Boll. Zool. agr. Bachic.
Ser. II, 29 (2): 157-166

31 dicembre 1997

D.J. WILLIAMS, G. PELLIZZARI

Two species of mealybugs (Homoptera Pseudococcidae) on the roots of Aloaceae in greenhouses in England and Italy

Abstract - Two species of mealybugs have been found recently on the roots of Aloaceae. One of them was described originally as *Ripersia speciosa* De Lotto from the Democratic Republic of Congo on the roots of *Coreopsis* sp.(Compositae). It now occurs under glass at the Royal Botanic Gardens, Kew, England, and at the Botanic Garden, Padua, Italy. The species possesses hind tibiae with unusual translucent pores and cannot be placed in any known genus. A new genus, *Trochiscococcus* gen. n., is described for it. *Rhizoecus aloes* sp. n. is also described from material collected under glass at the Royal Botanic Gardens, Kew, England.

Riassunto - *Presenza in Inghilterra e in Italia di due specie di pseudococcidi (Homoptera Pseudococcidae) su radici di Aloacee in serra.*

Due specie di pseudococcidi sono state di recente raccolte da radici di Aloacee. Uno di questi, noto finora solo per la Repubblica Democratica del Congo su radici di *Coreopsis* sp. (Compositae), era stato in origine descritto come *Ripersia speciosa* De Lotto. Esso risulta ora presente nelle serre dei Royal Botanic Gardens di Kew (Inghilterra) e nell'Orto Botanico di Padova (Italia). Questa specie presenta sulle tibie posteriori pori translucidi particolari e non è ascrivibile ad alcun genere noto. Un genere nuovo, *Trochiscococcus* gen. n. viene qui descritto per inserirvi questa specie. *Rhizoecus aloes* sp. n. viene inoltre descritto da esemplari raccolti nelle serre dei Royal Botanic Gardens di Kew (Inghilterra).

Key words: Root mealybugs, greenhouses, Italy, England, Aloaceae, *Trochiscococcus* gen. n., *Trochiscococcus speciosus* (De Lotto), *Rhizoecus aloes* sp. n.

During the last few years, a striking species of mealybug has been found on the roots of Aloaceae under glass at the Botanic Garden of Padua, Italy, and at the Royal Botanic Gardens, Kew, England. It was described originally as *Ripersia speciosa* De Lotto by De Lotto (1961). In Padua, the mealybug infests *Aloe* sp., *Gasteria* sp. and

Haworthia sp. Despite this apparent preference for species of Aloaceae, the mealybug was collected originally on the roots of *Coreopsis* sp. (Compositae) in the Belgian Congo (now Democratic Republic of Congo).

The genus *Ripersia* Signoret has never been defined satisfactorily because the identity of the type species, *R. corynephori* Signoret, remains an unrecognizable taxon (Ben-Dov & Matile-Ferrero, 1995). When discussing the species included in *Ripersia*, Matile-Ferrero & Ben-Dov (1995) transferred *R. speciosa* to *Chorizococcus* McKenzie. The mealybug possesses unusual characters and is not congeneric with the type species of *Chorizococcus, C. wilkeyi* McKenzie, described from California, nor can it be assigned to any other genus. A new genus *Trochiscococcus* is described for it.

An undescribed species of *Rhizoecus* has also been collected under glass on the roots of *Aloe glauca* at the Royal Botanic Gardens, Kew, England, and the opportunity is taken here to describe it as *Rhizoecus aloes* sp. n.

The genus *Aloe* is mainly African in distribution, extending to the neighbouring area of Arabia. Many species are cultivated as ornamentals worldwide or for their medicinal properties. Mealybug species known to feed on aloes, catalogued by Ben-Dov (1994), are *Nipaecoccus nipae* (Maskell) on *Aloe ciliaris*, *Pseudococcus longispinus* (Targioni Tozzetti) on *A. arborescens, Rhizoecus dianthi* Green on *A. humilis, R. elongatus* Green on *A. variegata, R. pseudocacticans* Hambleton on *Aloe* sp., and *Trionymus myersi* McKenzie on *Aloe* sp. McKenzie (1967) also recorded *Chorizococcus lounsburyi* (Brain) (now *Vryburgia amaryllidis* (Bouché)) from California on *Aloe* sp., *Gasteria* sp. and *Haworthia* sp.

The two mealybug species under discussion may have been accidentally introduced on plants directly from Africa or on plants donated privately. Occasionally plants are exhibited on loan from other localities in the Botanic Garden at Padua and these plants may have been the source of infection there. Transportation of mealybugs on roots is a common cause of infestation worldwide because small species of mealybugs are often difficult to detect. In order to afford easy recognition of the two species discussed here, in case they are found elsewhere, they are described in detail and illustrated.

The terminology used in this work is the same as that in Williams & Granara de Willink (1992) and each illustration shows the dorsal surface on the left and the ventral surface on the right.

Rhizoecus aloes sp. n. (fig. 1)

Adult female on microscope slide elongate-oval, membranous, largest specimen 1.65 mm long, 0.85 mm wide; posterior end of body rounded or with poorly developed anal lobes each with 1 ventral apical seta about 75 μm long and 2 dorsal setae each about 70 μm long, forming a group of 3, accompanied by a small group of trilocular pores. Antennae each 145-150 μm long, with 6 segments; antennal bases placed fairly close together. Legs well developed; hind trochanter + femur 110-115 μm

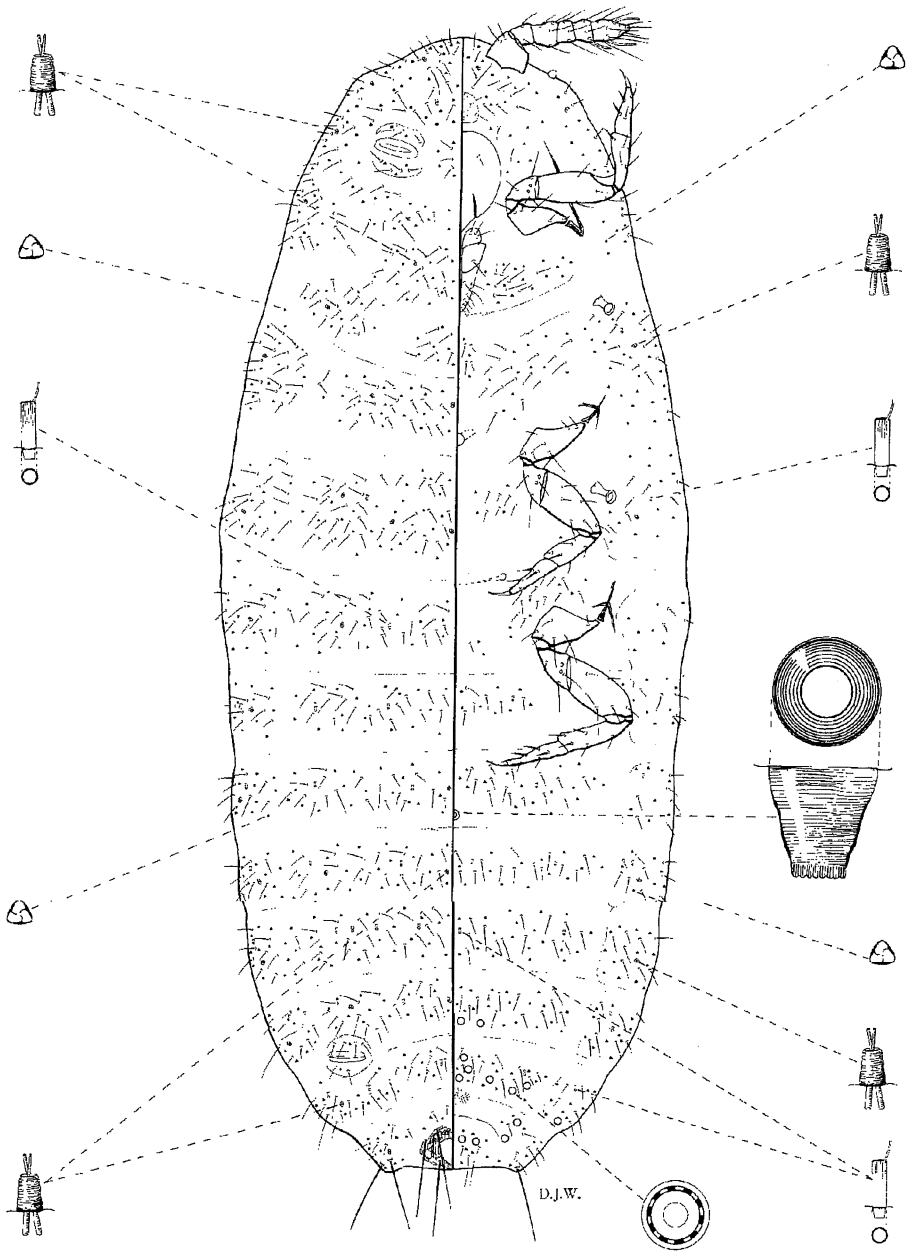

Fig.1 - *Rhizoecus aloes* sp. n. adult female.

long, hind tibia + tarsus 115-125 μm long, claw slender about 20 μm long, with a pair of clavate digitules about same length as claw. Ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.04-1.10. Ratio of lengths of hind tibia to tarsus 1.08-1.18. Setae on inner distal end of tibia and on inner edge of tarsus stouter than others. Labium 160-170 μm long, about same length as clypeolabral shield. Eyes protuberant. Circulus present near posterior edge of abdominal segment III but within borders of segment, 10-12.5 μm wide at base, truncate-conical, about same length as basal diameter, distal surface difficult to determine but as shown in profile probably faveolate. Ostioles present, each lip with 2-4 setae and a few trilocular pores. Anal ring 52.5-55 μm wide, with 6 setae each 70-75 μm long and with conspicuous cells comprising an outer row of elongate cells and 2-3 inner rows of triangular cells, the innermost row lightly sclerotized. Cephalic plate triangular, weakly sclerotized, barely perceptible in most specimens.

Dorsal surface with slender flagellate setae, fairly numerous in bands across the segments but absent from wide intersegmental areas; some lateral setae about 45 μm long and some across posterior abdominal segments about 35 μm long but most others shorter, the shortest about 10 μm long. Multilocular disc pores absent. Trilocular pores evenly distributed among the setae. Bitubular pores present, each narrower than a trilocular pore and about 7.5 μm long, with narrow tubes, distal ends often touching to appear unitubular; occurring around margins, on midline of some segments and singly in submedial areas of most segments. Oral collar tubular ducts minute, each narrower than a trilocular pore, not numerous, arranged in more or less single rows across abdominal segments.

Ventral surface with similar setae to those on dorsum. Multilocular disc pores, each about 7.5 μm in diameter, present medially on abdominal segment VI, across abdominal segment VII to margin and a few situated between positions of anal lobes. Trilocular pores distributed among setae. Oral collar tubular ducts minute, as on dorsum, few, situated mainly across middle of abdominal segments; 1 or 2 present also next to spiracles. Bitubular pores, same as on dorsum, few, distributed around margin.

HOLOTYPE. Adult female, England, Surrey, Royal Botanic Gardens, under glass, on roots of *Aloe glauca*, J. Keesing, 5.XII.1995, The Natural History Museum, London (BMNH).

PARATYPES. England, same data as holotype. 2 adult females, The Natural History Museum, London; 2 adult females, Istituto Entomologia Agraria, Università di Padova, Italy; 1 adult female, Muséum National d'Histoire Naturelle, Paris, France; 1 adult female, National Museum of Natural History, Entomological Collection, Beltsville, Maryland, USA (USNM).

COMMENTS. In this species, the 2 tubes of the bitubular pores projecting beyond the derm are often closely appressed to appear unitubular. Similar pores are present in *Rhizoecus geniculatus* James, described from Kenya and redescribed by De Lotto (1957) who discussed the pores as unitubular. These pores are very small and were mentioned by Hambleton (1946, 1974) who revealed their true structure. *R. genicu-*

latus differs from *R. aloes* in possessing dorsal multilocular disc pores on the abdomen and in the shape of the inner tibial and tarsal setae which are more slender. *R. aloes* also comes close to *R. graminicola* James, described from Kenya, but the latter species has many multilocular disc pores covering the dorsum and venter, whereas in *R. aloes* they are restricted to the area around the vulva.

The new species is also related to *R. palestinae* (Hambleton) in possessing similar bitubular pores but the latter species lacks multilocular disc pores. The first record of *R. palestinae* was from material intercepted in the USA from Palestine without locality. It has been intercepted since in the USA many times from the same area (Hambleton, 1979) and may be found eventually in Israel and neighbouring countries of the Middle East. The country of origin of *R. aloes* will probably be somewhere in Africa or the Middle East.

Although species with bitubular pores have often been referred to *Ripersiella* Tinsley, and those with tritubular pores to *Rhizoecus* Künckel d'Herculais, there are species described in *Rhizoecus* without either type of duct. The present species is included in *Rhizoecus* following Hambleton (1974) who synonymised the name *Ripersiella* with *Rhizoecus*. This action has been followed since by most workers.

The epithet is the Latin genitive singular of the plant generic name *Aloe*, meaning of or from aloes.

Trochiscococcus gen. n.

Type species *Ripersia speciosa* De Lotto

Body of adult female on microscope slide broadly oval, anal lobes moderately developed. Antennae 6- or 7-segmented. Legs well developed; hind tibiae each with unusually large translucent pores; claws without denticles. Ostioles present. Circulus present. Anal ring normal, with 2 rows of cells and 6 setae. Cerarii present numbering 3-6 pairs on last few abdominal segments only; anal lobe cerarii each with 4-6 conical setae, auxiliary setae and trilocular pores; cerarii on segments VI and VII similar, often divided; anterior cerarii sometimes represented by single conical setae.

Dorsal and ventral setae flagellate, some stout. Trilocular pores present. Multilocular disc pores present on venter of abdomen. Oral rim tubular ducts absent. Oral collar tubular ducts of 2 distinct sizes. An unusually large type, wider than a multilocular disc pore, present on dorsum and venter. A small type situated on venter of abdomen.

COMMENTS. This genus is created because the translucent pores on the hind tibiae are uncommonly large and cupped with heavily sclerotized rims, unlike others in the family Pseudococcidae (except in one species discussed below). Furthermore, the reduced number of cerarii, at least 3 pairs of which have a few conical setae, and the extremely large tubular ducts, form a combination of characters different from that in any other genus.

In *Chorizococcus*, the anal lobe cerarii and any anterior cerarii on abdominal segments VI and VII each possess only 2 conical setae. *Trochiscococcus* differs in possessing cerarii each with groups of 4-6 conical setae.

Chaetotrionymus Williams, an Australian genus, is close to *Trochiscococcus* in having long and robust dorsal setae, and one species, *C. murnpeowiensis* Williams, even has large oral collar ducts but the cerarii are restricted to the anal lobes and each contains only a pair of conical setae. *Maculicoccus* Williams, known from the tropical Pacific region, is similar in general appearance to *Trochiscococcus* in the stout dorsal setae and cerarii each with a few conical setae but lacks the large ducts and the peculiar translucent pores on the hind tibiae although small, normal translucent pores are present. Besides, the venter of the thorax and anterior abdominal segments in *Maculicoccus* is densely covered in discoidal pores, each with a granular surface.

The large translucent pores described here on the hind tibia of *Trochiscococcus* resemble the scent plaques of some mating females in the Aphidoidea. These scent plaques are known to emit sex pheremones (Pettersson 1970, 1971) and the large-rimmed translucent pores of *Trochiscococcus* probably have a similar function although, at present, there is no evidence for this and no adult males have been discovered in the type species.

Paracoccus limuricus (De Lotto), described from Kenya on *Coffea arabica*, is the only other species known to the authors with similar translucent pores on the hind tibiae. De Lotto (1964) transferred this species to *Paracoccus* Ezzat & McConnell, a genus possessing anal lobe bars, but commented that some African species, including *P. limuricus*, lacked anal lobe bars completely. A small, faint anal lobe bar is visible on each lobe of the holotype of *P. limuricus* and the present assignment of the species appears to be correct. *Paracoccus*, however, bears no relationship to *Trochiscococcus*.

The name *Trochiscococcus* is based on the Greek word `Trochiscos' meaning a small wheel or circle, combined with the generic name *Coccus*, referring to the conspicuous and thick-rimmed translucent pores.

Trochiscococcus speciosus (De Lotto) (fig. 2)

Ripersia speciosa De Lotto, 1961: 229. Holotype female, Belgian Congo [Peoples Republic of Congo], Nyatja, on roots of *Coreopsis* sp., The Natural History Museum, London [examined].

Chorizococcus speciosus (De Lotto), Matile-Ferrero & Ben-Dov, 1995: 258.

In life, body light yellow, covered with a powdery white waxy secretion, with 2 or 3 pairs of short, broad waxy filaments at posterior end of body, the caudal pair longer (fig. 3). Adult female on microscope slide broadly oval, membranous, 1.78-3.10 mm long, 0.97-2.40 mm wide, widest at about abdominal segment II; anal lobes moderately developed, each with a stout apical seta 200-210 µm long. Antennae each 350-

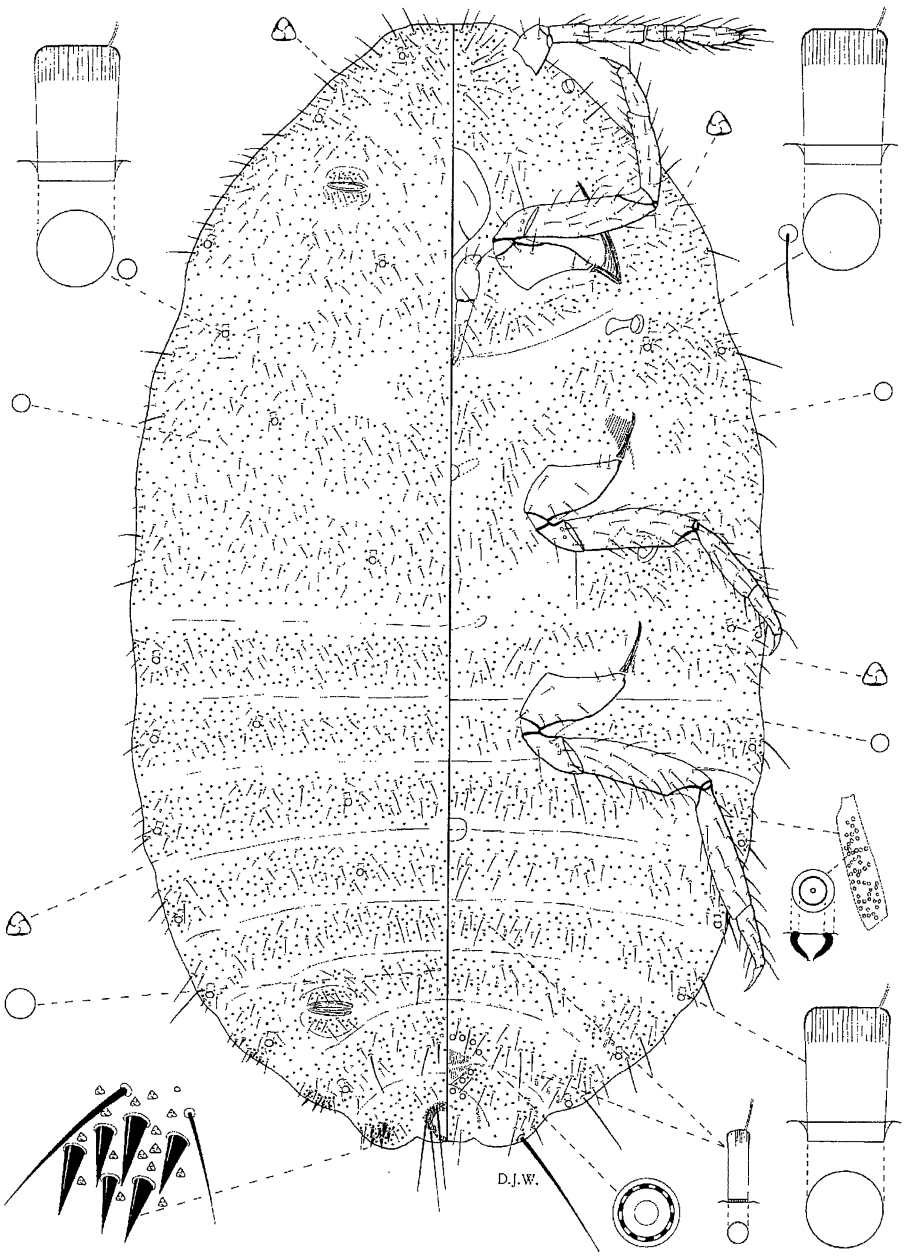

Fig. 2 - *Trochiscococcus speciosus* (De Lotto) adult female.

400 μm long, usually with 6 segments, the third longest; occasionally with 7 segments when third segment divided. Legs well developed; hind trochanter + femur 280-300 μm long, hind tibia + tarsus 300-320 μm long, claw only moderately stout, about 42.5 μm long. Ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.03-1.14. Ratio of lengths of hind tibia to tarsus 1.90-2.33. Translucent pores present on posterior surface of hind tibia only, these well developed, conspicuous, with stout rims each 5-6.25 μm in diameter, cupped, numbering 30-90 but often 50 at least present. Labium 160-170 μm long, about same length as clypeolabral shield. Circulus present between abdominal segments III and IV, oval to quadrate, 55-75 μm wide, divided by faint intersegmental line. Ostioles well developed, each with inner edges of lips moderately sclerotized, each lip usually with about 6 short setae and a group of trilocular pores. Anal ring about 80 μm wide, with 6 setae each 122-125 μm long. Cerarii usually numbering 4 pairs but sometimes as many as 6 present on posterior segments of abdomen only. Anal lobe cerarii each normally with 6 conical setae but occasionally with as few as 4, the largest about 25 μm long, the shortest about 15 μm long, accompanied by 3-5 auxiliary setae and a group of trilocular pores, all on a membranous area. Penultimate cerarii each often divided into 2 groups, an anterior group of 2 or 3 conical setae and a posterior group of 2-4 conical setae. Cerarii on abdominal segment VI usually similar; anterior cerarii, when present, each with 1 or 2 conical setae.

Dorsal surface with flagellate setae, some stout on posterior abdominal segments and around margin, often about 85 μm long; others of various sizes, shorter, the shortest slender, about 10 μm long. Multilocular disc pores absent. Trilocular pores present, fairly numerous, evenly distributed. Discoidal pores of 2 distinct types. A large type, each about 5 μm in diameter, larger than a trilocular pore, forming groups on midline of abdominal segments VI and VII. Other discoidal pores scattered, each smaller than a trilocular pore. Oral collar tubular ducts of an unusual large size, conspicuous, each about 17.5 μm long and 10 μm wide, often with 1 or 2 setae and a small discoidal pore near orifice, present singly on each segment around margin; a few situated on submargins and submedially on thorax and abdomen.

Ventral surface with similar setae to those on dorsum but the longest not so stout. Multilocular disc pores, each about 7.5 μm in diameter, present around vulva only, numbering 9-15. Trilocular pores in an even distribution. Discoidal pores scattered, similar to the small type on dorsum. Oral collar tubular ducts present of 2 sizes. A large type, same as those on dorsum, few, placed mainly around margin of thorax and abdomen. A small type, each narrower than a trilocular pore and about as long as diameter of a multilocular disc pore, present in small groups between anal lobes and on margins as far forward as abdominal segment V; others present in single rows across medial areas of abdominal segments V and VI and sometimes on segment IV.

HABITAT AND HOST PLANTS. Democratic Republic of Congo, Nyatja, on roots of *Coreopsis* sp., 1941. England, Kew, Royal Botanic Gardens, under glass, on roots of *Aloe excelsa*, J. Keesing, 5.XII.1995; base of stem and roots of *Haworthia* sp., P. Griffiths, 29.VII.1997. Italy, Padua, Botanic Garden, on roots of *Aloe* sp., on roots of *Gasteria* sp.; on roots of *Haworthia* sp., G. Pellizzari, 22.II.1990, 14.III.1994

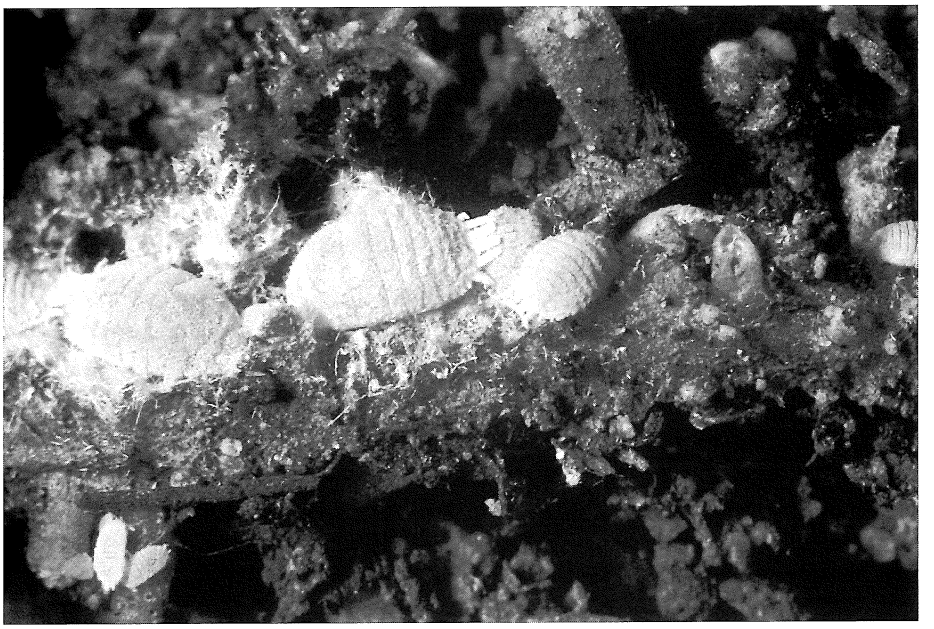

Fig. 3 - Adult female and nymphs of *Trochiscococcus speciosus* (De Lotto) feeding on roots of *Haworthia* sp. (Aloaceae).

ACKNOWLEDGMENTS

Dr C. Malumphy, Central Science Laboratory, Sand Hutton, York, England, sent all the material collected at the Royal Botanic Gardens, Kew, and has taken a keen interest in this study.

REFERENCES

BEN-DOV Y., 1994 - A Systematic Catalogue of the Mealybugs of the World. - Intercept Ltd, Andover: 1-686.

BEN-DOV Y., MATILE-FERRERO D., 1995 - The identity of the mealybug taxa described by V.A. Signoret (Homoptera, Coccoidea, Pseudococcidae). - Bull. Soc. ent. Fr. 100: 241-256.

DE LOTTO G., 1957 - The Pseudococcidae (Hom.: Coccoidea) described by H.C. James from East Africa. - Bull. Brit. Mus. (Nat. Hist.) Ent. 5: 183-232.

DE LOTTO G., 1961 - New Pseudococcidae (Homoptera: Coccoidea) from Africa. - Bull. Brit. Mus. (Nat. Hist.) Ent. 10: 209-238.

DE LOTTO G. 1964 - Observations on African mealy bugs (Hemiptera: Coccoidea). Bull. Brit. Mus. (Nat. Hist.) Ent. 14: 341-397.

HAMBLETON E.J., 1946 - Studies of hypogeic mealybugs. - Rev. de Ent. 17: 1-77.

HAMBLETON E.J., 1974 - Three new species of *Rhizoecus* (Homoptera: Pseudococcidae) from New Zealand, with notes and redescription of others. - New Zealand. J. Zool. 1: 147-158.

HAMBLETON E.J., 1979 - New information on the *Rhizoecus* of Florida including descriptions of four new species. - Florida Entomol. 62: 140-149.

MATILE-FERRERO D., BEN-DOV Y., 1995 - *Ripersia* Signoret: taxonomic and nomenclatural changes to settle its status (Homoptera, Coccoidea, Pseudococcidae). - Bull. Soc. ent. Fr. 100: 257-260.

MCKENZIE H.L., 1967 - Mealybugs of California with taxonomy, biology and control of North American species (Homoptera: Coccoidea: Pseudococcidae). University of California Press, Berkeley and Los Angeles: 1-526.

PETTERSSON J., 1970 - An aphid sex attractant I. Biological studies. - Ent. Scand. 1: 63-73.

PETTERSSON J., 1971 - An aphid sex attractant II. Histological, ethological and comparative studies. - Ent. Scand. 2: 81-93.

WILLIAMS D.J., GRANARA DE WILLINK M.C., 1992 - Mealybugs of Central and South America. - CAB International, Wallingford, University Press, Cambridge: 1-635.

DR. D.J. WILLIAMS - Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, UK.

PROF. GIUSEPPINA PELLIZZARI - Istituto di Entomologia agraria, Università degli Studi di Padova, Agripolis, via Romea 16, I-35020 Legnaro (Padova), Italy.

Accepted 2 December 1997.