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Interesting South African Scale Insects (Hemiptera: Coccoidea)

Abstract - The South African scale insect fauna comprise a number of species that are very interesting from historical taxonomic or biological perspectives. Thus it has a species described by Linnaeus in 1763, species with peculiar characters that confuse taxonomists and five gall-inducers from five different scale insect families. It also has two species in the Diaspididae where the female lacks the typical "armour" of the family when it is found living in ant galleries on plants.

Key words: scale insects, Coccoidea, insect galls.

Kosztarab (1987) highlighted the many unique and unusual characteristics found amongst members of the superfamily Coccoidea, for which the common name scale insects is used although most of them lack scales. He mentioned the protective cover produced by the armoured scales (Diaspididae), the way many species protect their eggs and young nymphs by secreting a waxy cover, by using their exoskeleton or by inducing their host plants to form galls; unusual reproductive strategies such as hermaphroditism and parthenogenesis; and the variety of sex determination mechanisms. He also pointed out that certain scale insects are used for natural dyes and their secretions as wax and lac. In this paper we wish to focus attention on some of the unique or interesting features of the South African scale insect fauna.

The scale insects of South Africa has been studied by local workers like C. K. Brain, J. Munting and I. Millar, while G. De Lotto and Y. Den-Dov spent several years in the country working on its scale insects. Several workers from elsewhere, such as T.D.A. Cockerell, W.J. Hall and D.J. Williams, have also studied South African scale insects. From their work it appears that all the major families are well represented, with the exception of the Eriococcidae of which only one endemic species is known. This is the gall-inducing *Calycicoccus merwei*, described in 1918 and recently relocated in the type locality.

Calycicoccus merwei is one of five gall-inducing scale insects known from South Africa, four described by Brain (1918) and one by Ben-Dov (1974). Remarkably, the five species are all from different families, thus having convergent behavioural characteristics. In addition to the eriococcid *C. merwei*, there is *Grewiacoccus gregalis*

Brain of the family Pseudococcidae, *Cissococcus fulleri* of the Coccidae, *Abditococcus acaciae* (Brain) of the Asterolecaniidae and *Discodiaspis gallamformans* Ben-Dov of the Diaspididae. This strange distribution amongst the families might indicate a poorly collected fauna, but this is probably not the case in view of the conspicuous nature of the galls and the fairly extensive collection of South African scale insects in the National Collection of Insects in Pretoria. In fact, gall inducing species are rare in some of the families mentioned above. Thus only five of the true gall producers in the Pseudococcidae are found outside Hawaii, the only one in the Coccidae is the one of South Africa and in the large family Diaspididae only 16 species of gall formers are known (Williams & Miller, 1999). However, in Australia, with its many gall-forming Eriococcidae, a significant proportion of the scale insects produce galls (Gullan, 1984).

One of the gall inducing species, *C. fulleri,* is also interesting from a taxonomic point of view as its affinities are uncertain. Cockerell (1902) considered to be an eriococcid, Brain (1918) placed it in a new subfamily (his concept of subfamily corresponds to family of today), Ferris (1920) showed that it shares characteristics such as the anal plate with the Coccidae (but lacks the anal cleft), while Hodgson (1994) pointed out that it also has other features which warrants its placement in at least a separate subfamily of the Coccoidea. These features include the absence of antennae; the reduction of the dorsum; the displacement of legs, mouthparts and spiracles to the dorsal surface; and the form of sclerotization around the anal plates. Some of the unusual characters of *C. fulleri* might be the result of adaptation to life in a gall. Thus it can be expected that a morphological study of the free-living adult male (which is present according to Brain (1918)) will elucidate the true relationships.

Such a study of male characters avoided possible confusion about the taxonomic position of another interesting species from South Africa, the aclerdid *Lecanoaclerda macropoda* Hodgson, though not a gall-inducer (Millar & Hodgson, 2001). Here the adult female appeared to be partly coccid and partly aclerdid as it has well-developed legs and antennae as well as some other characters present in the family Coccidae but unknown in the family Aclerdidae. However, phylogenetic analysis of adult male characters showed that it undoubtedly belongs to the Aclerdidae and that the differences justify no more than a new genus (Millar & Hodgson, 2001).

The species *Asterolecanium euryopis* Fuller (Asterolecaniidae) is interesting because already in 1899, in the very early days of biological control of weeds by insects, it was suggested that this species be used for the control of the native harpuisbos *Euryops tenuissimus* Less. (Compositae) which increased to cover large tracts of land (Fuller, 1899). Farmers were advised to take twigs well covered with healthy looking scales and tie them closely to new bushes. Evidently the insects were so numerous that they thickly covered the twigs and could kill the plants. However, the scales were themselves attacked by parasitoids, as could be expected for a native control agent, which probably rendered them ineffective. The species is also interesting on account of the exceptionally large 8-shaped pores in the female that produce copious amounts of wax surrounding the insects.

The species *Conchaspis capensis* (Linnaeus) (Conchaspididae) is also of historical

interest, since it is the only native scale insect of South Africa described by Linnaeus (Linnaeus, 1763.). Why this particular scale insect, which is by no means common in its habitat, and belongs to a small family of which only 24 species were known world-wide by 1981 (Ben-Dov 1981)? The explanation probably lies in the fact that Linnaeus (1753) also described the host plant, *Gnaphalium* (now *Metalasia*) *muricatum* (Asteraceae). Rijk Tulbagh, Dutch governor of the Cape settlement from 1751-1771, was a keen naturalist who asked his gardener to collect plants and insects. These, as well as stuffed animals, were sent as exotica from the southern tip of the dark continent to the taxonomists of Europe. Tulbagh was known to have corresponded with the Swedish Linnaeus in Latin. So Tulbagh probably sent the plant to Linnaeus who described it as well as the scale insect he noticed on it. This species was later described by Mamet (1954) as *C. phylicae* from *Phylica* sp. (Rhamnaceae) at the Cape and was recently collected by the senior author on *Diosma hirsuta* Linnaeus (Rhutaceae) at Hoy's Koppie, Hermanus.

The mutualistic relationship between ants and honeydew producing scale insects is well known. However, in South Africa there is also the close association between ants and two species of the Diaspididae which do not secrete honeydew. The two scale insect species, *Morganella conspicua* (Brain) and *Andaspis formicarum* Ben-Dov, live in the galleries of ants of the genus *Melissotarsus,* found in the stems of *Leucospermum praemorsum* (Proteaceae) and *Ficus capensis* (Moraceae) respectively (Prins *et al,* 1975; Ben-Dov, 1978). Most remarkable is the fact that the females of these scale insects lack the scale or "armour" formed of wax and exuviae that is typical for the Diaspididae. In the case of *M. conspicua* it was found that the "armour" is present in those individuals living outside the galleries on the bark of the plant, indicating that it is not a genetic character. The exact nature of the relationship is not known, but it is suggested that the scale insects are used as a source of wax or are preyed upon (Ben-Dov, 1978). This may explain why the adult female diaspidids inside the galleries are only about half the size of those outside and why no scale cover can be formed. The observation that worker ants appear to survey the pygidia of the diaspidids with their mouth parts (Prins *et al.,* 1975) suggests that they are continuously being "milked" for wax.

This association between *Melissotarsus* ants and diaspidids is probably much more widespread in Africa than is known today since it was earlier also observed by Delage-Darchen *et al.* (1972) in the Ivory Coast. Here the diaspidids were *Morganella* and *Aspidiotus* species.

Amongst the primitive scale insects it is interesting to note that at least five *Margarodes* species (Margarodidae), whose second instars form cysts or "ground pearls", have adapted to feed on the roots of grape vines in South Africa (De Klerk, 1980: De Klerk *et al.*, 1982a) Their natural hosts were probably grasses on which some of them and related species have been found (De Klerk *et al*, 1982b). It is quite surprising that so many have successfully adapted to the unrelated, introduced grape vine, to the extent that they cause economic damage.

Finally, as regards the general shape of the adult female, South Africa also has a

unique species in *Aspidoproctus tricornis* (Newstead) (Margarodidae). Here three prominent, pointed protuberances are found on the dorsum, giving the insect a peculiar thorn-like appearance. A congeneric species, *A. maximus* Lounsbury from neighbouring Zimbabwe, is equally remarkable in that the female is exceptionally large for a scale insect. Newstead (1911) gives it measurements as 33 mm long, 25 mm wide and 15 mm high.

Many species of scale insects are still to be described from South Africa, but it is clear that there are some very interesting species amongst those already known. It appears that the saying *"Ex Africa semper aliquid novi"* (out of Africa always something new), attributed to Pliny the Elder (23 - 79 AD), is also true for its scale insect fauna.

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