is to be expected that the species number will increase in the future as a result of continuing inspections. Moreover a reliable identification could not be made from several samples.

KEY TO THE FEMALE STAGES OF *RHIZOECUS HIBISCI* AND *RIPERSIELLA* N. SP.

1. Tritubular ducts present on the dorsum of the first abdominal segment, bitubular ducts absent **first instar**
- Tritubular ducts absent, bitubular ducts present 2
2. Posterior ostiole without trilocular pores and setae on posterior margin; bitubular ducts on the abdomen restricted to the margin of the segments II and VII **second instar**

- Posterior ostiole with two or three setae and trilocular pores on posterior margin; more than four bitubular ducts on abdomen 3
- 3. Dorsal abdomen with 6-8 bitubular ducts; multilocular disc pores, tubular ducts, circuli and vulva absent **third instar**
- Dorsal abdomen with more than eight bitubular ducts; multilocular disk pores and vulva present; circuli 0-2 **adult female**

KEY TO THE ADULT FEMALES OF SUBTERRAEAN MEALYBUGS OF THE NETHERLANDS, PREDOMINANTLY FOUND AT IMPORT INTERCEPTIONS AND IN GREENHOUSES.

1. Bitubular or tritubular ducts absent, common tubular ducts present 2
 - Bitubular or tritubular ducts present, common tubular ducts present or absent 3
2. Posterior abdominal segments terminating in a pair of strongly produced sclerotized anal lobes fused at basis, large translucent pores on the hind tibiae absent
 - *Geococcus coffeae* Green
 - Posterior abdominal segments not terminated in a pair of strongly produced sclerotized anal lobes; large translucent pores on the hind tibiae with heavily sclerotized rims, at least three pairs of cerarii of which have a few conical setae, large tubular ducts *Trochiscococcus speciosus* (De Lotto)
3. Bitubular pores present *Ripersiella* 4
 - Tritubular pores present *Rhizoecus* 9
4. Eyes absent, antennae 5-segmented 5
 - Eyes present, antennae 6-segmented 9
5. Multilocular pores present on venter and dorsum; 0-2 circuli 6
 - Multilocular pores confined to ventral abdominal segments VII-IX; 2-6 circuli present *campestris* (Hambleton)
6. Multilocular pores absent on head; small type bitubular pores present on venter and dorsum *hibisci* (Kawai & Takagi)
 - Multilocular pores present on venter and dorsum of head; small type bitubular pores confined to venter *multiplierifera* sp. n.
7. Dorsal multiloculars present in small number; common oral collar tubular ducts present 8
 - Dorsal multiloculars absent; common oral collar tubular ducts absent . . . *maasbaehi* (Jansen)
8. 4-6 bitubular ducts on dorsal abdominal segments *mexicana* (Hambleton)
 - 2-3 bitubular ducts on dorsal abdominal segments *planetica* (Williams)
9. Multilocular pores absent from venter 10
 - Multilocular pores present on venter 12
10. Median and submedian areas of dorsum with some tritubular pores, labium 60-85 µm long 11
 - Median and submedian areas of dorsum without tritubular pores and no more than four tritubular pores on dorsal margins, labium 90-105 µm long *elongatus* Green
11. Labium 60-70 µm long *albidus* Goux
 - Labium 75-85 µm long *cacticans* (Hambleton)
12. Circulus absent 13
 - One or more circuli present 14

13. Tubular ducts present. Ventral multilocular pores present across most abdominal segments, a few on head, thorax and dorsum. Tritubular pores of three sizes . . . *americanus* (Hambleton)
- Tubular ducts absent. A few multilocular pores on posterior abdominal segments only, absent from dorsum. Tritubular pores of equal size *dianthi* Green
14. Labium longer than wide, tubular ducts often with a pale circular area around orifice *amorphophalli* Betrem
- Labium as long as wide, tubular ducts without a pale circular area around orifice *advenoides* Takagi & Kawai

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