

# The *Aphytis* fauna of the Afrotropical region

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## Introduction

Our biosystematic knowledge of the genus *Aphytis* Howard in the Afrotropical region is still very limited, although more is probably known from this realm, and more specifically the Southern African subregion, than from most other parts of the world. In this respect, about one-third of all described species of *Aphytis* in the world are known from southern Africa, where the fauna has been subject to ongoing taxonomic research on the Aphelinidae for many years. This has resulted in a fairly accurate picture of the species and their host associations in the area, providing some insight into the true nature and extent of the fauna of at least part of the Afrotropical region.

In all, 41 species, including six deliberately introduced and six undescribed ones, are recorded here from the Afrotropical region. The taxonomy of the fauna of the region dates back to 1915, with the description of *A. erythraeus* by Silvestri from Ethiopia. Subsequent studies on the fauna are attributed almost exclusively to Compere (1955), Quednau (1964), and most recently to Rosen and DeBach (1979) who included the Afrotropical species in their detailed account of the world fauna.

Nothing has been published on the Afrotropical species since the abovementioned study by Rosen and DeBach. The present study is an overview of the fauna from the region, aimed at summarizing and updating our knowledge of the species of *Aphytis* from the area. It includes, *inter alia*, parasitoid-host lists with new records from the region, the description of two new species and notes on six undescribed species, and comments on habitat and host preferences, endemism and distributional trends of the fauna. Based on our knowledge of the southern African fauna, certain extrapolations regarding the occurrence of the genus in the region have also been made. In addition, the position of the genus *Aphytis* is discussed in relation to other

Afrotropical aphelinid genera, and a key is provided for its separation from those genera from the region that are also associated with diaspidid scale insects.

Unpublished data presented here are based on material and information in the National Collection of Insects, Pretoria; the type-material of the two new species is in the same institution.

### The Afrotropical aphelinid genera, species of which are parasitic on Diaspididae

The Aphelinidae is represented in the Afrotropical region by 19 of the 42 known genera and 185 of the more or less 900 described species that have been attributed to this chalcidoid family. The majority of the Afrotropical genera are rather poorly known from the region and are represented by less than 10 described species each, as shown in Table 1. Only four genera, namely *Aphytis*, *Coccophagus*, *Encarsia* and *Pteroptrix* contain more than 10 described species each. Collectively, these genera, the species of which are predominantly parasitic on scale insects, comprise about 70% of the known Afrotropical aphelinid genera. Undoubtedly, further taxonomic study will show that many of these genera, and especially those containing species that are primary parasitoids of sternorrhynchus Homoptera, are far more species rich in the region than present figures (Table 1) show.

**Table 1.** List of aphelinid genera, and the number of described species in each, that have been recorded from the Afrotropical region; genera that contain species which are either primary or secondary parasitoids of diaspidid scale insects are marked with an asterisk

Genus	Number of species	Genus	Number of species
<i>Ablerus</i> Howard*	1	<i>Eunotiscus</i> Compere	2
<i>Aphelinus</i> Dalman	5	<i>Euryischia</i> Riley	1
<i>Aphytis</i> Howard*	35	<i>Euxanthellus</i> Silvestri	3
<i>Azotus</i> Howard*	8	<i>Lounsburyia</i> Compere and Annecke	2
<i>Centrodora</i> Foerster	3	<i>Marietta</i> Motschulsky*	8
<i>Coccobius</i> Ratzeburg*	8	<i>Promuscidea</i> Girault	1
<i>Coccophagus</i> Westwood	65	<i>Pteroptrix</i> Westwood*	18
<i>Coccophagoides</i> Girault*	1	<i>Samariola</i> Hayat	1
<i>Encarsia</i> Foerster*	16	<i>Verekia</i> Risbec	1
<i>Eretmocerus</i> Haldeman	6		

Of the 19 Afrotropical genera, eight contain species that are associated with diaspidid scale insects, either as primary or secondary parasitoids, as indicated in Table 1. Amongst the five genera that contain primary parasitic species, *Aphytis* is unique in that its species are ectoparasitic in nature, not endoparasitic. The eight genera, as represented by the Afrotropical fauna, can be separated by the key provided below and include *Ablerus*, *Aphytis*, *Azotus*, *Encarsia*, *Coccobius*, *Coccophagoides*, *Marietta* and *Pteroptrix*.

Although these eight genera are exclusively or partly associated with Diaspididae,

they do not form a natural group and are, with the exception of *Marietta*, not phylogenetically closely related to *Aphytis*. The relationships of *Aphytis* have been dealt with in detail by Rosen and DeBach (1979, 1990) and need no further attention here. It will suffice to mention that those genera regarded as being most closely related to *Aphytis* include *Centrodora* Foerster, *Debachiella* Gordh & Rosen (regarded as a synonym of *Centrodora* by some authors), *Marietta* Motschulsky, *Marlattiella* Howard and *Proaphelinoides* Girault. These genera, of which only *Marietta* and *Centrodora* have been recorded from the Afrotropical region, can be separated by the keys provided by Rosen and DeBach (1979, 1990).

**Key to the Afrotropical genera of Aphelinidae, species of which are primary or secondary parasitoids of Diaspididae.**

**Males and Females**

1. All tarsi 4-segmented .....  
*Pteroptrix* Westwood  
 Antenna 7- or 8-segmented, the funicle with 2 or 3 segments, the club 3-segmented, longer than the funicle; fore wing infuscated below marginal vein, the marginal fringe ranging from short to long. Primary endoparasitoids of Diaspididae, with males of some species being hyperparasitoids.  
 All tarsi 5-segmented, or fore and hind tarsi 5-segmented and middle tarsi 4-segmented ..... 2
2. Antenna with 4–6 segments; disc of fore wing with a distinct linea calva ..... 3  
 Antenna with 7–8 segments; fore wing without a linea calva ..... 4
3. Propodeum medially subequal in length to the metanotum, the hind margin without crenulae ..... *Marietta* Motschulsky  
 Antenna 6-segmented in female, 5- or 6-segmented in male; fore wing with hyaline and infuscated patches lending it a mottled or banded appearance, or wing rarely entirely infuscated; body and legs usually distinctly mottled. Ectophagous hyperparasitoids on various coccoid species, including diaspidids.  
 Propodeum medially distinctly longer than the metanotum, the hind margin crenulate except in *A. acrenulatus* and *A. faurei*, in which the crenulae are barely or not discernible ..... *Aphytis* Howard  
 Antenna usually 6-segmented in both sexes, the funicle with 3 segments, the club not segmented; antenna rarely 4 or 5-segmented, in which case the funicle has 1 or 2 segments respectively; fore wing usually hyaline, rarely at most faintly infuscated in part; body most often largely yellowish, the legs not mottled or banded (species with mottled wings and legs known in extra-limital fauna). Exclusively primary ectoparasitic on Diaspididae.
4. Submarginal vein of fore wing with 1 or 2 setae ..... 5  
 Submarginal vein with 3 or more setae ..... 7
5. Antenna with 7 segments; either body entirely black or forewing infuscated from base to near apex, the latter broadly hyaline ..... 6  
 Antenna usually 8-segmented or, if rarely 7-segmented (some males), then

neither body entirely black nor fore wing infuscated as above .....

..... *Encarsia* Foerster

Usually yellowish or yellow and brown species; antenna with number of funicle and club segments variable; scutellum with 2 pairs of setae; fore wing hyaline or infuscated. Mostly primary endoparasitoids of aleurodids and diaspidids, although species are known in which males develop as secondary parasitoids.

6. Fore wing usually with characteristic infuscated patches or bands, rarely entirely hyaline, the discal setae often coarse and arranged in groups, or wing disc densely and largely setose .....

*Azotus* Howard

Black species, sometimes with a metallic tinge in part, the antennae often bicolorous; fore wing with long marginal fringe; stigmal vein less than half as long as the marginal vein; ovipositor strongly exerted. Parasitic in various coccoid species, most of which are diaspidids; extra-limital species known to be both primary and secondary parasitoids.

Fore wing evenly infuscated from near base to near apex, the latter broadly hyaline, the disc very sparsely and unevenly setose .....

*Alerus* Howard

Blackish-brown species; fore wing with long marginal fringe; stigmal vein long, almost as long as the marginal vein; ovipositor strongly exerted. Local species reared from diaspidids and aleurodids; extra-limital species are hyperparasitic in aleurodids, species of Coccoidea, and also non-homopterous insects.

7. Axillae projecting strongly forward so that the larger part of each axilla is placed beyond the level of the anterior margin of the scutellum; marginal vein of fore wing relatively short, not longer than half the length of the costal cell; antenna 8-segmented in both sexes .....

*Coccophagoides* Girault

Known from a single undetermined species; blackish-brown species; female antenna spindle-shaped; fore wing palely infuscated below the marginal vein, the marginal fringe short. Reared from Diaspididae; in extra-limital species females develop as internal primary parasitoids of Diaspididae and males as secondary parasitoids of their own species.

Axillae not projecting strongly forward, extending anteriorly only a little beyond the level of the anterior margin of the scutellum; marginal vein long, distinctly longer than half the length of the costal cell; female antenna 7-segmented, that of the male 8-segmented .....

*Coccobius* Ratzeburg

Often yellowish or yellowish and black species with bicolorous antennae; wings usually hyaline, rarely faintly yellowish. Exclusively parasitic in Diaspididae; in extra-limital species females develop as primary endoparasitoids, while males are internal or external hyperparasitoids of their own species or other parasitoids.

### The genus *Aphytis* in the Afrotropical region

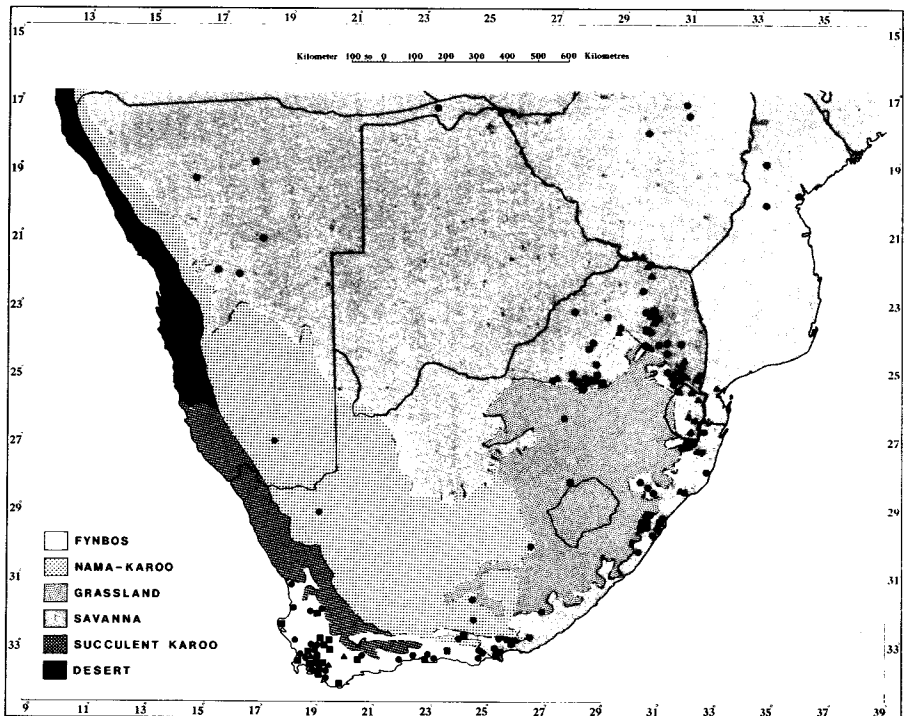
A total of 41 species, including six undescribed ones, are recorded here from this area, which includes Africa south of the Sahara, Madagascar, the Mascarene islands and a number of smaller islands along the east and west coasts of the African continent. The

Afrotropical fauna comprised by these 41 species can be divided into the following three faunal elements, and is dealt with accordingly below: (1) species that have been deliberately introduced into the area for purposes of biological control, (2) species that have probably been accidentally introduced, and (3) indigenous species.

#### *Deliberately introduced species*

Six species, namely *A. coheni*, *A. holoxanthus*, *A. lepidosaphes*, *A. lingnanensis*, *A. melinus* and *A. mytilaspidis* are represented by this element of the Afrotropical fauna. Information on the introduction of these species into the region is summarized in Table 2. Except for *A. mytilaspidis*, all of these species were introduced into South Africa for the control of diaspidid pests on citrus, and they were dealt with in this context most recently by Prinsloo (1984). Williams and Greathead (1990) provide further information on *A. mytilaspidis*, which was imported into the island of Mauritius for the control of *Aulacaspis tegalensis* on sugar cane.

**Occurrence.** The five southern African introductions were all imported to control their target hosts on citrus in the main citrus producing areas of the Transvaal, Natal and eastern Cape Provinces. *Aphytis holoxanthus*, *A. lepidosaphes* and *A. melinus* are known to have become well established. Since *A. lingnanensis* and *A. coheni* are for all practical reasons regarded as sibling species their status is uncertain, although it would seem that at least *A. lingnanensis* has become established.



**Figure 1.** Correlation between southern African biomes (according to Rutherford and Westfall (1986) with Forest biome omitted) and the known distribution of the genus *Aphytis* in the region; triangles = deliberately introduced species; squares = accidentally introduced species; circles = indigenous species.

**Table 2.** Species of *Aphytis* deliberately introduced into the Afrotropical region for the purpose of biological control of diaspidid scale insect pests

Species	Described from	Introduced from	Imported into	Target host
<i>A. coheni</i> DeBach	Israel	California, 1962-63	South Africa	<i>Aonidiella aurantii</i> (Maskell)
<i>A. holoxanthus</i> DeBach	Hong Kong	California, 1962-63	South Africa	<i>Chrysomphalus aonidum</i> (Linnaeus)
<i>A. lepidosaphes</i> Compere	China	California, 1966	South Africa	<i>Cornuaspis</i> (= <i>Lepidosaphes</i> ) <i>beckii</i> (Newman)
<i>A. lingnanensis</i> Compere	China	California, 1962-63	South Africa	<i>Aonidiella aurantii</i>
<i>A. melinus</i> DeBach	India and Pakistan	California, 1962-63	South Africa	<i>Aonidiella aurantii</i>
<i>A. mytilaspidis</i> (Le Baron)	USA	Java, 1975	Mauritius	<i>Aulacaspis tegalensis</i> (Zehntner)

The collective distribution of this complex of introduced species (Figure 1) includes areas which fall within the Fynbos and Savanna biomes of southern Africa, as is the case with the other two *Aphytis* faunal element of the subregion (see section on habitat preference of the indigenous southern African fauna below).

It is not known whether any of these five species have spread naturally from South Africa to other areas in the Afrotropical region. However, given the wide distribution of their preferred hosts in Africa, the long post-introduction period that has elapsed, and the proven ability of *A. melinus*, *A. lingnanensis* and *A. lepidosaphes* to disperse in other parts of the world (DeBach, 1971; Rosen and DeBach, 1979), it is likely that at least some of these species now occur in areas to the north of South Africa.

Two of the species listed under this faunal element, namely *A. lingnanensis* and *A. mytilaspidis* are, paradoxically, also listed as accidentally introduced species below. In this respect, *A. lingnanensis* has been reported from the island of Mauritius in association with sugar cane, but its presence on the island is obviously not due to natural spread of the material that was introduced into South Africa. As for *A. mytilaspidis*, this species is also known from South Africa, but its presence in this area cannot be attributed to the spread of this species from Mauritius, since its deliberate introduction into the island took place after its discovery in South Africa in 1966.

*Host preference.* Extensive surveying of the *Aphytis* fauna over many years has shown that the five species that were deliberately introduced into South Africa are largely restricted in their host preference to their target species in this area. This is to be expected in the case of *A. holoxanthus* and *A. lepidosaphes*, which are known to be rather host specific, also in other parts of the world. On the other hand, the other three species, and especially *A. melinus* and *A. lingnanensis*, have been recorded from a fairly wide range of hosts (see Rosen and DeBach, 1979) in various parts of the world. Many of these hosts also occur in South Africa, mostly in the same areas where the introduced species of *Aphytis* have become established. Yet, except for one record of *A. lingnanensis* from *Insulaspis* (= *Lepidosaphes*) *gloverii* (Packard), there are no reports of parasitism of such diaspids by these species of *Aphytis* since their introduction some 30 years ago. Likewise, despite the potentially oligophagous nature of some, there is no evidence of any introduced species of *Aphytis* having adopted any indigenous diaspidid species as their host.

No additional information is available on the host associations of *A. mytilaspidis* in Mauritius. It should be noted that *A. mytilaspidis* is an Holarctic species, while it is not otherwise known to be parasitic on *Aulacaspis tegalensis*. This host, its association with sugar cane, and the tropical (Javanese) origin of the introduced material, place uncertainty on the identity of the species from Mauritius presently regarded as being *A. mytilaspidis*.

#### *Accidentally introduced species*

This element of the Afrotropical *Aphytis* fauna includes seven species that are most probably not indigenous to the region but which have spread naturally into the region or, more likely, have been accidentally introduced with their hosts by man

**Table 3.** Species of *Aphytis* believed to have been accidentally introduced into the Afrotropical region; endemic southern African diaspidid hosts are marked with an asterisk

Species	Possible origin	Afrotropical distribution	Afrotropical diaspidid hosts
<i>A. chilensis</i> Howard	Oriental region	South Africa	<i>Aspidiotus nerii</i> Bouché <i>Hemiberlesia rapax</i> (Comstock) * <i>Rolaspis</i> ? <i>incisa</i> Munting <i>Quadraspidotus perniciosus</i> (Comstock) <i>Anidiella aurantii</i> (Maskell) <i>Aspidiotus nerii</i> * <i>Fulaspis mazoensis</i> (Hall) <i>Temnaspidotus</i> (= <i>Aspidiotus</i> ) <i>destructor</i> (Signoret) ? <i>Chrysomphalus aonidum</i> (Linnaeus) * <i>Aonidia mesembryanthemi</i> Brain <i>Anidiella aurantii</i> <i>Aspidiotus nerii</i> <i>Chrysomphalus aonidum</i> * <i>Duplacionaspis sansevieriae</i> Williams * <i>Entaspidotus lounsburyi</i> (Marlatt) <i>Parlatoria pittospori</i> Maskell <i>Pseudaulacaspis pentagona</i> (Targioni Tozzetti) <i>Quadraspidotus perniciosus</i> <i>Aulacaspis rosae</i> (Bouché) <i>Aulacaspis tubercularis</i> (Newstead) <i>Aulacaspis tegalensis</i> (Zehntner) <i>Quadraspidotus perniciosus</i>
<i>A. chrysomphali</i> (Mercet)	Mediterranean basin	South Africa Mauritius	
<i>A. comperei</i> DeBach & Rosen <i>A. diaspidis</i> (Howard)	Oriental region Uncertain	South Africa South Africa Ethiopia Madagascar Reunion Mauritius	
<i>A. hispanicus</i> (Mercet) <i>A. lingnanensis</i> Compere <i>A. mytilaspidis</i> (Le Baron)	southern Palearctic Oriental region Europe	South Africa Mauritius South Africa	



(ecesis). That the occurrence of these species in the region can probably be attributed to accidental introduction induced by man, rather than to natural spread, is indicated by the fact that most of their hosts are mainly widespread exotic pests of cultivated plants.

*Occurrence.* The seven species in this category are *A. chilensis*, *A. comperei*, *A. diaspidis*, *A. chrysomphali*, *A. hispanicus*, *A. lingnanensis* and *A. mytilaspidis*. Of these, *A. mytilaspidis* and *A. lingnanensis* have also been listed as deliberately introduced species in a different context, as explained above.

Information on the possible origins of some of these species is provided by DeBach (1971) and Rosen and DeBach (1979) and summarized, together with the Afrotropical countries from where these species are known, in Table 3. As in the case of those species that have been deliberately introduced, the seven species are probably far more widely distributed in the Afrotropical region than is presently known. This assumption is based on the fact that most of their recorded exotic hosts are widespread within the region, and that at least three of these species are now known to develop on indigenous diaspidids, which widens their choice of hosts and therefore probably their range of distribution.

As for the occurrence of species of this faunal element in the Southern African subregion (Figure 1), their distribution is restricted to the Fynbos and Savanna biomes, and not correlated with the overall distribution of their hosts, which are far more widespread in the area. This reiterates the important role of environmental factors such as climate and vegetation in regulating the occurrence of these parasitoids (see section on habitat preference of the indigenous southern African fauna below).

*Host preference.* The recorded hosts of the seven species are listed in Table 3. Unlike the deliberately introduced species, those that have been accidentally introduced tend to be oligophagous in their Afrotropical environment and, in the case of *A. chrysomphali*, *A. diaspidis* and *A. chilensis*, they have been recorded from a variety of different hosts. Evidently, the latter three species have also adopted indigenous diaspidids as their hosts, as indicated by the five endemic southern African diaspidids listed in Table 3.

### *The indigenous Aphytis fauna*

*Species composition.* The 22 previously described indigenous Afrotropical species of *Aphytis*, together with their species groups, as defined by Rosen and DeBach (1979), are listed in Table 4. Also included are two species which are here described as new, in addition to a further six probably undescribed ones.

The systematics of all the Afrotropical species described to date were dealt with in detail by Rosen and DeBach (1979) and, for the purpose of this article, does not need any further mention. Much of the information that has subsequently become available on some of these species pertains to new locality and country records (the latter included in Table 4), as well as new host records, which are included in Table 6. The two new species are described, and the six undescribed ones noted, in a separate section below.

**Table 4.** List of the indigenous Afrotropical species of the genus *Aphytis*, the species groups to which they belong, and their known distribution

Species	Species group	Distribution
<i>acrenulatus</i> DeBach & Rosen	unplaced	Mauritius
<i>anneckeii</i> DeBach & Rosen	<b>chrysomphali</b>	South Africa, Kenya
<i>africanus</i> Quednau	<b>lingnanensis</b>	South Africa, Zimbabwe, Mozambique
<i>bedfordi</i> Rosen & DeBach	unplaced	South Africa
<i>capensis</i> DeBach & Rosen	unplaced	South Africa
<i>cercinus</i> Compere	<b>chilensis</b>	South Africa, Namibia
<i>confusus</i> DeBach & Rosen	<b>proclia</b>	South Africa
<i>erythraeus</i> (Silvestri)	unplaced	Ethiopia, South Africa
<i>equatorialis</i> Rosen & DeBach	<b>lingnanensis</b>	Ivory Coast, South Africa
nr. <i>equatorialis</i>	<b>lingnanensis</b>	Cameroun
<i>faurei</i> Annecke	<b>chilensis</b>	South Africa
<i>funicularis</i> Compere	<b>funicularis</b>	South Africa
<i>griseus</i> Quednau	unplaced	South Africa
<i>merceri</i> Compere	<b>chilensis</b>	South Africa
<i>mimosae</i> DeBach & Rosen	unplaced	South Africa, Ethiopia
<i>pilosus</i> DeBach & Rosen	unplaced	South Africa
nr. <i>proclia</i> (Walker)	<b>proclia</b>	South Africa
<i>rolaspidis</i> DeBach & Rosen	unplaced	South Africa
<i>roseni</i> DeBach & Gordh	unplaced	Kenya, Uganda (Peru, introduced)
<i>secundus</i> (Compere)	unplaced	Ethiopia
<i>setosus</i> DeBach & Rosen	unplaced	South Africa
<i>taylori</i> Quednau	unplaced	South Africa
<i>aberrans</i> spec. nov.	unplaced	Uganda
<i>vastus</i> spec. nov.	<b>chrysomphali</b>	Namibia
sp. 1	<b>funicularis</b>	South Africa
sp. 2	<b>chilensis</b>	Uganda
sp. 3	<b>mytilaspidis</b>	South Africa
sp. 4	unplaced	South Africa
sp. 5	unplaced	Namibia
sp. 6	unplaced	South Africa

*Host relations.* The Afrotropical region has a rich diaspidid fauna which, apart from the Palaearctic and Oriental realms, contains more species than any of the other major zoogeographical regions of the world. Some 370 species have been recorded from the Afrotropical region (Kozar, 1990), which comprise about 175 genera (I.M. Millar, personal communication). Based on the classificatory system proposed by Ben-Dov (1990), these Afrotropical taxa are represented by all the known diaspidid tribes, namely the Diaspidini, Aspidiotini, Parlatoriini, Leucaspidini, Odonaspidini and Rugaspidotini, with the vast majority of the Afrotropical diaspidid genera belonging to the first two mentioned tribes.

This rich diaspidid fauna is one indication that the Afrotropical region probably hosts a far richer *Aphytis* fauna than is presently known. On the other hand, based on our knowledge of the southern African fauna it would appear that a significant proportion of diaspidid taxa from Africa, or at least those known from the Southern subregion, do not act as hosts for species of *Aphytis*. In this subregion, where the diaspidid host/parasite faunas have been extensively sampled and well studied, only

33 of the more or less 270 known species of Diaspididae have been recorded as hosts of the indigenous *Aphytis* fauna. Similarly, these diaspidid host species are represented by only 23 of the 100 genera known from the area. As for the Afrotropical region as a whole, the indigenous species of *Aphytis* are known to attack only 36 species in 26 genera from the totals mentioned in the first paragraph.

*Preference of host genera.* Although parasitoids do not necessarily respond to the systematic position of hosts (see Rosen and DeBach, 1977) an analysis of the genera to which the hosts of the indigenous *Aphytis* species belong does show certain trends regarding host preference at this taxonomic level.

The indigenous species of *Aphytis* seem to prefer host genera that belong to the tribes Aspidiotini and Diaspidini, each of which contain roughly 50% of these Afrotropical host genera. Not a single recorded host genus belongs to the other four tribes. This is perhaps not surprising, since these are the smallest of tribes (Ben-Dov, 1990), which are not as well represented in the Afrotropical region as in other areas of the world.

Within the Aspidiotini and Diaspidini, the indigenous species of *Aphytis* seem to prefer hosts that belong to very widespread genera. Only five of the recorded host genera appear to be restricted in their distribution to the Afrotropical region, of which *Rolaspis*, *Paraselenaspis*, *Entaspidiotus* and *Spinaspidotus* are widespread in the area, whereas *Separaspis* occurs in southern Africa. The remaining 21 host genera (see Table 5) are all more widely distributed and represented in one or more zoogeographical regions, in addition to the Afrotropical region. In temperate Africa (which includes southern Africa) there are some 11 genera (Kozar, 1990) which are found only in this part of the world. Apart from *Separaspis*, we are not aware of any other endemic genus that has been recorded as a host genus of *Aphytis*. As for the other subregions of the Afrotropical region, there are 17 genera in tropical Africa and 20 in Madagascar (Kozar, 1990) which occur in these areas only, none of which are known to contain species that are parasitized by a species of *Aphytis*.

**Table 5.** Afrotropical genera of Diaspididae, species of which are known to be hosts of *Aphytis*; names in italics are genera probably restricted to the region, the remaining names those of genera with wider distributions; genera marked with an asterisk contain pest species in accordance with the world list of diaspidid pests by Miller and Davidson (1990)

Diaspidid host genus	No. of <i>Aphytis</i> parasite spp.	Diaspidid host genus	No. of <i>Aphytis</i> parasite spp.
Africaspis	3	Hemiberlesia*	1
Aonidia*	1	Ledaspis	1
Aonidiella*	1	Lindingaspis*	2
Aspidiella*	1	Melanaspis*	2
Aspidiotus*	4	Mycetaspis*	1
Chionaspis*	1	<i>Paraselenaspis</i>	1
Chrysomphalus*	3	Pseudaulacaspis*	1
Dentachionaspis	1	<i>Rolaspis</i>	5
Diaspis*	1	Selenaspis*	1
Duplachionaspis*	2	<i>Separaspis</i>	1
<i>Entaspidiotus</i>	1	<i>Spinaspidotus</i>	1
Fulaspis	2	Tecaspis*	2
Furchadiaspis*	1	Temnaspidotus*	1

The apparent tendency of the indigenous *Aphytis* fauna to prefer hosts belonging to genera with extra-African distributions (which contain many pest species) to those with restricted local distributions (containing few pest species) may be an indication of the potential value of the Afrotropical *Aphytis* fauna as a natural enemy source for the control of diaspidid pests in other parts of the world. In this respect, 16 of these 21 widely distributed genera (see Table 5) are represented elsewhere in the world by one or more species that are regarded as pests.

Within the recorded range of diaspidid host genera it does not seem as if the genus *Aphytis* as a whole has a preference for hosts belonging to any particular genus, as shown in Table 5. Thus, 13 of these host genera are associated with a single *Aphytis* species, 5 genera with 2 species and only 3 genera with 3 or 4 species of *Aphytis*.

*Preference of host species.* The 36 diaspidid species that have so far been recorded as hosts of the indigenous *Aphytis* fauna are listed in Table 6. Unlike the genera to which they belong, these species are less widely distributed, and about two-thirds of them are known to occur only in the Afrotropical region. With much of our knowledge being based on the southern African fauna, most of these host records are from this area and they represent, to a very large extent, diaspidids that have only been recorded from this subregion. Thus, there appears to be a strong element of endemism at the species level of the hosts of the Afrotropical *Aphytis* fauna which, on the other hand, is absent at the generic level of these hosts. This is likely to have an influence on the natural distribution of the Afrotropical species of *Aphytis*, a matter which is discussed in the section on "Some biogeographical considerations" below.

The remaining one-third of the known hosts represent diaspidids that also occur in other zoogeographical regions and which, in some cases, are cosmopolitan in their distribution. Ten species have been recorded in this category and, with the exception of *Aspidiella zingiberi*, these are all regarded as pests in accordance with the list provided by Miller and Davidson (1990). In total, these diaspidids are parasitized by seven indigenous *Aphytis* species (Table 6). One of these species, namely *A. roseni*, has already proven its value as a successful biological control agent (of *Selenaspidus articulatus*), while the potential value of the others still needs to be established.

Based on the large amount of reared southern African material, it is possible to provide some basic information on host specificity of the indigenous species in their native environment. In this respect, the majority of species (69%) have been reared from a single diaspidid host species, and a further 19% are known from two or three different hosts. Apart from these, a single species each has been recorded from four, five and seven different diaspidid hosts, respectively. Thus, at least as far as the southern African fauna is concerned, most species appear to be either monophagous or narrowly oligophagous in their native environment, which supports the view of Rosen and DeBach (1977) with regard to the species of *Aphytis* on a global scale.

The available data also show that in those species that attack more than one species of host, these often belong to different genera. In such cases there is an indication that certain hosts are preferred above others, which reiterates the view of Rosen and DeBach (1977) on the matter. *Aphytis cercinus* has, for instance, been repeatedly reared from *Tecaspis visci* throughout southern Africa, but has on single

**Table 6.** Known hosts of the indigenous Afrotropical species of *Aphytis*; host species marked with an asterisk are regarded as pests in accordance with the world list of diaspidid pests by Miller and Davidson (1990)

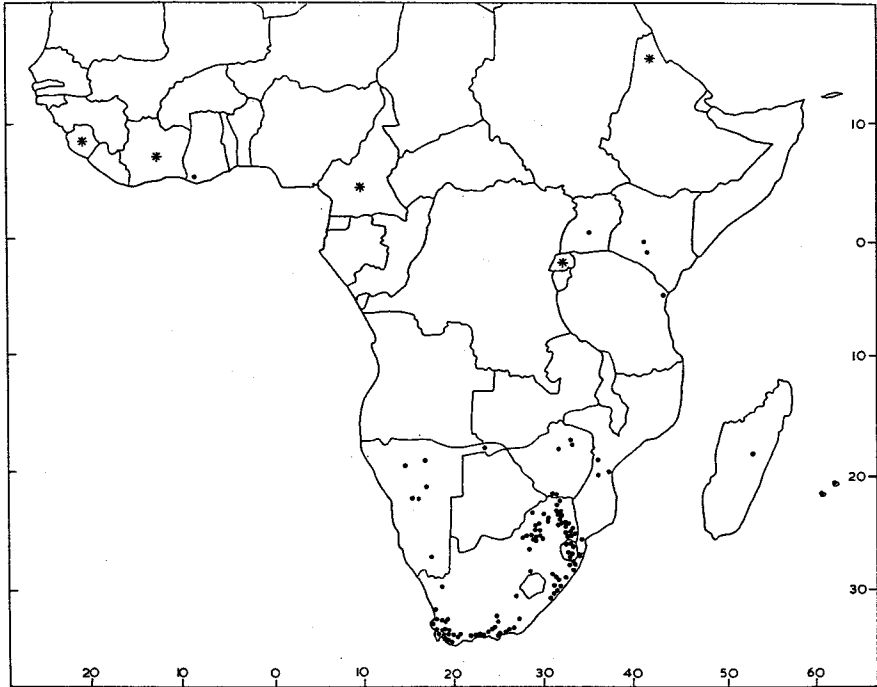
Diaspidid host	<i>Aphytis</i> parasitoids
<i>Africaspis chionaspiformis</i> (Newstead)	<i>confusus</i> ; Undescribed sp. (Sp. 2)
<i>Africaspis terminaliae</i> Munting	<i>cercinus</i>
<i>Aonidia rhusae</i> Brain	Undetermined species
<i>Aonidiella aurantii</i> (Maskell)*	<i>africanus</i>
<i>Aspidiella zingiberi</i> Mamet	<i>acrenulatus</i>
<i>Aspidiotus capensis</i> Newstead	<i>taylori</i>
<i>Aspidiotus elaeidis</i> Marchal	<i>erythraeus</i> , <i>mimosae</i>
<i>Aspidiotus</i> sp.	<i>cercinus</i>
<i>Chionaspis</i> sp.	<i>griseus</i>
<i>Chrysomphalus aonidum</i> (Linnaeus)*	<i>africanus</i> , <i>merceti</i> , <i>comperei</i>
<i>Dentachionaspis margaritae</i> (Brain)	<i>capensis</i>
<i>Diaspis hererina</i> Munting	<i>cercinus</i>
<i>Duplachionaspis exalbida</i> (Cockerell)	<i>griseus</i>
<i>Duplachionaspis sansevieriae</i> Williams	<i>africanus</i>
<i>Entaspidiotus lounsburyi</i> (Marlatt)	Undescribed sp. (Sp. 3)
<i>Fulaspis mazoensis</i> (Hall)	<i>pilosus</i> ; Undetermined species
<i>Furchadiaspis zamiae</i> (Morgan)*	<i>funicularis</i>
<i>Hemiberlesia rapax</i> (Comstock)*	<i>merceti</i>
<i>Ledaspis distincta</i> (Leonardi)	<i>confusus</i>
<i>Lindingaspis greeni</i> (Brain & Kelly)	<i>merceti</i>
<i>Lindingaspis rossi</i> (Maskell)*	<i>africanus</i> , <i>merceti</i>
<i>Melanaspis corticosa</i> (Leonardi)	<i>merceti</i>
<i>Melanaspis pedina</i> Munting	Undescribed sp. (Sp. 5)
<i>Mycetaspis personata</i> (Comstock)*	nr. <i>equatorialis</i>
<i>Paraselenaspis madagascariensis</i> (Mamet)	<i>anneckeii</i>
<i>Pseudaulacaspis pentagona</i> (Targioni Tozzetti)*	<i>africanus</i>
<i>Rolaspis chaetachmae</i> (Brain)	<i>funicularis</i> , <i>rolaspidis</i> , <i>setosus</i>
<i>Rolaspis incisa</i> Munting	<i>funicularis</i>
<i>Rolaspis lounsburyi</i> (Cooley)	<i>griseus</i> , <i>funicularis</i>
<i>Rolaspis</i> sp.	Undescribed sp. (Sp. 6)
<i>Selenaspis articulatus</i> (Morgan)*	<i>roseni</i> , <i>aberrans</i>
<i>Separaspis capensis</i> (Walker)	<i>africanus</i>
<i>Spinaspidotus fissidens</i> (Lindinger)	Undetermined species
<i>Tecaspis visci</i> (Brain)	<i>cercinus</i>
<i>Tecaspis retigera</i> (Cockerell)	Undescribed sp. (Sp. 1)
<i>Temnaspidotus destructor</i> (Signoret)*	<i>equatorialis</i>

occasions also been reared from species of *Diaspis*, *Aspidiotus* and *Africaspis*. The same applies to *A. griseus*, which prefers *Duplachionaspis exalbida* to *Rolaspis lounsburyi*. Likewise, *A. merceti* seems to prefer *Lindingaspis rossi* and *L. greeni* to species of *Melanaspis*, *Hemiberlesia* and *Chrysomphalus*, which it is also known to attack.

### Some biogeographical considerations

Based on the literature and available study material, the areas from where the genus

*Aphytis* is known in the Afrotropical region are depicted in Figure 2. Apart from southern Africa, this is obviously a poor reflection of the actual distribution of the genus in the region due to very poor collecting activity. Nevertheless, certain general trends regarding the occurrence of the genus in the Afrotropical region, can be extrapolated on the basis of available parasitoid/host information.



**Figure 2.** Distribution of the genus *Aphytis* in the Afrotropical region; asterisks denote countries from where exact collecting localities are unknown.

#### *Habitat preference of the southern African fauna*

From the relatively large amount of available data it is evident that the distribution of the 24 known indigenous species of *Aphytis* from the area does not depend so much on the distribution of their hosts, but rather on environmental factors such as climate and vegetation. Thus, the genus appears to be limited, to a very large extent, to certain preferred habitats and areas of the subregion. A knowledge of these areas, which are described below, could be of value in the future exploration of the indigenous *Aphytis* fauna of the area for purposes of biological control.

Distributional information of 33 diaspidid host species from some 270 different localities, shows that virtually all of these hosts are widely and randomly distributed over a wide variety of habitats and vegetational biomes in southern Africa. This, however, is not the case with their *Aphytis* parasitoids, and it is evident that the genus is limited in its occurrence to certain areas within the distributional ranges of these diaspidid hosts. On the other hand, the areas where *Aphytis* is known to occur can be positively correlated with certain regional biomes, as delineated by Rutherford and Westfall (1986), and as shown in Figure 1.

Thus, the genus *Aphytis* in southern Africa is largely confined to the Fynbos and Savanna biomes, despite the fact that the hosts of most species are also commonly found in areas other than these biomes. In general, these biomes represent the temperate and subtropical areas of the subregion and include the south-western Cape Province with its macchia vegetation and Mediterranean type climate (Fynbos biome), in addition to the moist eastern coastal areas and the drier bushveld savanna regions to the north. With the odd exception, there is a distinct absence of species from the western semi-arid and arid areas, which form the Desert, Nama-Karoo and Succulent Karoo biomes. In this respect the presence of *Aphytis* in these areas, as shown in Figure 1, is attributed to one widespread species, namely *A. cercinus*, and a single record of *A. merceti*. The Grassland biome seems to be an equally unsuitable habitat for *Aphytis*. Only one record, namely that of *A. mimosae*, is known from this large area of South Africa, which mainly includes the high central plateau, inland areas of the seaboard of the Natal Province and mountain areas of the south-eastern Cape Province. Finally, the genus remains unrecorded from the Forest biome (not shown in Figure 1), which is delineated by a very small area in the southern Cape Province of South Africa.

#### *Some general trends in the distribution of the Afrotropical fauna*

The overall distribution of the genus *Aphytis*, as represented by the indigenous fauna, is shown in Figure 2. The depicted pattern is, as mentioned above, a poor reflection of the actual distribution and extent of the genus in the region. At present, 24 of the 30 species (described and undescribed) recorded here are known from the Southern African subregion, while only seven species are known from elsewhere in the region, mainly West and East Africa. In reality, the greatest diversity of species is probably to be found in West and Central Africa, since diaspids in general are more diverse in tropical than temperate zones, as also seems to be the case in Africa.

As for the well studied southern African fauna, all of the 24 species except *A. annecki*, *A. erythraeus*, *A. equatorialis* and *A. mimosae* are known only from this subregion. Ten of these species, including three undescribed ones, are known only from hosts that are limited in their distribution to the subregion. This probably shows that unless these species are polyphagous, which they are unlikely to be (see section on "preference of host species"), they do not have a widespread Afrotropical distribution. The described species in this category are: *A. capensis*, *A. cercinus*, *A. griseus*, *A. rolaspidis*, *A. setosus*, *A. taylori* and *A. pilosus*.

A further six of the species originally described from southern Africa include amongst their hosts diaspids that are all widely distributed throughout sub-Saharan Africa and in some instances also the east and west coast islands. These species are: *A. africanus*, *A. annecki*, *A. confusus*, *A. funicularis*, *A. merceti* and *A. mimosae*. Further collection will probably show that these species are equally widespread through Africa in suitable habitats. That this is likely to be the case, is demonstrated by *A. annecki* and *A. mimosae* which, apart from South Africa, are now also known from Kenya and Ethiopia, respectively. In the case of *A. africanus*, *A. merceti* and *A. funicularis*, their host spectra (Table 6) include well-known pest species with wide extra-African distributions, which might show that these *Aphytis* species extend their distributional range beyond the Afrotropical region. On the

other hand, *A. africanus* has been introduced into Israel and California for the control of *Aonidiella aurantii* on citrus but failed to become established in these areas (Rosen and DeBach, 1979).

Host information on six species originally described from west and east Africa indicates that they too probably occur widely in the Afrotropical region, with possible extra-African distributions in the case of some. In this respect, *A. erythraeus* from Ethiopia is a parasitoid of *Aspidiotus elaeidis*, which is found throughout sub-Saharan Africa, whereas *A. roseni* and *A. aberrans* spec. nov. from Uganda attack *Selenaspidus articulatus*, which is equally widespread in Africa and a pest in many other subtropical and tropical areas of the world. *Aphytis roseni* has subsequently been introduced into Peru for the control of this pest on citrus where it has become established (DeBach and Gordh, 1974; Beingolea, Chapter 6, this volume). *Aphytis equatorialis* and *A. nr. equatorialis* from equatorial West Africa are parasitoids of *Temnaspidotus* (= *Aspidiotus*) *destructor* and *Mycetaspis personata*, respectively, two widespread Afrotropical diaspidids associated with tropical fruit trees also in several other parts of the world. During the course of this study, *A. equatorialis* and *A. erythraeus* were discovered in South Africa in association with *T. destructor* and *A. elaeidis*, respectively, thus confirming their anticipated wide distribution.

Unfortunately, almost nothing is known about the indigenous *Aphytis* fauna of Madagascar and the Mascarene islands which, according to Kozar (1990), have a rich and diverse diaspidid fauna. A single species, *A. acrenulatus*, has been described as a parasitoid of *Aspidiella zingiberi* from Mauritius. This host is not known from elsewhere in the Afrotropical region but from Thailand, which may indicate that *A. acrenulatus* is of Oriental rather than Afrotropical origin.

## Description of new species

Eight apparently undescribed Afrotropical species are present amongst the large amount of material examined for the purpose of this study. Two of these species are described below. The other six are not described, since they are either represented by insufficient study material, or differ in such a way from certain described species that their status as distinct species cannot be determined with absolute certainty. Further study on the extent of intra- and interspecific variation among the Afrotropical species, supported by cross-breeding experiments, is needed to verify the identity of these species.

The existence of the six undescribed species (listed in Table 4) is briefly documented as follows:

### *Species 1*

Relationship: close to *A. funicularis* Compere (**funicularis** group) but differs in the dimensions of the ovipositor and shape of the crenulae.

Distribution: eastern Cape Province of South Africa (Grahamstown and Wilderness).

Host: *Tecaspis retigera* on *Scutia myrtina* (Burm.F.) Kurz (Rhamnaceae).



*Species 2*

Relationship: close to *A. cercinus* Compere (**chilensis** group), but differs in dimensions of ovipositor and antennae, and in the crenulae which overlap.

Distribution: Uganda (Kawanda).

Host: *Africaspis chionaspiformis*.

*Species 3*

Relationship: very close to *A. aonidiae* (Mercet) and allied species (**mytilaspidis** group).

Distribution: western and eastern Cape coastal areas of South Africa (Strandfontein and Port Elizabeth).

Host: *Entaspidiotus lounsburyi* on *Carpobrotus edulis* (L.) L.Bol. (Mesembryanthemaceae).

*Species 4*

Relationship: very close to *A. mimosae* DeBach and Rosen (unplaced), differing in dimensions of ovipositor and propodeum and number of mesoscutal setae.

Distribution: south western Cape Province, South Africa (Kogelberg).

Host: undetermined Diaspididae on *Brachylaena neriifolia* (L.) R.Br. (Asteraceae).

*Species 5*

Relationship: very close to *A. mimosae* DeBach and Rosen.

Distribution: Namibia (Windhoek).

Host: *Melanaspis pedina* on *Boscia albitrunca* (Burch.) Gilg. and Ben. (Capparaceae).

*Species 6*

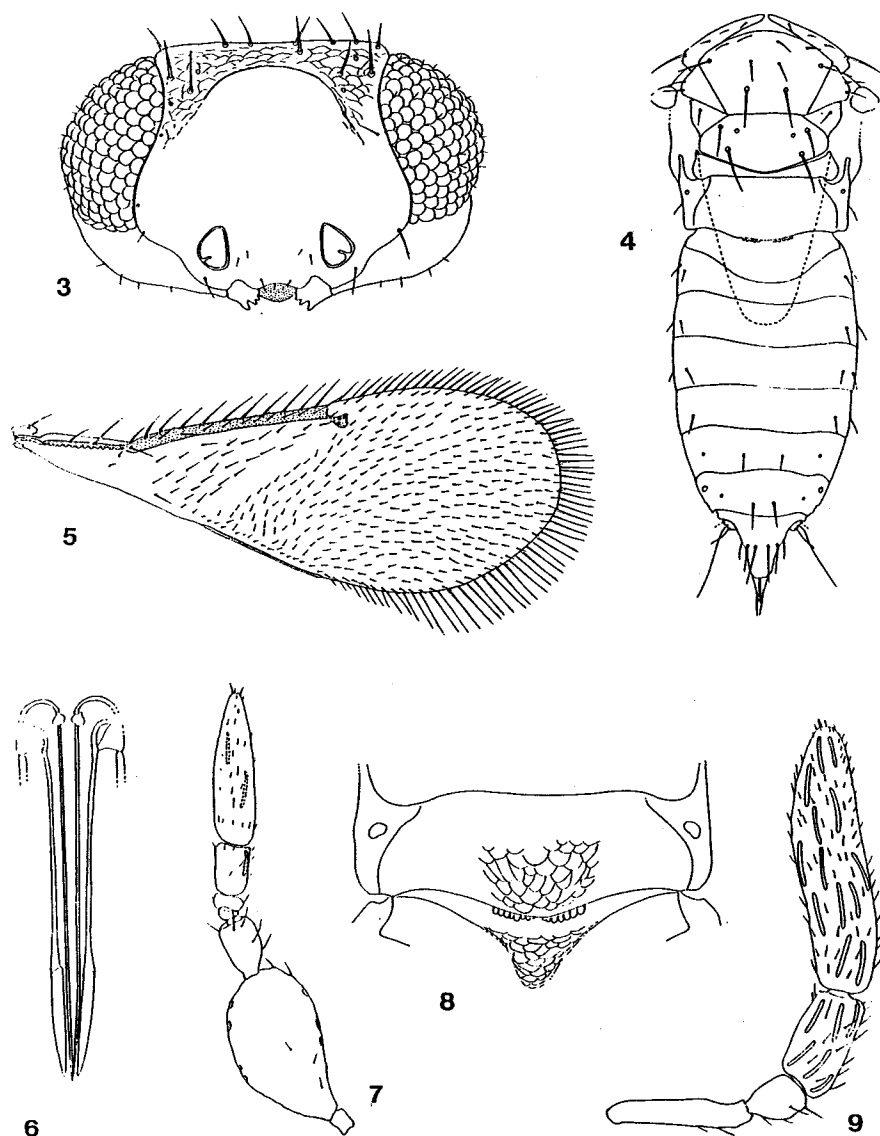
Relationship: close to *A. capensis* DeBach and Rosen (unplaced), differing mainly in color and dimensions of the ovipositor.

Distribution: south western Cape Province (Goudini) and Natal Coast (Warner Beach), South Africa.

Host: *Rolaspis* sp. on *Anthospermum aethiopicum* L. (Rubiaceae); undetermined Diaspididae (prob. *Rolaspis* sp.) on *Chaetachme aristata* Planch. (Ulmaceae).

*Aphytis aberrans* spec.nov. Figures 3–9

*Aphytis aberrans* is a unique and aberrant species, which differs from all other known species of the genus in that the female antenna is 4-segmented and that of the male 6-segmented. It appears to be most closely related to *A. faurei* Annecke (also from the Afrotropical region), which is placed in the **chilensis** group, while also sharing certain similarities with *A. antennalis* Rosen and DeBach, a species regarded as being related to the same species group. Both *A. faurei* and *A. aberrans* have the same peculiar 4-segmented antenna in the female, with a single elongate



**Figures 3–9.** *Aphytis aberrans* spec. nov. 3. Head, frontal view (female holotype). 4. thorax and abdomen, dorsal view (female holotype). 5. Fore wing (female holotype). 6. Ovipositor (female paratype). 7. Antenna (male paratype). 8. Propodeum and base of gaster, showing crenulae and sculpture (female paratype). 9. Antenna (female holotype).

funicle segment and long club bearing numerous sensilla, while the maxillary palpi are unsegmented in both. In *A. antennalis* the female antenna has the same peculiar structure, but with a distinct anellus, which makes it 5-segmented. The male antenna of *A. aberrans*, however, differs markedly from that of *A. faurei* and other members of the **chilensis** group of species: in *A. aberrans* it is 6-segmented with 3 funicle segments and a swollen scape, which is unlike any other species of *Aphytis* known to us; in species of the **chilensis** group it is 4-segmented and differently shaped.

Because of the discrepancy in the structure of the male antenna, and our incomplete knowledge of the fauna, we regard *A. aberrans* as an unassigned species related to the *chilenis* group, but not a bona fide member of it.

The only other species in the genus with a 4-segmented female antenna is *A. secundus* (Compere) from East Africa, which is also unassigned (Rosen and DeBach, 1979), but thought to be somewhat related to the *funicularis* group. This species shows no specific relationship to *A. aberrans*, differing most notably from it in the structure of the female antenna in which the funicle segment is small and wider than long, in the male antenna which is 4-segmented, and in the short propodeum.

*Aphytis aberrans* is the second species to have been described from Uganda in East Africa as a parasitoid of the rufous scale, *Selenaspidus articulatus* (Morgan). The other species is *A. roseni*, which was described by DeBach and Gordh (1974) and subsequently imported into Peru for the control of rufous scale on citrus. The two species are not closely allied, *A. roseni* representing yet another peculiar, unassigned species, the antennae of which are 6-segmented in both sexes.

Female. Length: 0.7 mm. Color: head, thorax and propodeum largely dark yellow, with the pronotum anteriorly, and sides of meso- and metanotum and propodeum, darkly suffused, the mesosternal furca dark; gaster dusky; antenna with scape white, the remainder a little darker; legs entirely white; wings entirely hyaline; setae on head and thoracic dorsum pale.

Head, in frontal view, with dimensions and setation as in Figure 3, the genal suture unusual in that it is curved in the middle as illustrated; eyes finely setose; maxillary and labial palpi each with a single segment; mandible small, weakly sclerotized, tridentate; antenna (Figure 9) with scape about 5 times as long as wide, just more than one-half the length of the club; pedicel slightly longer than wide, about 0.6 times the length of the funicle segment; flagellum with a single vestigial ring segment and a single large elongate funicle segment which is a little broader basally than apically and 1.8–2.0 times as long as broad, bearing 12 long sensilla; club very long, about 4 times as long as broad, about 2.5 times the length of the funicle segment, rounded apically, covered with numerous long sensilla as illustrated; flagellar setation as in Figure 9.

Thorax (Figure 4) with pronotal plates narrowly joined in the middle, each plate with 3–4 short setae in addition to the long seta at each posterior corner; mesoscutum twice as wide as its median length; midlobe with 10 setae, the single seta placed at each lateral corner and the posterior pair much stronger and longer than the remaining 6 setae; each side lobe with 2 setae at its lateral angle; axillae each with a single seta; scutellum shaped as in Figure 4, medially 0.6 times as long as the mesoscutum; scutellum with 4 setae, the discoid sensilla much closer to the anterior pair than to the posterior pair of setae; propodeum very long, medially 11.5–12.0 times the length of the metanotum, about 1.1 times as long as the scutellum; crenulae as in Figure 8, the two sets narrowly separated medially, each consisting of a row of 6–8 crenulae which vary in size, the outer 4 or 5 the largest and not or slightly overlapping, the inner ones small, not clearly defined; sculpture of mesonotum, and median part of propodeum (Figure 8), appearing finely reticulate and mostly not clearly discernible in the slide-mounted material, the cells large.

Abdominal tergite II (first gastral) with a clearly discernible triangular-shaped

median sculptured area as in Figure 8; tergites III–VIII with clearly discernible transverse reticulate sculpture extending across the entire width of each tergum; tergites III–VII each usually with 2 setae, rarely with 3, at each side, tergite VII with an additional submedian pair; tergite VIII with 4 setae between the spiracles; syntergite 1.3–1.6 times as wide as long, broadly rounded or acute apically in the two slide-mounted specimens, with a transverse row of 4 setae; cerci placed a little closer to the spiracles than to the tip of the abdomen.

Fore wing (Figure 5) about 2.8 times as long as broad; marginal fringe with longest cilia about 0.3 times as long as the width of the wing; delta area relatively sparsely setose, with 28–37 setae roughly arranged in 3 or 4 rows; cephalic margin of marginal vein with 8–10 long setae which are subequal in length; submarginal vein with 4–5 setae and 13–14 bullae.

Middle leg with tibial spur about equal in length to the basal tarsal segment. Ovipositor (Figure 6) 1.5 times and gonostyli 0.4 times the length of the middle tibia, respectively.

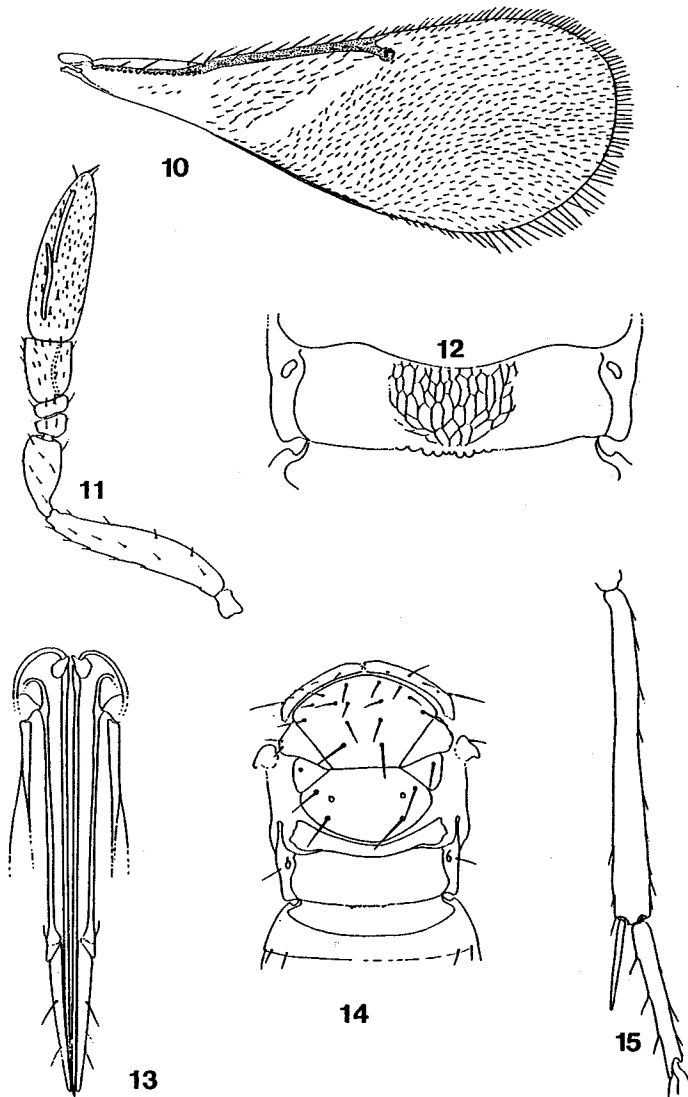
Male. Color: described from material preserved in alcohol: head and body entirely pale yellow, except the pronotum which is darkly suffused anteriorly, the gaster not dark as in the female; appendages white, wings hyaline.

Apart from the antenna and genitalia, structurally essentially similar to the female. Antenna (Figure 7) uniquely structured, 6-segmented, not 4-segmented as in the female; scape sub-hemispherical, enlarged and swollen, the ventral and dorsal surfaces each with a row of circular indentations, more than 2.5 times the length of the pedicel; pedicel about as long as the basal two segments and one-half to two-thirds of the third funicle segment combined; funicle with 3 segments; segment I and II each at least twice as wide as long, II slightly longer but distinctly wider than I; segment III much larger than the preceding segments, about twice the length of I and II combined, 1.2–1.5 times as long as broad, about 0.4 times the length of the club; club about 3.5 times as long as wide, a little longer than the funicle and pedicel combined, tapering to a narrowly rounded apex; antenna with shape and setation otherwise as in Figure 7. Genitalia slender, about 0.6 times as long as the middle tibia; digital sclerites almost 0.2 times the combined length of the aedeagus and apodemes, apparently without apical claws.

*Material examined.* Female holotype, 1 female, 2 male paratypes, all cleared and mounted on slides with the following data: UGANDA: Kawanda, i.1971, D.J. Greathead, ex *Selenaspidus articulatus* (Morgan) on *Coffea canephora* (T 3778 and T 3779).

#### *Aphytis vastus* spec. nov. Figures 10–15

This new species from Namibia is placed in the **chrysomphali** group of species on the basis of the following characters: color overall yellow, the thoracic setae pale, the fore wings hyaline; female antenna six-segmented; propodeal crenulae small, non-overlapping. However, the relatively short propodeum of *A. vastus* (at most 4 times the length of the metanotum) is not characteristic of this group of species, and its placement in the **chrysomphali** group should therefore be regarded as tentative.



**Figures 10–15.** *Aphytis vastus* spec. nov., female. 10. Fore wing (paratype). 11. Antenna (paratype). 12. Propodeum, showing crenulae and sculpture (holotype). 13. Ovipositor (paratype). 14. Thorax, dorsal view (holotype). 15. Middle tibia (holotype).

Apart from this character, the female of *A. vastus* (the male is unknown) is readily separated from all known species of the **chrysomphali** group by the short tibial spur of the middle leg, which is only about half the length of the basal tarsal segment. *Aphytis vastus* is otherwise distinguished from other members of the group by the usual combination of structural characters (see diagnosis below), and it does not seem to be closely related to any particular species. As a matter of convenience, it can be grouped with *A. immaculatus* Compere, *A. mazalae* DeBach and Rosen, *A. sensorius* DeBach and Rosen, *A. japonicus* DeBach and Azim and *A. fioriniae*

Rosen and Rose, all of which differ from the remaining species in the group by the thoracic sterna which are immaculate, not dusky.

The **chrysomphali** group, which presently includes 11 described species, is represented mainly in the Oriental region, and was hitherto known from the Afrotropical region from only two species: *A. chrysomphali* (Mercet), a cosmopolitan species which is thought to have been accidentally introduced into the region (see Table 3); and *A. annecki* DeBach and Rosen, which was described from South Africa and is now also known from Kenya. The short middle tibial spur, immaculate sterna, and the other characters mentioned in the diagnosis below, also serve to readily distinguish *A. vastus* from these two African species.

**Diagnosis (female).** The following combination of characters separates this species from others in the **chrysomphali** group: body, including sterna, entirely yellow; mandible with two teeth and a truncation; antennal club short, about 3 times as long as broad, almost 3 times as long as the distal funicle segment; midlobe of mesoscutum with 12–15 setae; propodeum medially about 3.75–4.0 times as long as the metanotum, the crenulae rounded, non-overlapping; ovipositor about twice, and gonostyli half, the length of the middle tibia, respectively; middle leg with tibial spur short, 0.5–0.6 times the length of the basal tarsal segment.

**Description:** Length: about 0.7 mm. Color: head and dorsum of body yellow, the sides and venter of the body slightly paler with a whitish tinge; antennae yellowish; legs concolorous with the venter of the body; wings hyaline; setae on head and thorax entirely pale.

Head with eyes finely setose; vertex with two pairs of long, strongly developed setae and numerous shorter ones; genal suture gently and evenly curved; mandible with two teeth and a truncation; maxillary palpi 2-segmented, the labial palpi not segmented; Antenna (Figure 11) with scape 5.9–6.5 times as long as wide, slightly longer (1.1–1.2:1) than the club; pedicel slightly more than twice as long as wide, 1.2–1.3 times as long as the distal funicle segment; funicle with 3 segments; segment I small, varying somewhat in shape but usually somewhat triangular in shape, about twice as wide as its median length; segment II more symmetrical in shape, approximately the same length as I medially but wider, about 2.3 times as wide as long, 0.3 times the length of segment III; segment III 1.3–1.5 times as long as wide; club basally about as wide as the preceding funicle segment, 3.1–3.3 times as long as wide, 2.8–2.9 times as long as the distal funicle segment; distal funicle segment usually with 1 (rarely 2) long sensilla, the club usually with 7 (rarely 5 or 6) sensilla; antenna otherwise as illustrated.

Thorax as in Figure 14; pronotal plates narrowly joined medially, each with a row of 4 setae besides the long, strongly developed seta at each posterior corner; mesoscutum about twice as wide as its median length; midlobe with 12–15 setae, the single seta at each lateral corner and the posterior pair distinctly longer than the remaining setae which vary in length and position on the disc; sidelobes each with 2 setae; axillae each with a single seta; scutellum shaped as in Figure 14, medially almost as long as (0.8–0.9:1) the mesoscutum; scutellum with 4 setae, the discoid sensilla placed closer to the anterior than to the posterior pair of setae; propodeum approximately 3.75–4.0 times as long as the metanotum medially, about 0.5 times the length of the scutellum; propodeum with a continuous row of approximately 9 crenulae, these non-overlapping, with the middle two or three distinctly smaller than

those on the sides, their shape varying in the available slide-mounted material, ranging from being rather flat to more round (as in Figure 12) in outline; mesonotal sculpture finely reticulate, the cells large, that of the propodeum much the same in coarseness, the cells shaped as illustrated in Figure 12.

Abdominal tergites weakly sculptured, the sculpture hardly discernible in slide-mounted material except at the sides of each tergite and on most of tergite VIII; tergites III–VII each with 2 setae at each side, tergite VII with an additional submedian pair; tergite VIII with a row of 5–6 (usually 6) setae between the spiracles; syntergite a little wider than long (1.1–1.3:1), triangular apically with a row of 4 setae; cerci placed a little closer to the spiracles than to the apex of the gaster, each cercus with 2 long and 1 short setae.

Fore wing (Figure 10) usually 2.6 times (2.5–2.65) as long as wide; marginal fringe with longest cilia just more than 0.1 times (0.13–0.15) as long as the width of the wing; delta area with 49–58 setae roughly arranged in 5 rows; cephalic margin of marginal vein usually with 9 or 10 (ranging from 7–12) long subequal setae; submarginal vein with 4–5 setae and 17–19 bullae; ventral surface of costal cell with a row of 2–5 fine small setae, the dorsal surface with a single seta near its apex.

Middle leg (Figure 15) with tibial spur unusually short, about half (0.5–0.6:1) the length of the basal tarsal segment; ovipositor (Figure 13) long, twice the length of the middle tibia, the gonostyli 0.6 times the length of the latter.

Male. Unknown

*Material examined.* Female holotype, 6 female paratypes with the following data: NAMIBIA: Hochfeld, v.1973, G.L. Prinsloo, ex undetermined Diaspididae on *Lonchocarpus capassa* Rolfe (Fabaceae) (T 6680).

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