

SYSTEMATICS AND MORPHOLOGY: Posters and Abstracts:

THE TAXONOMIC RELATIONSHIP OF SOME COCCOIDEA
(HEMIPTERA) BASED ON MALE CHARACTERISTICS.

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Male characters of species from five different families were studied and the taxonomic status of the families are described. A key of characters was presented for adult males. The quantitative evaluation method was applied to assess the relationship between the families. All the characters included were regarded as being of equal importance and those shared by any one family exhibited some differences, justifying the recognition of the taxon as a distinct family. It was found that the Margarodidae were the most primitive group followed by Pseudococcidae. The Diaspididae showed the maximum number of specialised characters, with the Coccidae and Dactylopiidae falling between the Diaspididae and the Pseudococcidae. The Coccidae and Dactylopiidae shared an equal number of characters with the Pseudococcidae and are considered to be close to each other.

MORPHOLOGICAL VARIATION IN THE MEALYBUGS *PSEUDOCOCCUS*
CALCEOLARIAE AND *P. SIMILANS* (HEMIPTERA: COCCOIDEA:
PSEUDOCOCCIDAE).

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Examination of slide-mounted laboratory-reared daughters from isolines of *Pseudococcus calceolariae* (Maskell) and *P. similans* (Lidgett) mothers collected from two widely separated locations in the North Island of New Zealand has thrown doubt on the validity of the defining characters of the species. For *P. similans*, the number and position of oral rim tubular ducts varied widely and sometimes fell outside the defined species limits. In addition, the characteristic 'stout abdominal setae' were lost in the F1 generation. The combinations of leg-length and number of oral rim tubular ducts which separate *P. calceolariae* (Maskell) from *P. similans* co-existed in cohorts of F1 sisters and both character-sets could be manipulated by changing the temperature at which the mealybugs developed. Mating studies are proposed to investigate whether the two species are valid, or whether they merely represent the phenotypic extremes of one widely polymorphic species.

APIOMORPHA: AN EXTRAORDINARY SCALE INSECT GENUS.

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Apiomorpha is a gall-inducing eriococcid genus which is endemic to Australia, where it is restricted to *Eucalyptus*. Females of most species induce large and spectacular galls which generally have species-specific morphologies. *Apiomorpha* is one of the most chromosomally diverse of all animal genera. Closely related species usually have very different karyotypes and there is extensive chromosomal variation between populations within most morphologically defined species. Some, but not all, of the karyotypic variation within morphospecies probably represents species-level differences. A phylogeny of *Apiomorpha* based on DNA sequence data has been proposed, onto which chromosomal and morphological traits have been mapped. Both fusion and fragmentation appear to be playing a role in chromosomal evolution in this genus.

A PUTATIVE MOLECULAR PHYLOGENY OF NINE SCALE INSECT
“FAMILIES” AND ITS IMPLICATIONS.

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An incomplete and only partially tested molecular phylogeny of the scale insects based on 18S rDNA using sample taxa from the Margarodidae, Ortheziidae, Pseudococcidae, Coccidae, Kerriidae, Eriococcidae, Diaspididae, Dactylopiidae and Asterolecaniidae is presented. Aphids and psyllids have been included as outgroup taxa. The general topology is discussed in relation to the evolution of the scale insects. Several well-supported clades have major implications for the classification and taxonomy of the Eriococcidae. A phylogeny of the eriococcids based on sequence data from the mitochondrial gene cytochrome oxidase subunit II is in general agreement with the nuclear gene-based tree.

SOME ASPECTS OF THE TAXONOMY OF PALAEARCTIC MEALYBUGS
(HEMIPTERA: COCCINEA: PSEUDOCOCCIDAE).

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In the group of mealybugs possessing oral rim ducts, the genera *Atrococcus* Goux, *Spilococcus* Ferris, *Chorizococcus* McKenzie and *Paracoccus* Ezzat & McConnell are discussed. The genus *Atrococcus* is a small natural group of species, sharing similar morphology, the presence of black pigment and a Palearctic distribution. The borders between the other genera are not clear, as has been mentioned by other authors. The

genera *Spilococcus* and *Chorizococcus* are separated from each other by the number of cerarii (6-17 or fewer), while the genus *Paracoccus* is characterized by the presence of an anal lobe bar. In the fauna of the former USSR, there are 6 species: *Spilococcus furcatispinus* (Borchsenius), *S. flavus* (Borchsenius), *S. expressus* (Borchsenius), *S. erianthi* (Kiritshenko), *S. herbaceus* Danzig and *S. balli* McKenzie & Williams. These are all very similar morphologically and are associated with grasses (the other 7 known species in the genus *Spilococcus* live on dicotyledons). The placement of these species in genera based on the number of cerarii (which varies from 1 to 17 pairs) or on the presence of an anal lobe bar (*S. expressus*) is here considered to be artificial. Therefore, it is here suggested that the genus *Spilococcus* should be accepted in the wide sense (at least for the fauna in the Palaearctic region).

THE STRUCTURE AND FUNCTION OF THE TEST OF NEW ZEALAND MALE SOFT SCALE INSECTS.

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Male scale insects (Hemiptera: Coccoidea) undergo a metamorphosis from scale-like nymph through prepupa and pupa to winged adult. The nymphal instar preceding the prepupa secretes a protective cover or test under which these complex life changes take place. Each family of scale insects is characterised by a different type of male covering, whether cocoon, cap or test. Male mealybugs make rather fluffy cocoons from cottony wax strands, eriococcids produce woven wax covers, while armoured scales incorporate their moulted skins into waxy caps. The Coccidae or soft scales construct glassy wax tests. This test, being rigid, needs a mechanism to allow for the emergence of the adult male. A suture across the posterior third of the test enables the back plate to flex at a pair of hinges (so forming something akin to an “up-and-over garage door”). The hinges are secreted by groups of tubular ducts on the dorsum of the 2nd-instar males. The rows of hexagonal wax-plates found in the male tests of most New Zealand Coccidae are apparently unique in the way they are constructed. Scanning electron micrographs show the detail and diversity of the hinge types and how the hexagonal plate structure of the test is distinct from the back plate suture. Very little research has been published on male scale insects and even less on their coverings. In comparison with North American species, only two species of New Zealand native soft scales have male tests similar to those in other parts of the world.

SOME CHARACTERISTICS OF THE DEVELOPMENT OF THE SEX ORGANS IN MARGARODID MALES.

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A comparative study of the male sex organs of three subfamilies of the Margarodidae (namely Margarodinae, Monophlebinae and Coelostomidiinae) has

shown that some morpho-functional rearrangements occur in their ontogenesis during the pre-imaginal period. These changes lead to a reduction of the testes and the formation of an evolutionarily new structure, a spermsac filled with semen bundles.

During this general process of structural transformation, two types of spermsac construction can be distinguished, which allows the males of these subfamilies to be divided into two groups:

1. A group which has a spermsac with an ejaculatory duct which penetrates the more or less long, sclerotised penis (e.g., as in species of *Porphyrophora*, *Steingelia* and *Matsucoccus*)

2. A second group where the ejaculatory duct opens into the spermsac and the penis is very short and straight. In this group, the duct is turned out during copulation and then lowered into it - as in species of *Icerya*, *Drosicha* and *Neomargarodes*.

The inner position of the ducts in the male sex organs of some scale insects (e.g., male *Neomargarodes* which retain rudiments of the testes) suggests that this is the primitive condition and that the external position of the ejaculatory duct is secondary. In addition, further study of the Margarodidae has shown that the duct has evolved differently in different groups. Thus, in the first group, the penis tube with the ejaculatory duct within it has developed progressively, while in the second group, in which the penis tube is short, the development of the ejaculatory duct seems to have occurred within the spermsac.

PHYLOGENY OF THE MARGARODIDAE (HEMIPTERA: COCCOIDEA) USING MOLECULAR SEQUENCES.

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In the past, the taxonomy of the Margarodidae has been based solely on morphological features, mainly those of adult females. However, the reduction and loss of structures makes it difficult for evolutionary relationships to be estimated from morphology alone. Morrison (1927) characterised the margarodids by their possession of abdominal spiracles in all stages and compound eyes in the adult males, two features that are clearly not shared derived features (synapomorphies) (Miller, 1984). The characters upon which the family is based are ancestral features (plesiomorphies) that margarodids share with other hemipterans. Thus, the Margarodidae may be a paraphyletic grouping of species that could not be placed in other families (Schlee, 1969), rather than a monophyletic group. A re-construction of margarodid phylogeny using molecular sequences and cladistic methodology was presented, addressing the question of monophyly.