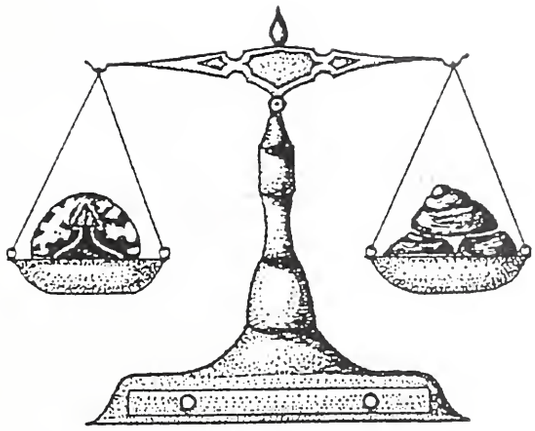
The Scale



Editors: Dug Miller & Gary Miller
Systematic Entomology Lab.,
Plant Science Institute, USDA
Henry A. Wallace Beltsville
Agricultural Research Center
Bldg. 005, Rm. 137
10300 Baltimore Ave.
Beltsville, MD 20705 USA
email: dmiller@sel.barc.usda.gov

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Mealybugs

Jack (John) W. Beardsley, January 18, 2001

Among the bugs that plague our plants,
There are those beloved by ants.
Mealybugs to be specific,
Are among the most prolific.
Mealy wax adorns their bodies;
Soft and plump, the're insect oddies.
No wings have they; they cannot fly,
But in their mealy beds they lie,
Sucking sap from leaf and twig;
Small they are, but damage big.
Nearly all their time is spent
Pumping sap through mouth to vent.
And the stuff they void from anus
Creates a mess that's moist and heinous.
Sticky sweet this buggy poo,
And we call it honeydew.
You or I would never eat it;
Yet the ants with joy do greet it.
Sugar sweet it lifts their mood.
Soon they feed it to their brood.
Trails of ants will soon appear
To partake this formic beer.
They guard their bugs with jealous zeal;
Allow no other to share their meal.
Chase away all wasps and spiders,
To protect their bug providers.
This makes life a bit more quiet
For those bugs, whose only diet
Is the sap that flow, I fear,
In the plants that we hold dear.

TOPIC FORUM

This is a new section for "The Scale". Three discussion papers are presented in preparation for the meetings in Padua. Please take the time to read these perspectives on the higher classification of the Coccoidea-Coccinea and the Homoptera-Hemiptera and be prepared to enter into the discussion.

Hemiptera or Homoptera; Coccura, Coccinea or Coccoidea?

Michael Kosztarab
Virginia Tech, Blacksburg, VA

We have to make up our minds about the appropriate higher taxonomic categories where our subjects of study, the scale insects, belong. Coccidologists currently include various taxonomic ranks above the family level in the titles of their papers, book chapters and books. In a review of article titles for 1999 in The Scale, some of us even use Homoptera in one paper and Hemiptera in another of two papers published during the same year.

It surely looks contradictory in the eyes of other entomologists and library catalogers. They must be saying, "Why can't we make up our minds?" And, they are right. Those colleagues, publishing in the United Kingdom or in the former British Commonwealth countries, normally use Hemiptera, while those of us in the United States usually use Homoptera. Which of these is the correct higher taxonomic category to be included in the titles of our future papers? Should we use Homoptera as an order, or as a suborder name under Hemiptera? Let us debate this issue and agree on a standard and use it in the future. Upon agreement, let's inform journal editors and our professional societies on the appropriate standardization. The Coccidology session on this topic at ISSIS-IX in Padua this year could serve as a milestone in the establishment of standardization of the higher category name that includes the scale insects.

The other higher taxonomic category name to be standardized for all scales, after debating and probably voting on it in Padua, could be the future use of the superfamily name Coccoidea, or the suborder name Coccinea or even the already proposed order name Coccura.

Before our debate, some colleagues may want to consult other Sternorrhyncha specialists about the highest taxonomic category names already used for scale related groups, e.g. for all aphids, whiteflies, and adelgids.

Our decision in selecting the appropriate higher taxonomic rank and category name for inclusion of all scale insect families should be based on comparisons with related groups (aphids, whiteflies, adelgids, etc.) on a large variety of criteria of taxonomic value. Some of my cited literature sources are found in former scale bibliographies and in issues of The Scale. Other bases for deciding the status of the taxa might be: morphology (e.g. number of tarsal segments, of claws, etc.), in both adult males (Boratynski & Davis 1971; Giliomee 1990) and females, and their immature stages (Williams, D.J. 1986); formation of protective covers (Stoetzel 1976); comparative ultrastructure of wax-producing glands (Foldi 1991); polymorphism (Takagi 1990), including host-induced polymorphism (Liu et al. 1989); their unique sperm (Robison 1977); their life cycle (male and female development) and biology, including host-plant specificity; ecology (Beardsley & Gonzalez 1975); adaptations (Gullan & Kosztarab 1997), e.g., egg-protecting

methods; genetics, including their unique chromosome systems (Brown 1977; Nur 1980); phylogeny (Miller & Miller 1993; 1993c), including molecular phylogeny and records from fossil scales (Koteja 1990); behaviour, including their unique honeydew droplet disposing mechanism and associated structures (Danzig 1983, 1986), and finally, their associated unique endosymbionts (Tremblay 1977, 1989).

Input on this subject from colleagues before ISSIS-IX, especially from those not able to attend the meeting, is welcomed and when permitted will be cited.

CATEGORY, NAME AND AFFILIATION OF SCALE INSECTS

Jan Koteja
Institute of Applied Zoology, Krakow, Poland

It is a very good idea to devote some time for a special debate at the ISSIS in Padua, to discuss scale insects, the object of our love and study, particularly concerning their name, category, and placement with other bugs. I would like to add my own opinion regarding the suggestions presented by Michael Kosztarab[1)].

1. It should be strongly emphasized that names and taxa, nomenclature and systematics, belief and information, are independent **to some extent**. A few examples:

a. The name "Hemiptera" (Homoptera, Sternorrhyncha, etc.) in paper titles is a bit of **information** that helps people unfamiliar with scale insects to place these creatures. They **do not** necessarily reflect our opinion on the status and relationships of the scales. The application of any of these names largely depends on the periodical in which the article is published. No wonder various names are included in paper titles by the same author in the same time frame!! For coccidologists it would be enough to mention just the family to which the object of study belongs.

b. Names, obviously, refer to objects. With the change of objects (or our knowledge of them), names also change. Thus, one day we call the object " a nice girl", and later " a distinguished lady". And nobody wonders about our unstable minds. In fact, all objects are *in statu nascendi*. Currently, results of **some** investigations have demonstrated that groups united in Homoptera **may not** be related[2)]; and we are confused and wonder if we should use the name Homoptera. With the discovery of DNA (and other) differences within "homopterans" the position and relationships of scale insects did not change; (on the other hand, these differences are a problem for students of the "auchenorrhynchans'). Thus, the information (in a title) that scale insects are "homopterans"', i.e., certainly **not** heteropterans, is correct. As an alternative the taxon and name Sternorrhyncha (aleyrodids+psyllids+aphids+coccids) has been suggested. However, only a few zoologists are familiar with this name and the monophyly of this group is questioned[3)].

c. Authors of the code of zoological nomenclature strongly emphasize that the nomenclatural rules do not limit the freedom of researchers or their eventual taxonomic decisions. The code refers to **formal** features of names and not to the zoological merit of taxa. This point is very difficult for many zoologists to understand.

2. We distinguish "lower" and "higher" taxa, i.e. taxa of various levels or categories;

species being the lowest, kingdom the highest. How many levels are between them? Many!!! Use of Hennigian methods gives **many** levels; too many! Being aware of this evidence, authors of the Code limited the rules to three levels: species, genus and family categories; the superfamily, subfamily, tribe and subtribe being family-group categories. Russian paleoentomologists[4] extended the rules to higher categories, and changed Coleoptera into Scarabaeiformes, Hemiptera into Cimicomorpha etc. etc., i.e., names derived from nominal genera. This idea and procedure has not been generally accepted, fortunately.

3. The classification of taxa between superfamily and order is like a volcano with permanent eruptions, depending on new discoveries achieved by means of new methods or reinterpretation of 'old' data. And this is "normal" in science. We cannot decide whether "Homoptera", "Aphidiformes", "Coccomorpha" and the like are "correct" names, categories or taxa by means of "common agreement" or voting! It is a question of scientific belief of individual researchers, under the conditions that they know what they are talking about. Often various "specialists" propose new higher level classifications and introduce new names but they can hardly recognize scale insects and aphids in the field. Unfortunately, knowledge of scale insects, their true nature and diversity, is extremely poorly known among entomologists. For instance, most paleoentomologists believe that wingless fossils (including evident crawlers!) are females, winged forms - males - without being aware of the existence of 'larvae' and apterous males.

4. Currently, in various disciplines, scale insects are considered a family, superfamily, cohort or suborder[5]. The question is what category would we, the coccidologists, like to ascribe to these insects. Most of us prefer a superfamily level with the obligatory (Code!) name Coccoidea. The next lower category is family, i.e. Ortheziidae, Coccidae, Diaspididae etc. Note that with this concept we are devoid of the freedom to recognize higher (than family) formal groupings of the scale insects. How, then, can we express the evidence that armoured scales are definitely different from other scales, that ortheziids and matsucoccids are much more closely related to each other than they are to pseudococcids or coccids, etc. etc.? The only possibility is to lower the status of well established and currently accepted families into subfamilies, subfamilies into tribes and so on. Please remember that we are still beginners in this field (our knowledge of the "margarodids" is very poor!). I am quite certain that a formal category between family and superfamily will be urgently needed in the near future.

5. Balachowsky, Bodenheimer and Borchsenius were aware of this problem and ascribed to the scale insects a category slightly higher than superfamily (Coccinea or similar), and divided them into two (archeococcids and neococcids) or three (by distinguishing the diaspidids as a separate branch) taxa and placed them higher than the family category. These branches received a formal superfamily status (Orthezioidea, Coccoidea) in further application. This resulted in the confusing or misleading usage of the superfamily name Coccoidea, either as covering all scale insects or only a group of them.

6. Similar conditions occur in other sternorrhynchans (the aphids, aleyrodids and psyllids), except that the coccids are many, many times more abundant and diverse in all aspects. Superfamilies have also been recognized within each of these groups, for instance Aphidoidea and Phylloxeroidea (or Adelgoidea) in the aphids.

7. It is somewhat surprising and strange that coccidologists (including myself) have never

dealt with the systematics or phylogeny of hemipterans except scale insects. I do not know of even a single modern original concept proposed by a coccidologist that considers the phylogeny of sternorrhynchans and places the scale insects among them. Instead, we worry about the feelings and opinions of librarians who may wonder about the usage of different names and categories referring to scale insects in paper titles. Maybe it is a kind of modesty.

8. It is necessary to distinguish between taxa and names that are governed by the Code, and associated with nominal genera and species and type specimens, on one side, and various rankles taxa and vernacular names, on the other. In the former group we are obliged to follow strictly the nomenclatural rules; in the latter, we don't need to worry about the category of taxon (group, clade, lineage, branch etc.) or suffix of the name. In my papers, I refer to the scale insects as "Coccinea", a taxon higher than a superfamily. The name could be as well Coccina, Coccodea, Cocciformes or Coccomorpha; it makes no difference to me, and the Code of Zoological Nomenclature does not govern these names.

9. In English the vernacular name of the object of our study is "scale insects" or, currently, a name derived from the scientific superfamily name Coccoidea - "coccoids". However, only some dozen years ago "coccids", derived from the family name Coccidae, was commonly used, and still is used in some languages, for instance the Russian "kokcidy" (not "kokkoidy"). Respectively, the science on scale insects is "coccidology", and not "coccoidology". Since the category and name of the scale insects may change (guaranteed by the freedom of research), the vernacular name of scale insects would also have to be changed which is a nonsense procedure. For this reason I would suggest the traditional name "coccids" for all scale insects in general papers and add "sensu stricto" (s. str.) in cases when we mean the Coccidae (soft scales). This provides a kind of vernacular stability for the name of scale insects. It avoids the instability that would be caused if the vernacular name was altered each time an author changed the rank or name of the scales.

10. Conclusions:

a. Coccidologists should be more concerned with research on scale insect relationships within sternorrhynchans, and should not only rely so heavily on the suggestions of other entomologists. Scale insects are a large and extremely diverse group and are worth study in this respect.

b. We should not worry about the name of scale insects included in paper titles. They certainly are hemipterans. "Homoptera" (although paraphyletic) is more informative for more readers; "Sternorrhyncha" may be more useful in specialized journals. With time, Sternorrhyncha will certainly replace Homoptera.

c. I would suggest considering the scale insects as a taxon (slightly) higher than superfamily, named Coccinea or something similar; with respect to other members of the Sternorrhyncha.

d. Rankles taxa and informal names should be more widely used in any phylogenetic research, both within the scale insects and sternorrhynchans.

e. I prefer "coccids" as a vernacular name equivalent to "scale insects" rather than "coccoids".

Footnotes

1) I am referring to the manuscript kindly submitted by Prof. Michael Kosztarab.

2) Consult Gullan P., 1998, Why the taxon Homoptera does not exist, VIIIth ISSIS, Abstracts.

3) Shcherbakov D.E., 2000, The most primitive whiteflies (Hemiptera; Aleyrodidae...) from the Mesozoic of Asia..., Bull. Nat. Hist., Geology Ser., 56: 29-37. A piece from this paper: "... "Paleontological evidence supports the classification of Homoptera proposed by Börner... and developed by Hennig and Schlee who group whiteflies with psyllids separating them from aphids plus coccids. The fossil record indicates that these two lineages were separate from the very beginning, so, instead of the polyphyletic [*sic!* JK] 'Sternorrhyncha', two subordinal units within Hemiptera s.l. are used: Aphidinea (including Aphidomorpha and Coccomorpha) and Psyllinea (including Psyllomorpha and Aleyrodomorpha)... In contrast, molecular phylogenies of Hemiptera... show the whiteflies lineage in a variable position, ... even as sister group of psocids....but never as a sister group of psyllids.... so the morphological and paleontological evidence should not be discredited simply in favour of novel molecular techniques."

4) I mean students from the Arthropod Laboratory at the Paleontological Institute RAS, Moscow. Members of this excellent team, especially Dr A.P. Rasnitsyn, Dr D.E. Shcherbakov and Dr Y.A. Popov, discovered many scale insect fossils in various world collections.

5) Hennig (1981, p. 254 and other) uses the name "Coccina" for the scale insects (respectively "Aphidina" for aphids, etc.), without defining its category. The name "Coccidomorpha" (at superfamily level) was perhaps first used by Bekker-Migdisova (In Rodendorf, 1962) to contain "Coccina" and fossil scale insects. Strümpel (1983) uses "Aphidiformes" (= Aphidomorpha) as an infraorder to contain scale insects and aphids each as superfamilies Coccoidea or(!) Coccina, respectively Aphidoidea, and "Sternorrhyncha" as a hemipteran suborder. Shcherbakov (1990, 2000) considers Aphidinea (with Coccomorpha and Aphidomorpha) as a hemipteran suborder. (1981) includes to the Aphidina (sic!) also Psylloidea and Aleyrodoidea. Heie (1981) recognized several superfamilies within aphids (Aphidodea, in Aphidomorpha Homoptera), later (1999), only two. The group and name Sternorrhyncha is questioned by Hennig, Schlee and Shcherbakov on the grounds of the fossil record (cf. 3)). According to Williams (1969) the name "Coccinea" was first used by Baier 1938, and "Coccaria" by Atkinson 1885, but I do not know the context.

Do we need to change the rank of the higher taxa of scale insects (Hemiptera: Sternorrhyncha: Coccoidea)?

Penny Gullan, University of California, Davis, USA (pjgullan@ucdavis.edu)
Dug Miller, Systematic Entomology Laboratory, PSI, USDA, Beltsville, Maryland, USA (dmiller@sel.barc.usda.gov)

At the next International Symposium of Scale Insect Studies (ISSIS), to be held in Padua, Italy, there will be a special session on the classification of scale insects with emphasis on

questions concerning the rank of higher taxa. This session is being organized by Professor Michael Kosztarab, who has published a preliminary discussion document in this issue of *The Scale*. We wish to present some additional views, with the intention of providing balance to the ensuing deliberations. However, we agree with the sentiments expressed by Professor Kosztarab that we must consider users of taxonomic names, and thus we should promote the stability of names. We also must strive to achieve an evolutionary classification of scale insects.

Several issues require consideration:

1. Should the name Homoptera be used as a higher taxon for the scale insects?

This question is integrally related to the next question, although the answer to this first question is extremely clear-cut from a phylogenetic perspective. The taxon Homoptera is paraphyletic and as such is an unnatural unit (in an evolutionary sense) and should be abandoned as a formal name. The paraphyly of the Homoptera has been demonstrated by assessment of morphological data (e.g. Carver *et al.*, 1991; Zrzavy, 1992) and by phylogenetic analysis of nucleotide sequence data (e.g. von Dohlen & Moran, 1995; Campbell *et al.*, 1995), as reviewed by Gullan (2001). Even Hennig (1981, p. 239) questioned the monophyly of the Homoptera. Hence authors of papers on scale insects should be using the ordinal name Hemiptera and/or subordinal name Sternorrhyncha (see below) to refer to taxonomic ranks above scale insects. This brings us to the next point.

2.What should be the rank of the taxon containing all scale insects?

Should it remain superfamily Coccoidea, or should it become suborder Coccinea, infraorder Coccodea (e.g. Maw *et al.*, 2000), or even order Coccura. As Professor Kosztarab suggests, coccidologists cannot decide this alone as the rank given to scale insects has repercussions for all other sternorrhynchans and for all other hemipterans. The monophyly of the Sternorrhyncha, containing the aphids, scale insects, jumping plant lice and whiteflies, is undisputed (see Schaefer, 1996, especially pp. 6-7) and current molecular evidence most strongly supports the Sternorrhyncha as the sister group of all other hemipterans (e.g. von Dohlen & Moran, 1995; Sorenson *et al.*, 1995). Relationships among the other hemipteran groups is presently a matter of much controversy. For nomenclatural stability, Sternorrhyncha should be retained as a suborder. This name has been in use for a long time, including in textbooks (e.g. Borror *et al.*, 1989; Carver *et al.* 1991; Gillott, 1995), and refers to a natural phylogenetic unit. If the Sternorrhyncha were to be elevated to ordinal status, then their sister group, the so-called Euhemiptera - currently a rankless clade (Sorenson *et al.*, 1995), also could become an order, and the taxon Hemiptera would disappear (redefining Hemiptera to exclude Sternorrhyncha would be confusing, but is another option). However the Hemiptera is a well-defined monophyletic group, and all bugs are recognized readily by entomologists. Such changes would disrupt all users, only to allow the scale insects to be a suborder. We argue that it is unnecessary and undesirable to elevate them to suborder status and, further, that there is absolutely no justification for the scale insects to be an order in their own right. The possession of many unique features is irrelevant to the question of rank - what is important is the relationships of scale insects to their relatives, the rank of their relatives, and the stability of names and rank.

Systematists specializing in the other three sternorrhynchan groups almost universally refer to their groups as superfamilies. The sister group of scale insects is the aphids and so the rank of aphids is relevant to that of scale insects. Internationally renowned aphidologists, such as

Roger Blackman, Victor Eastop, Carol von Dohlen, Nancy Moran, Georges Remaudière and Manya Stoetzel, who are either systematists or phylogeneticists or both, all use the three-family system for aphids. That is, only families Aphididae, Adelgidae and Phylloxeridae are recognized and are placed within the superfamily Aphidoidea. Refer to any of the following recent papers or books: Blackman & Eastop (2000), Eastop (1995), Remaudière and Remaudière (1997), or von Dohlen & Moran (2000). A minority of workers use a multi-family, two-superfamily classification for extant aphids (e.g. Heie, 1999; Maw *et al.* 2000), but even Heie uses the names Hemiptera and Sternorrhyncha. Similarly, among psylloid researchers, the group is universally recognized as a superfamily, Psylloidea, by the active systematists. Refer to any of the following recent publications: Burckhardt (1994) Burckhardt *et al.* (1999), Burckhardt and Basset (2000), Hollis and Martin (1997) or Hodkinson and Bird (2000). No whitefly systematist has ever suggested that Aleyrodoidea (with a single family, Aleyrodidae) is anything but a superfamily. Refer to recent publications by Campbell *et al.* (1994), Martin (1999), Martin *et al.* (2000) or Russell (2000), although Louise Russell continues to use "Homoptera". Thus there is no precedent among the other sternorrhynchans for abandoning the superfamily rank.

Within the superfamily rank, coccidologists are free to recognize formal or informal higher taxa within the Coccoidea. Taxonomists in some other insect orders, e.g. the Lepidoptera, refer to clades at higher levels without necessarily specifying the rank of those clades, e.g. the lepidopteran groups Myoglossata, Neolepidoptera, Apoditrysia, etc. (Nielsen and Common, 1991) or they simply write the word "clade" before a taxon name, e.g. clade Coelolepida (e.g. Kristensen, 1998). Thus, the monophyletic neococcoid (or neococcid) group does not have to have a specified rank. We cannot give named ranks to every monophyletic group -- there are simply not enough ranks in the traditional taxonomic hierarchy to do so.

3. What is the appropriate rank of the higher taxa (currently subfamilies or in some cases tribes) within Margarodidae *sensu lato*?

This question was not raised by Professor Kosztarab, but Dr. Yair Ben-Dov is considering it in relation to the compilation of data on margarodid genera for ScaleNet. Also Dr. Imré Foldi, who is working on a revision of the genera, is interested in the higher classification of margarodids for his work. Dr. Jan Koteja (1974a,b) proposed a phylogeny and classification of the scale insects that, among other things, gave family rank to a number of groups currently placed as subunits of the Margarodidae. More recently, he has described several new families (e.g. Koteja, 2000a) and presented fossil data to suggest that archaeococcoids (= archeococcids = at least margarodids *senso lato* plus ortheziids) represent the relics of an ancient radiation (e.g. Koteja, 1990, 1996, 2000a,b, 2001). He recognizes a number of families, such as Matsucoccidae, Steingeliidae, Monophlebidae, Pityococcidae, etc., for taxa that most other coccidologists recognize as margarodid subfamilies or tribes, following Morrison (1928). The morphological disparity of the various margarodid s.l. higher taxa, their great age in the fossil record (e.g. Koteja, 2000a,b, 2001) and also the difficulty of reconstructing their interrelationships (Gullan & Sjaarda, 2001) all suggest that we should re-examine the higher classification of margarodids. Perhaps this is something that we could discuss fruitfully at the next ISSIS.

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NECROLOGY

Wally Dekle

On Sunday, October 29, 2000 George (Wally) Dekle died at Eden Gardens in Gainesville, Florida at the age of 84. Wally was an entomologist at the Division of Plant Industry of the Florida Department of Agriculture and Consumer Services in Gainesville. According to ScaleNet he published 21 papers on scale insects including a book on the Florida armored scales and was honored by colleagues with the patronyms *Cerococcus deklei* a pest of hibiscus in Florida and the Caribbean area and *Melanaspis deklei* an armored scale from Florida, Georgia, Mexico, and the West Indies.

Jack Beardsley

On Monday, February 5, 2001 Jack (John) W. Beardsley died of a heart attack while working on the Bishop Museum collection. This is the obituary that was published in a Hawaii newspaper: "Emeritus Professor of Entomology John W. Beardsley passed away last Monday while working at the B.P. Bishop Museum. He was 74 years old. Dr. Beardsley was an internationally recognized authority in the areas of biological control and insect systematics, particularly with respect to the mealybugs and scale insects of major significance to agriculture in the State of Hawaii. During his career, he conducted extensive research on these insects as well as their natural enemies. He was recognized as an authority on Hawaiian insects as well as the mealybugs and scale insects of the world. During his extensive career, he authored over 150 scientific articles in refereed journals, book chapters, and reviews. He contributed over 500 published scientific notes on new immigrant insects, new host records and new island records. Dr. Beardsley served as Chair of the Department of Entomology from 1981-1991."

A quick search of ScaleNet (which does not currently cover armored scales, pit scales, or margarodids) reveals that Jack published 73 papers on scale insects, described 11 genera (2 eriococcids and 9 mealybugs), 47 species (1 soft scale, 4 eriococcids, 1 halimococcid, 1 phenacoleachid, and 40 mealybugs), and was honored by his coccidology colleagues with 5 patronyms. He was well known for his diverse interests in scale-insect systematics. He was the first to examine an array of male mealybugs intensively, was interested in fossil scales, was an avid collector and recorded many invasive species of scales and other insects in Hawaii before invasiveness became a buzz word, had a comprehensive knowledge of the scale insects of the Hawiian Islands, published an important book on the scale insects of Micronesia, wrote a fascinating chapter on gall-forming scales, and had nearly completed a comprehensive study of the Australian genus *Lachnodius*. Jack's accomplishments are truly outstanding. They have added to our understanding of scale insects in a very significant way. He will be missed.

Jack sent a contribution for "The Scale" on January 18, 2001. It is included below in the "News from around the world" section. He also contributed the mealybug poem on the first page.

SCALE INSECT FORUM

This web site has added some new categories that many of you may find interesting including a prepublication area, requests for information section, image gallery, a download area for obtaining difficult to locate publications (they currently have Borchsenius 1966 available), and much more. A preview of the ISSIS-IX meeting in Padua, Italy is available under "This issue topics." You can view the site at http://193.204.185.103/scaleinfo/scale.htm and see what it has to offer.

ISSIS-IX ON THE HORIZON

The organisation of ISSIS-IX, to be held in Padua, Italy, September 2-7, 2001 is proceeding on schedule. Presently, 96 delegates from different countries are registered. The most numerous are from USA (12 delegates), Israel and Turkey (6 delegates), France (5 delegates), Georgia (former USSR), Egypt and New Zealand (4 delegates). The Italians number 19. The Symposium will be held at the Faculty of Agriculture, which is located in Agripolis, Legnaro, a village 15 km from Padua. Agripolis is the "town of Agriculture". The Faculty of Agriculture and Forestry, the Faculty of Veterinary, the Regional Agriculture Organisation are located at this location. The Opening Session will take place in Padua at the University Palace. For a virtual tour of the Palace of Padua (Palazzo BO) link to: http://www.unipd.it/main/storia.html. Please, help the Local Organising Committee and send your accommodation forms, title and abstracts of poster/ paper by the date reported in the second circular and in the Accommodation form. With regard to accommodations, please remember that booking depends on the availability of rooms; late reservations may not get their preferred accommodation. In case of full booking, another accommodation will be chosen for you. If anyone needs an official invitation to attend the ISSIS IX, remember please to ask for it. If specific wording is required in the invitation, please let me know when you ask for your invitation. If you have any difficulties or special requests, please don't hesitate to contact us. Looking forward to meeting you in Padua **The Local Organising Committee**, Giuseppina Pellizzari, Patrizia Dall'Ara, Paolo Fontana, Valeria Malagnini. e-mail: ISSIS@agripolis.unipd.it

COLLECTION INFORMATION

About Brazilian Scale Collections: A note from Penny Gullan: When I was in Brasil in September I visited Dr. Saulo Soria at the Instituti Oswaldo Cruz. I was able to examine a small part of the Costa Lima collection and I also asked Dr. Soria about the depositories of scale insect collections in Brasil. He very kindly sent me the following information, which may be useful to publish in the next ScaleNet. [Editor's Note: A list of types present in some of these museums was given in "The Scale" in 1993 by Claps 18: 2-12].

Hempel collection is at: Centro Nacional de Identificacao de Insetos, Departamento de Zoologia, Universidade Federal de Paraná, Caixa Postal 19020, 81531.990 Curitiba, Paraná, Pr., BRASIL (Referencia: Prof. Albino M. Sakakibara)

Part of the Costa Lima collection is at: Colecao Entomologica, Departamento de Entomologia, Instituto Oswaldo Cruz, IOC/FIOCRUZ, Avenida Brasil 4365, Manguinhos, Pavilhao Mourisco,

sala 201, 23045.900 Rio de Janeiro, RJ, BRASIL, (Referencia: Dr. Saulo de Jesus Soria Telephone 21.598.4342)
Most of the Costa Lima collection is at: Colecao Entomologica, Escola de Postgraduacao em Parasitologia Animal, Universidade Federal Rural de Rio de Janeiro (UFRRJ) Km 47, Antiga Rodovia Rio - Sao Paulo, 23851.970 Seropedica, Rio de Janeiro, RJ, BRASIL, (Referencia: Prof. Dr. Euripedes Menezes)
"Homoptera" and Hemiptera (in general): Museu de Zoologia da Universidade de Saõ Paulo Avenida Nazareth, s/n, Bairro Ipiranga, Caixa Postal 42694, 04299.970 Sao Paulo, SP., BRASIL, (Referencia: Dr. Ubirajara R. Martins)
For Diaspididae: Departamento de Biologia, Pontificia Universidade Catolica de Rio Grande do Sul (PUC), Cidade Universitaria da PUC, 90000.000 Porto Alegre, RS, BRASIL, (Referencia: Prof. Dr. Helio Corseuil Telephone 51.339.1511)

New York State Museum, Albany, List of Types
The following list comes from Timothy L. McCabe and J. K. Barnes (http://www.nysm.nysed.gov/bio_insect_mite_types.html)
COCCOIDEA

Ceroplastidia bruneri Cockerell, 1910, Can. Ent. 42:76. Syntypes: San Bernardino, Paraguay, S.A.(Bruner)(part of type)/ Ceroplastidia bruneri Ckll. Type material/ N.Y.S. Coll.

Diaspis cacti Comstock, 1883, 2nd Rpt. Cornell Univ. Exp. Sta. Dept. Ent.:91. Syntypes: Comstock No. 181 [sp?]/ J. A. Lintner Collection/ Diaspis cacti Comstock Type 9012.

Poliaspis carissae Cockerell, 1902, Entomologist 35:112. Syntypes: On Carissa, Durban, Natal, Africa, T.D.A. Cockerell Types Poliaspis carissae Ckll./ "Type" Ac. 9652.

Fiorinia carnelliae Comstock, 1880, Rpt. U.S.D.A.:329. Syntype: J. A. Lintner Coll./ det. as Parlatoria pergandii var. carnelliae Comst. 8558/ Uhleria carnelliae Comst. Type.

Lecanium caryae Fitch, 1856, Rpt. Ins. N.Y. 3:443. Syntypes: Hickory scale-insect and its chalk mark on the bark Lecanium caryae/ Coll. N.Y. State Agric. Soc./ Lecanium caryae Fitch labeled by Dr. Fitch.

Aspidiotus cerasi Fitch, 1856, Rpt. N.Y. State Agric. Soc.:368. Syntypes: Cherry Scale Insect. Aspidiotus cerasi/ Coll. N.Y. State Agric. Soc.

Eriopeltis coloradensis Cockerell, 1905, Can. Ent. 37:136. Syntypes: Boulder, Colo. Dec-1904 N.Y.S. Coll./ Type/ Eriopeltis coloradensis Ckll. 9862 Type Mat'l.

Pseudococcus cuspidatae Rau, 1937, Bull. Brooklyn Ent. Soc. 32:195, Paratypes, 4: N.J. [slide mount].

Coccus diversipes Cockerell, 1907, Davenport Proc. Acad. Nat. Sci. 10:130. Syntypes: Coccus diversipes Ckll on fern, Lucena, Philippines Is. (Townsend)/ Coccus diversipes Ckll Type Material/ Sept 27 '06/ 9894.

Aspidiotus furfurus Fitch, 1856, Rpt. N.Y.S. Agric. Soc.:352. Syntypes: Scurfy Bark Louse

Aspidiotus furfurus/ Coll. N.Y. State Agric. Soc.

Chionaspis gleditsiae Sanders, 1903, Ohio Nat. 3:413. Syntype, 1: Chionaspis gladitsiae Sand. Cotype Columbus, Ohio 11 Mar. 1903 on Gleditsia triacenthos cotype [slide mount].

Tachardiella glomerella Cockerell, 1905, Ent. News 16:52. Syntypes: Mesilla Val., N.M. Dec-1904 N.Y.S. Coll./ Tachardiella glomerella Ckll. Type Matl. ac. 9863.

Halimococcus lampas Cockerell, 1902, Entomologist 35:15. Syntypes: Durban, Natal, Africa 22-Dec-1902 N.Y.S. Coll./ Halimococcus lampas Ckll. Cotype 9653 [3 palm leaf samples].

Pseudococcus ledi Cockerell, 1911, Ent. News 22:217. Syntypes, 4: 1,2,3) Sand Lake, N.Y. 14 July 1910 N.Y.S. Coll. Cotypes 9811 [3 branch samples]. 4) Sand Lake, N.Y. July 14, 1910 C. H. Peck on ledum cotype 9811 [slide mount].

Drosicha lichenoides Cockerell, 1913, Jour. Econ. Ent. 6:142. Syntypes: Cotypes Drosicha lichenoides Ckll. On Ficus nota, Los Banos, Phillippine Is., 1912. Coll. C. F. Baker Sent by T.D.A. Cockerell 9820.

Chionaspis lintneri Comstock, 1883, 2nd Rpt. Cornell Univ. Exp. Sta. Dept. Ent., Cornell Univ.:103. Syntypes: Aspidotus on Viburnum lantanoides/ Comstock No. 251/ J. A. Lintner Coll./Chionaspis lintneri Comst. Type 8557.

Chionaspis micropori Marlatt, 1908, Wash. Tech. Ser. U.S.D.A. Ent. 16:25. Paratypes: China, Chionaspis micropori Marlatt. Part of type see orig. descr. for details./ Type material to N.Y. Coll.?/ Chionaspis micropori Marl. Type Material.

Phenacaspis natalensis Cockerell, 1902, Ann. Mag. Nat. Hist. 9(7):25. Syntypes: Phenacaspis natalensis Ckll. Type Material/ 9651 [leaf sample].

Aspidiotus pinifoliae Fitch, 1855, Rpt. N.Y.S. Agric. Soc.:488. Syntypes: Pine-leaf Scale-insect Aspidiotus pinifoliae/ Coll. N.Y. State Agric. Soc.

Lecanium pyri Fitch, 1854, Trans. N.Y.S. Agric. Soc.:809. Syntypes: Pear Scale Insect Lecanium pyri/ Coll. N.Y. State Agric. Soc.

Lecanium quercifex Fitch, 1858, Trans. N.Y.S. Agric. Soc-:805. Syntypes: White Oak Scale-Insect Lecanium querci/ Coll. N.Y. State Agric. Soc. [Although labeled L. querci, Comstock believed this to be the specimen before Fitch when he described L. quercifex (see 2nd Rpt. Cornell Univ. Agric. Exp. Sta.:134)].

Lecanium quercitronis Fitch, 1858, Trans. N.Y.S. Agric. Soc.:805. Syntypes: Quercitron Scale-Insect Lecanium quercitronis/ Coll. N.Y. State Agric. Soc.

Coccus salicis Fitch, 1851, 4th Rpt. N.Y.S. Cab. Nat. Hist.:69. Syntype: No. 873. Willow Coccus C. salicis Fh./ Coll. N.Y. State Agric. Soc./ Coccus salicis Fitch 1491/ Det. J. G. Sanders Jan 1915 Washington, D.C./ Lecanium corni Bouch det. Sanders.

Ceroplastes sanguineus Cockerell, 1905, Ent. News 16:162. Syntype: Paraguay, S.A. Nov-1908, N.Y.S. Coll./ Ceroplastes sanguineus Ckll. Part of Type. Villa Encarnacion Paraguay (Schrotky) 9798/ Ceroplastes sanguineus Ckll. Type Material.

Chionaspis spartinae Comstock, 1883, 2nd Rpt. Cornell Univ. Exp. Sta. Dept. Ent.:106. Syntypes: J. A. Lintner Coll./ Chionaspis spartinae Comst. Type 8559.

Pulvinaria occidentalis subalpina Cockerell, 1910, Jour. Econ. Ent. 3(5):428. Syntypes: Pulvnaria occidentalis subalpina Ckll. Part of type Ac. 9877 (immature).

Trionymus violascens Cockerell, 1913, Jour. Econ. Ent. 6:143. Syntype: Trionymus violascens Ckll. Part of type 9_19.

Icerya zeteki Cockerell, 1914, Jour. Econ. Ent. 7:148. Syntypes: Panama Canal Zone/ 9866/ Icerya zeteki Ckll. Cotypes [many on paper strip].

NEWS FROM AROUND THE WORLD

Editors Note: If you have news that you would like to have appear in the next edition I would be most happy to receive it. E-mails are especially appreciated.

Jack Beardsley, Alhambra, California. I am trying to earn enough these days, doing consulting jobs, to afford to pay page charges. Not much in press related to scales I'm afraid. One small paper designating a lectotype for *Dactylopius nipae* Maskell in the New Zealand Entomologist should appear soon. I'm doing some consulting work for the Hawaii Dept. of Agriculture in Honolulu related to plant and animal quarantine at the Maui Airport. Also, I'm identifying parasitoid Hymenoptera from there, and from Midway Atoll and other Leeward Hawaiian Islands, from the Bishop Museum. Went to Midway myself last year and collected Coccoidea, etc. Nothing but tramp species there, but quite a few new records since the last survey was made in the 1960's. I am enclosing a bit of doggerel [the poem on page 1] that you might find interesting. Regards to all. Jack B.

Vera Regina dos Santos Wolff, Brasil. I submitted my doctoral thesis on *Pseudoparlatoria* on October 18, 2000 and received a favorable evaluation. I intend to publish this work soon. The results encompassed nine new species, 25 redescribed species, and two new combinations. I have discovered material of another armored scale genus that I intend to describe separately. Last year Dr. Lucia Claps and I described *Dynaspidiotus riograndensis*. I will be happy to send copies of this paper to people who are interested. Dr. Claps from Argentina, Dr. Roberto González from Chile and I are planning to publish an atlas of the species of Diaspididae from Argentina, Brasil, and Chile with keys and illustrations.

Ferenc Kozár, Plant Protection Institute, Budapest, Hungary: I continue to work mostly on ortheziids. There are many new species in several genera from different parts of the World. I have decided to discontinue my previous strategy of publishing a separate paper for each major genus in a zoogeographic region (although some earlier manuscripts are now in press) and to complete a monograph of the Ortheziidae of the world. If I can finish in time, I would like to dedicate the book to Morrison in honor of his monograph 50 years ago. Thanks to Imre Foldi, I was able to spend two very successful and pleasant months in Paris where several new ortheziids were discovered in the collections. One of these has already been described as Matileortheziola angolaensis. I also have completed a revision of the

Carayonemidae, including several new species and genera. I currently am thinking about starting work on the Rhizoecinae group of mealybugs, since I have lots of material from different parts of the World taken from Berlese samples. I am afraid that this will be a much more difficult project than the one on ortheziids.

Benjamin Normark, Department of Entomology, University of Massachusetts, Amherst, USA: In my graduate work and in a series of postdocs, I have studied the phylogeny and evolution of alternative genetic systems (especially apomixis and haplodiploidy) in various insects: broad-nosed weevils, bark and ambrosia beetles, and aphids. I have long been fascinated by the tremendous diversity of genetic systems found in scale insects. This May I had a crash course in coccidology when I had the privilege of assisting Doug Williams, Dug Miller, Penny Gullan, and Ray Gill in sorting the dried scale material in the Bohart Museum at Davis. This fall I began a tenure-track faculty position at the University of Massachusetts and I am currently setting up a molecular systematics lab. I plan to study the evolution of scale insect genetic systems. My first major project is a molecular-phylogenetic study of the Diaspididae, focusing on resolving origins of the diaspidid chromosome elimination system, of apomixis, and of automixis. My student Lisa Provencher will be studying the molecular systematics and phylogeography of the *Aspidiotus nerii* complex. I have obtained funding for a 5-year Hatch project on "Molecular systematics and molecular identification of armored scale insects" and, in collaboration with Roy Van Driesche, for a molecular-systematics component of a study of beech scale (*Cryptococcus*). I am also participating, with Penny Gullan and Dug Miller, in drafting a PEET proposal on scale insect systematics. I would be very grateful for (a) any alcohol-preserved (or otherwise quick-dried or frozen) armored scale insects from anywhere, and (b) inquiries from prospective graduate students interested in the systematics, evolution, or genetics of scale insects.

Jan Giliomee, University of Stellenbosch, South Africa: Waktola Wakgari, a student from Ethiopia, received his Ph D at the University of Stellenbosch, South Africa at the end of 2000. His research under my supervision covered the biology and ecology of *Ceroplastes destructor*, an endemic wax scale (also occurring in Australia) causing damage to citrus. He also described the immature stages and studied the effects of insecticides on its dominant parasitoid. Penny Gullan and Carina Cilliers were the external examiners. Several papers on this work have been published or are in the process of being published. As a result of his good work, Waktola has received a post-doc stipendium and will remain at the University of Stellenbosch for the next two years to study the mealybug complex of citrus.

Yair Ben-Dov, Department of Entomology, Agricultural Research Organization, Bet Dagan, Israel: My official retirement occurred in 1999. Nevertheless, the Department of Entomology and the ARO have allowed me to maintain my laboratory in part of the facilities that I occupied previously. The official retirement did not interrupt my work, and I am proceeding with three major topics in scale-insect research. 1.) ScaleNet. This is a joint project with our colleague Dug Miller, Systematic Entomology Laboratory, USDA, Beltsville; we have been cooperating since 1995. So far the Israeli team has prepared and placed 9 family databases on the Internet, namely Aclerdidae, Beesoniidae, Carayonemidae, Coccidae, Conchaspididae, Dactylopiidae, Kerriidae, Lecanodiaspididae and Pseudococcidae.

We, at Bet Dagan, are continuing to build databases of the Asterolecaniidae, Diaspididae (subfamilies Aspidiotinae and Odonaspidinae) and Margarodidae. 2.) Mediterranean Mealybugs. This is a joint project with Daniele Matile-Ferrero, Museum National d'Histoire Naturelle, to revise all mealybug taxa from this region. So far we have completed about 10 papers that have improved our knowledge of the genera and species in this region. 3.) Scale insects (Coccoidea) of the Middle East. This research involve studies on the taxonomy, faunistics, life history and economic importance of scale insects in Israel and neighbouring countries in the Middle East.

Chris Hodgson, The National Museum of Wales, Cardiff, UK: Subject -- Proceedings of the VIIIth International Symposium on Scale Insect Studies - AND Request for Male Coccoidea. Firstly, I am sure that everyone will be delighted to know that I have completed my examination of the page proofs of the Proceedings of the last Scale Insect Symposium in Wye. It should, therefore be out later in the Spring. Also, I am currently describing as many male Coccoidea as possible with the intention of doing a phylogenetic study (with the help of Dug Miller) on their relationships. I am therefore keen to hear from anyone who has slides (or dry material) of males of almost any taxon. I am trying to describe at least 3-4 species in each taxon and so, to some extent, the more the better. I am particularly keen to get material of some of the taxa whose relationships seem open to question - of which there seem to be quite a few!! I am only interested in the macropterous males at this time. I would be very pleased if anyone willing to help should email me at (hodgsoncj@cardiff.ac.uk).

Doug Williams, Department of Entomology, The Natural History Museum, London, UK: There has been steady progress with my work on the mealybugs of southern Asia and most of the illustrations have been completed. I am about to start on *Pseudococcus*, the final genus. Writing up will take some time. Although Australia has shown some interest in publishing the work, nothing is finalised yet. In the past year I received a few interesting species of mealybugs inside thecae of the fungus *Boletus dimorcarpicola* on the roots of longan fruit trees in Thailand. The mealybugs are associated with *Pseudolasius* ants. I keep receiving remarkable mealybugs from the ant department of Ulrich Maschwitz, Frankfurt, and I am awaiting a collection associated with ants from Java, possibly the last I shall have time to include. During the past year I described 3 mealybugs associated with *Acropyga* ants, some held in the mandibles, in Dominican amber, at least 20 million years old. Hopefully this paper will be published in 2001.

Imre Foldi, Muséum National d'Histoire Naturelle, Entomology, Paris: I am working on several different projects and one or two of them should be finished this year including the Mediterranean margarodids and western Mediterranean kermesids. I continue to make progress on the phylogeny and morphology of the Coccoidea; I have added to the tentative phylogeny published in 1997, but the new results will not be publish for another 2-3 years. I have had difficulty finding as much time for research on the Coccoidea as in years past because of my responsibilities as President of the Entomological Society of France. Anyway, it will be very nice to meet with coccidology colleagues in Italy this year.

Penny Gullan, Department of Entomology, Davis, California: Penny Gullan moved into

her new lab at the University of California, Davis, in June 2000 (see her new contact details below). Most of her time since then has been spent setting up the lab and also rehousing and updating nomenclature of the coccoid slide collection of the Bohart Museum of Entomology (BME), UCD. Slides of all families, except the enormous collection of Diaspididae, some common species of other groups and some accession material, have been moved to new flat-tray storage cabinets in Penny's lab. In May 2000, Dug Miller and Doug Williams visited Davis for two weeks to assist with the sorting and identifying of the BME's dry collection of Coccoidea. For some of the time, they were assisted by Ray Gill, who escaped his administrative work at the CDFA whenever he could, and by Ben Normark, who has started a project on the molecular systematics of Diaspididae and visited UCD to interact with other coccidologists and learn more about Diaspididae. By the end of 2000, the student assistants in the BME, supervised by Dr. Steve Heydon, had completed the task of rehousing and labeling the whole scale insect dry collection consisting of about 20,000 boxes. During the re-curation work, an important manuscript by Gladys Hoke Lobdell came to light. Many of you may remember that the last issue of The Scale (Volume XXIV, 2000) had an important article by Terence Lee Schiefer on scale insects from the Lobdell collection that had been found in her son's attic and donated to the Mississippi Entomological Museum. The manuscript in the BME had apparently been sent (or given) to L.E. Myers because this name is handwritten on the inside cover and there are copies of a couple of letters between Myers and Lobdell inserted near the back pages. The work is a compilation of drawings, mostly of Pseudococcidae and Diaspididae but also a few species of Aclerdidae, Asterolecaniidae, Coccidae and Lecanodiaspidiae, plus lists of species and slides in the Mississippi Collection in 1931. There are no descriptions. The cover page of the manuscript has just the words: SCALE INSECTS OF MISSISSIPPI. PREPARED FOR PUBLICATION 1929GLADYS HOKE LOBDELL. DRAWINGS BY S. HOKE DeBORD. NEVER PUBLISHED BY THE MISSISSIPPI STATE PLANT BOARD DUE TO LACK OF FUNDS. In August 2000, Penny attended the International Congress of Entomology (ICE) at Iguassu, Brazil, and had the pleasure of meeting both Takumasa (Demian) Kondo and Cristina Granara de Willink for the first time. Other coccidologists at the meeting included Jan Giliomee, Bill Gimpel and Mike Williams, and so Demian organized a mini-ISSIS dinner. After ICE, Penny spent a further 2 weeks in Brazil visiting universities and also the Instituto Oswaldo Cruz in Rio de Janeiro where she meet Dr. Saulo Soria and examined part of the institute's collection of scale insects. Dr. Soria was extremely generous with his time and very helpful in providing information on the location and contact details of other collections of Brazilian scale insects. These details are reproduced elsewhere in this issue of The Scale. In late December 2000, Penny spent a week in New Zealand followed by five weeks in Australia, mostly working on scale insects and related research in her old department in Canberra. A memorable event occurred on January 24th 2001 with the submission of Lyn Cook's Ph.D. thesis on the evolution and systematics of the gall-inducing scale insect *Apiomorpha* (Eriococcidae). With Lyn free of the thesis writing, Lyn and Penny plan to get back to their molecular phylogenetic research on Coccoidea, although Lyn currently is employed researching legume systematics. Dr P.J. Gullan, Department of Entomology, University of California, One Shields Avenue, Davis, CA 95616-8584, USA, Tel: +1-530-754 5805, Fax: +1-530-754 5804

Gillian Watson, UK: I was made redundant by CAB International at the end of 2000, and am currently unemployed. I was part-way through compiling an ETI CD-ROM identification aid to Diaspididae of world importance. The University of Amsterdam and The Natural History Museum, London are negotiating to enable me to complete the CD-ROM on 100 species (80% of my time over the next 14 months at the NHM). I will also be identifying scale insects for the NHM Insect Information Service. This means that I am available for contract work in the remaining 15% of my time, and from April 2002 I will be looking for full-time employment. Does anyone out there need an experienced scale insect identifier/ taxonomist/ trainer/ field surveyor/ or a collaborator on a funded project? I also cover better-known species of aphids and whiteflies. I can be reached on G.Watson@nhm.ac.uk

Jan Koteja, Institute of Applied Zoology, Krakow, Poland: I am moved with the death of Dr. John Beardsley, an extremely friendly man. He has greatly contributed to our knowledge of the fossil scale insects; in the 70's and 80's he provided unpublished information and opinions on coccid fossils housed at the American and Canadian museums. His suggestions concerning various paleontological and general questions were very useful in my studies. The paper on the New Jersey amber scale insects was intended to be a kind of acknowledgement and appreciation of his generous help; unfortunately, it appeared a bit too late. **Please recall**: Twenty years ago, Dr. Kajetan Boratynski (+Dec 4, 1980) and prof. Zbiegniew Kawecki (+Jan 26, 1981) died. Dr. Boratynski initiated modern studies of male morphology and introduced numerical methods in scale insect systematics. You will remember the now classical papers of his students (J.G. Theron, M.S.K. Ghauri, J.H. Giliomee and S. Afifi). Prof. Kawecki stimulated development of scale insect studies for many years in both Cracow and Warsaw. I am one of many of his students; he devoted all his scientific life to the study of scale insects. **Fossils**: The number of registered scale insect fossils has increased to 1,570, items since my last report. All the specimens have been entrapped in resin or buried in rocky sediments while moving, thus their hosts remain a puzzle. There are only two exceptions to this rule, a Miocene impression fossil of a lauracean leaf with several diaspidid- (or coccid) like larvae or females, and a "leafy conifer shoot" with two, apparently "margarodid" larvae in Cretaceous New Jersey amber; none thoroughly examined. **Conference:** The IInd International Congress of Paleoentomology, will be held in Cracow, Poland, on September 5-6, 2001. [Organizer: The Natural History Museum of the Institute of Systematics and Evolution of Animals].

Jack Munting, South Africa: I wonder whether you remember me. I was the taxonomist working on scale insects in South Africa from 1962 - 1970. I was working with the National Collection of Insects in Pretoria. Much water has of course gone under the bridge: since I entomologised I went into high school biology teaching; then taught in Jerusalem for 4.5 years; back to South Africa where I then worked as head of the science dept. of a college for training teachers. In dec 1992 this folded and I was forced into early retirement. Took on a clerical job as administrator of the distance education courses for the Law Society of S A which is not of my choice but was forced upon me since at age 52. I was too young to live on my pension and too old to get back into teaching which I would have loved. So the Law Society of S A is where I am at present, and although I am not at all interested in matters

legal, I can get some satisfaction from doing a good job. Since being retrenched the closest I get to matters biological is wood turning which I thoroughly enjoy. The closest to taxonomy is trying to identify different indigenous trees by examining their timber. That's my life in a nutshell. Will be delighted to hear from you again. My email address is jack.cle@lssa.org.za.

Roberto González, Facultad de Ciencias Agrarias y Forestales, Universidad de Chile, Santiago: Roberto wrote an extensive letter about his current projects that somehow was lost in the mess on my desk [sorry Roberto]. I recall that he is especially interested in a project on the mealybugs of fruit trees. He also mentioned that he is considering retiring although he apparently hasn't made a final commitment.

Maren Gimpel, Gary Miller, and Dug Miller, Systematic Entomology Laboratory, USDA, Beltsville, Maryland: There is a new web page available that lists all of the scale species present in the U. S. National Collection of Coccoidea with associated type data (sel.barc.usda.gov/scaleframe.html). Gary has done a lot of work designing and preparing the page to go online and Debra Creel has been responsible for getting the database into shape so that Gary could put it on the web. Current and back issues (1996-2000) of **The Scale** are available at this web site. You can access them from the side menu on the main page or at http://www.sel.barc.usda.gov/Coccoidea/the_scale.htm. Hard copy of **The Scale** is not searchable, but use of the "Find" feature in the "Edit" menu of your browser allows a search mechanism. The big news this year is that the first (we hope not the last) of the hard-copy catalogs resulting from the ScaleNet project has been published, i.e., Miller, D.R. & Gimpel, M.E. (Collaborators Ben-Dov & Gibson). 2000. A Systematic Catalogue of the Eriococcidae (Felt Scales) (Hemiptera: Coccoidea) of the World. Intercept Ltd., Andover, U.K. 589 pp. ScaleNet continues to progress and Maren is more than half through our assigned area of the Diaspidinae and related groups. She informed me yesterday that she was working on the "N' s having finished such difficult genera as *Lepidosaphes* and *Leucaspis*. Two major additions to ScaleNet this year are a new query that allows a search for all or any part of a species name and a comparison table that will help with alternate spellings of authors names. We are working on including images and a way of identifying invasive speceies. We are planning to do a new volume on other smaller families in our assignment including the Cerococcidae, Halimococcidae, Kermesidae, Micrococcidae, Ortheziidae, Phenacoleachiidae, Phoenicococcidae, and Stictococcidae. Yair Ben-Dov indicated that the Israel team also is working on a book on some smaller families. Dug will be going to Davis again this year to work on the collection. Doug Williams will participate as will Penny Gullan, Ray Gill, and Benjamin Normark. This past year Gary traveled to St. Kitts to discuss the papaya mealybug, *Paracoccus marginatus*, and Dug went to Belize and Mexico to help with the pink hibiscus and papaya mealybug projects. Our current collaborative research continues on: *Newsteadia* (Kozár); some eriococcids in South America (Hodgson); descriptions of papaya mealybug instars (Miller and Miller); economic armored scales of the U.S. (Davidson); *Furcaspis* (Williams); *Antonina* (Williams); an unusual species of *Dysmicoccus* (Miller and Miller); new species of Chilean mealybugs of importance in quarantine (González); scale insects of importance in ornamental plants in Brasil (Peronti); selected scales of the Galapogos Island (Causton); etc.

RECENT LITERATURE

Compiled by Karen Veilleux

This is the first edition of "Recent Literature" that has been partially generated from "ScaleNet" . Karen has used the output from "ScaleNet" and modified it to complement last years contribution by eliminating anything that was included in the latter. She has maintained the unique citation codes for each entry. A detailed explanation of these codes can be found in Miller and Gimpel 2000. Essentially they are codes used in the ScaleNet database that are compiled by listing the first six letters of the first author's family name and the first two letters of the next two author's family names accompanied by the date. If there are more than two publications in the same year with the same authors then they are given a letter designation after the date. A paper by Williams and Watson in 1993 would be WilliaWa1993. A second paper by the same authors in 1993 would be WilliaWa1993a. A paper in 2000 by Cook, Gullan, and Stewart would be given the citation code of CookGuSt2000.

Abate, T., van Huis, A. & Ampofo, J.K.O. 2000. Pest management strategies in traditional agriculture: An African perspective. Annual Review of Entomology 45: 631-659. [AbateVaAm2000]

Notes: African agriculture is largely traditional, characterized by a large number of smallholdings of no more than one ha per household. Crop production takes place under extremely variable agro-ecological conditions, with annual rainfall ranging from 250 to 750 mm in the Sahel in the northwest and in the semi-arid east and south, to 1500 to 4000 mm in the forest zones in the central west. Farmers often select well-adapted, stable crop varieties, and cropping systems are such that two or more crops are grown in the same field at the same time. These diverse traditional systems enhance natural enemy abundance and generally keep pest numbers at low levels. Pest management practice in traditional agriculture is a built-in process in the overall crop production system rather than a separate well-defined activity. Increased population pressure and the resulting demand for increased crop production in Africa have necessitated agricultural expansion with the concomitant decline in the overall biodiversity. Increases in plant material movement in turn facilitated the accidental introduction of foreign pests. At present about two dozen arthropod pests, both introduced and native, are recognized as one of the major constraints to agricultural production and productivity in Africa. Although yield losses of 0% to 100% have been observed on-station, the economic significance of the majority of pests under farmers' production conditions is not adequately understood. Economic and social constraints have kept pesticide use in Africa the lowest among all the world regions. The bulk of pesticides are applied mostly against pests of commercial crops such as cotton, vegetables, coffee, and cocoa, and to some extent for combating outbreaks of migratory pests such as the locusts. The majority of African farmers still rely on indigenous pest management approaches to manage pest problems, although many government extension programs encourage the use of pesticides. The current pest management research activities carried out by national or international agricultural research programs in Africa focus on classical biological control and host plant resistance breeding. With the exception of classical biological control of the cassava mealybug, research results have not been widely adopted. This could be due to African farmers facing heterogeneous conditions, not needing fixed prescriptions or one ideal variety but a number of options and genotypes to choose from. Indigenous pest management knowledge is site-specific and should be the basis for developing integrated pest management (IPM) techniques. Farmers often lack the biological and ecological information necessary to develop better pest management through experimentation. Formal research should be instrumental in providing the input necessary to facilitate participatory technology development such as that done

by Farmer Field Schools, an approach now emerging in different parts of Africa. ***Phenacoccus manihoti*** is used as an example of a target of classical biological control efforts.

Abd Rabou, S. 1999. Parasitoids attacking the Egyptian species of armored scale insects (Homoptera: Diaspididae). (In English with summary in Arabic). Egyptian Journal of Agricultural Research 77(3): 1113-1129. [AbdRab1999]

Notes: A total of 18 parasitoids associated with the Egyptian armoured scale insects (Homoptera: Diaspididae) were recorded. The parasitoids belonged to the genera: ***Aphytis, Encarsia, Marietta, Habrolepis, Coccophagoides***. Keys to the parasitoids attacking each species of armoured scale insects in Egypt were constructed, based on the morphology of the adult female. The general characteristics of the adult parasitoids are illustrated, together with more detailed figures of some key characteristics. The keys were designed for use with slide mounted specimens, and the techniques for their preparation are described.

Acheche, H., Fattouch, S., M'Hirsi, S., Marzouki, N. & Marrakchi, M. 1999. Use of optimised PCR methods for the detection of GLRaV3: A closterovirus associated with grapevine leafroll in Tunisian grapevine plants. Plant Molecular Biology Reporter 17(1): 31-42. [AchechFaMH1999]

Notes: A report of a modification and optimisation of a previously published procedure for the detection of GLRaV3 in infected grapevine plants. GLRaV3 RNA was successfully detected not only in total crude nucleic acid extracts of infected grapevine tissues but also in viruliferous mealybug extracts by IC-RT-PCR. This detection was rapid, sensitive and specific without occurrence of any background. A comparative ELISA, RT-PCR and IC-RT-PCR assays were carried out and revealed the greater sensitivity and specificity of PCR techniques. GLRaV3 is normally transmitted by ***Planococcus ficus, P. citri, Pseudococcus longispinus, P. calceolariae, Ceroplastes rusci*** and ***Pulvinaria vitis***.

Ackonor, J.B. & Mordjifa, D.K. 1999. Parasitism and predation in ***Planococcoides njalensis*** (Laing) (Homoptera: Pseudococcidae) on cacao in Ghana. Tropical Agriculture 76(4): 269-274. [AckonoMo1999]

Notes: From 1988 to 1992, 1870 colonies of ***Planococcoides njalensis*** (Laing) were sampled from 188 randomly distributed cacao farms in Ghana. Natural enemies obtained from these colonies included two predatory beetles, ***Hyperaspis egregia*** and ***Scymnus (Pullus)*** sp., and a predatory Diptera, ***Coccodiplosis coffeae*** (Cecidomyiidae). Six hymenopterous parasitoids, ***Aenasius abengouroui, Anagyrus beneficians, A. amoenus, Leptomastix dactylopii, Tropidophryne melvillei***, and ***Chryptochetum (Lestophonus)*** sp. were observed. A hymenopterous hyperparasitoid, ***Cheiloneurus carinatus*** and a parasitoid of ***C. coffeae***, i.e., ***Xyphigaster pseudococci***, were also observed, as were unidentified Lepidoptera whose exact role was uncertain. ***Coccodiplosis coffeae*** was the most common natural enemy, followed by ***A. abengouroui, Hyperaspis, Scymnus, A. beneficians, L. dactylopii***, and ***C. carinatus***. The rates of parasitism were low for the individual species with the highest (0.8 to 6%) by ***A. abengouroui***. Simultaneous parasitism by more than one species was common in infested colonies. This gave rise to monthly parasitism levels ranging from 0.9 to 11.6%. The observations of ***A. abengouroui, A. amoenus***, and ***H. egregia*** appear to be the first indication of their presence on Ghanaian cacao. The recovery of ***L. dactylopii*** suggests its establishment in Ghana after it was introduced here in 1949. The frequencies of occurrence of the beneficial insects and their proportional representations in the mealybug's colonies are discussed.

Adu Ampomah, Y., Adomako, B., Owusu, G.K., Ollennu, L.A.A. & Bekele, F. 1999. Breeding for resistance to the cocoa swollen shoot virus in Ghana. In: Proceedings of the International Workshop on the Contribution of Disease Resistance to Cocoa Variety Improvement. 173-179. [AduAmpAdOw1999]

Notes: [Conference held in Salvador, Bahia, Brazil, 24-26 November, 1996.] Cacao swollen shoot virus (CSSV) is caused by a badnavirus transmitted by mealybug (***Planococcoides njalensis***) and occurs in all the main cocoa [***Theobroma cacao***]-growing areas of West Africa. Progress on breeding for CSSV resistance in Ghana is discussed by referring to: variation in mealybug (***Planococcoides njalensis***) vectors; variation in CSSV isolates; resistance breeding, including varieties in use in 1969, development of Inter-Amazon hybrids (1969-81), methods of screening

for resistance (manual inoculation of seeds and mealybug inoculation), searching for pollen parents to replace *Amelonado*, searching for female parents, and mutation breeding; mild strain cross protection; and identification of markers linked to loci controlling resistance to CSSV.

Afroze, S. 2000. Bioecology of the coccinellid, ***Anegleis cardoni*** (Weise) (Coleoptera : Coccinellidae), an important predator of aphids, coccids and pseudococcids. Journal of Entomological Research. New Delhi 24(1): 55-62. [Afroze2000]

Notes: The bioecology of ***Anegleis cardoni*** (Weise) was studied under controlled laboratory conditions, where the temperature and relative humidity were maintained at 25 degrees +- 5 degrees C and 80 +-5 per cent, respectively. The rearing was done on the pseudococcid, ***Centrococcus insolitus*** Green; and the cabbage aphid, ***Brevicoryne brassicae*** L. to evaluate its effectiveness against both the host pests. The life cycle was completed in 25 and 22 days in ***B. brassicae*** and ***C. insolitus***, respectively. The average fecundity of a female was 821.2 and 1099.9 eggs, and the egg hatching was 86 and 95 per cent on ***B. brassicae*** and ***C. insolitus***, respectively. Also, higher adult longevity and voracity was recorded on ***C. insolitus*** than ***B. brassicae***.

Aftab Ahamed, C.A., Chandrakala, M.V. & Maribashetty, V.G. 1999. Effect of feeding mealy bug affected mulberry leaves (tukra) on nutritional efficiency and cocoon yield in the new bivoltine silkworm, ***Bombyx mori*** L. Entomon 24(3): 265-273. [AftabAChMa1999]

Notes: Mealy bug infestation of mulberry by ***Maconellicoccus hirsutus*** (Green) causes malformation of terminal buds and the appearance of small curly leaves on the shoots. The food and dietary water intake and utilization were studied by feeding diseased mulberry leaves to the new bivoltine silkworms, ***Bombyx mori*** (Race: KSO1) during fourth and fifth instars, caused shortening of the larval duration and significant increment in conversion rate, conversion efficiencies (K1 & K2), water absorption efficiency, water retained in the body and water retention efficiency. In continuation of this, a significant increase in larval biomass, cocoon, pupal and shell weights followed by their efficiencies were noticed in spite of lesser wet food consumed. The factors responsible for these beneficial changes in food and water intake and utilization are discussed.

Ahamed, C.A.A., Chandrakala, M.V. & Maribashetty, V.G. 1999. Effect of feeding mealy bug affected mulberry leaves (tukra) on nutritional efficiency and cocoon yield in the new bivoltine silkworm, ***Bombyx mori*** L. Entomon 24(3): 265-273. [AhamedChMa1999]

Notes: Mealybug infestation of mulberry (***Morus alba***) by ***Maconellicoccus hirsutus*** (Green) causes malformation of terminal buds and appearance of small curly leaves on the shoots. The food and dietary water intake and utilization were studied by feeding diseased mulberry leaves to the new bivoltine silkworms, ***Bombyx mori*** (Race: KSO1) during the fourth and fifth instars, causing shortening of the larval duration and significant increment in conversion rate, conversion efficiencies (K1 & K2), water absorption efficiency, water retained in the body and water retention efficiency. In continuation of this, a significant increase in larval biomass, cocoon, pupal and shell weights followed by their efficiencies were noticed in spite of the decrease in quantity of wet food consumed. The factors responsible for these beneficial changes in food and water intake and utilization are discussed.

Alichi, M. & Ahmadi, A.A. 1999. [Effects of two IGRs, buprofezin and pyriproxifen, on *Icerya purchasi* Maskell (Homoptera: Margarodidae).] (In Persian). Journal of Science and Technology of Agriculture and Natural Resources 1999(3): 1, 75-82. [AlichiAh1999]

Notes: The effectiveness of buprofezin (40% SC) and pyriproxifen [pyriproxyfen] (10% EC) on the mortality of nymphal stages and fecundity of ***Icerya purchasi*** was investigated under glasshouse conditions. The LC50 of the insect growth regulators (IGRs) was also determined for the first nymphal stage. Two applications were conducted at intervals of one day prior to introduction of crawlers and 42 days after infestation. The results indicated that buprofezin was superior to pyriproxifen in suppressing the growth and development of crawlers. The mortality of first instars was determined 28 days after the first application. Although the total mortality of second instars due to pyriproxifen was higher than that caused by buprofezin, the cummulative mortality of 1000 ppm treatment was

estimated to be 100% in both experiments after 42 days. The effect of buprofezin on incomplete moulting of nymphs and its ovicidal activity showed a decreasing rate in third-instar nymph survival and fecundity of the pest in relation to different concentrations of the IGRs, but it never reached 100%. Meanwhile the 1000 ppm concentration of pyriproxifen in the same treatments brought about complete mortality in third instar nymphs and inhibited adult and egg formation due to imbalanced juvenile hormone activity. However in 1 ppm concentration of pyriproxifen, a noticeable increase in fecundity of the adults was observed.

Allsopp, P.G., McGill, N.G. & Stringer, J.K. 2000. Host-plant resistance in sugarcane to pink ground pearls, ***Eumargarodes laingi*** Jakubski (Hemiptera: Margarodidae): Confirmation and further screening of clones. Australian Journal of Entomology 39(4): 316-321.[AllsopMcSt2000]

Notes: The response of 11 commercial cultivars and nine experimental clones of sugarcane to the margarodid ***Eumargarodes laingi*** Jakubski were evaluated over the plant (first harvest) and two successive annual ratoon harvests in a field trial in southern Queensland. Clones varied in the number of cysts developing on the roots with the lowest numbers on Q147, Q135 and Q182 and the highest on Q124, Q141, Q184 and 85S1247. The effect was similar over the three crops and indicates the presence of antibiosis and/or antixenosis. Clones also varied in cane and sugar yields and sugar content, with Q136, Q135, Q155, Q147 and Q124 giving the highest cane and sugar yields and 87S7364, 87S7367, 85S1247, Q141 and Q184 giving the lowest. Deviations from a general relationship between number of cysts and yield suggest that clones such as Q136, Q124 and Q155 have tolerance to ***E. laingi***. Good concurrence in the ranking of clones between harvests and between this trial and previous work indicates that the resistance is stable and could be selected for on the basis of data from 1 or 2 years.

Anga, J.M. & Noyes, J.S. 1999. A revision of the African and Malagasy species of the genus ***Leptomastix*** (Hymenoptera, Encyrtidae), parasitoids of mealybugs (Homoptera: Pseudococcidae). Bulletin of the British Museum (Natural History) Entomology 68: 2, 93-128[AngaNo1999]

Notes: The 11 species of ***Leptomastix*** known from Africa and Madagascar are revised and illustrated. Three species are described as new, ***Leptomastix herreni*** sp. nov., ***Leptomastix africana*** sp. nov. and ***Leptomastix jonesi*** sp. nov. Three new synonymies are proposed. A dichotomous key to all species is provided and each species is further characterized by a taxonomic diagnosis or description. Notes are provided on distribution, hosts and use in biological control.

Arai, T. 2000. The existence of sex pheromone of ***Pseudococcus cryptus*** Hempel (Homoptera: Pseudococcidae) and a simple bioassay. Applied Entomology and Zoology. Tokyo 35(4): 525-528. [Arai2000]

Notes: The attractiveness of the volatiles from females to adult males of ***Pseudococcus cryptus*** was tested in a glasshouse to verify the presence of a sex pheromone. Males were attracted to the volatiles from females, and therefore, the existence of the sex pheromone of this mealybug was confirmed. The attractiveness of the pheromone to adult males aged from 0 to 5 days at 0, 2, 4, 6, 8, 10 h after lights-on was investigated in plastic petri dishes. Adult males were attracted to the pheromone under all these conditions, and it was considered that a bioassay in plastic petri dishes could be conducted using 0- to 5-day-old males within 10h after lights-on.

Arantes, A.M.V.T. & Correia, A. do C.B. 1999. [Diversity of fungi associated with ***Parlatoria ziziphus*** (Lucas) (Hemiptera: Diaspididae) in citrus.] Diversidade de fungos associados a ***Parlatoria ziziphus*** (Lucas) (Hemiptera: Diaspididae) em citros. (In Portuguese with summary in English). Anais da Sociedade Entomologica do Brasil 28(3): 477-483.[AranteCo1999]

Notes: There are many reports on species of entomopathogenic fungi that impact on host (pest) populations, but information on their biology, identification and relationship with the host are scarce. This study was conducted to identify fungi associated with ***Parlatoria ziziphus [P. ziziphi]*** in two Citrus groves in the region of Taiuva, Sao Paulo, Brazil. Samples were collected monthly in 15 trees by removing 16 leaves from each plant. In the laboratory, fungi associated with ***P. ziziphi*** were determined using a microscope, taking into account aspects of reproductive structures and spores. Four species were identified: ***Fusarium coccophilum [Nectria flammea], Tetracrium***

coccicolum, *Podonectria coccicola* and *Myriangium duriaei*. *N. flammea* was the most abundant species in both groves.

Asef, F.M. 1999. [Chemical control trials against the euonymus and juniper scales (*Unaspis euonymi* and *Carulaspis juniperi*, Homoptera: Coccoidea).] Kémiai védekezési kisérletek a kecskerágó-és boroka-pajzstetvek (*Unaspis euonymi, Carulaspis juniperi*. (In Hungarian). Növényvédelem 35(11): 567-569. [Asef1999]

Notes: Six insecticides (including formulations of buprofezin, dioxalane [of unstated composition], fenoxycarb and phosalone) were tested in Hungary in 1996 against *Unaspis euonymi* (a pest of *Euonymus*) and *Carulaspis juniperi* (a pest of *Juniperus* and *Thuja*). The results against these two diaspidids are presented in the form of histograms showing the levels of control in June, July and November.

Babcock, C.S., Heraty, J.M., De Barro, P.J., Driver, F. & Schmidt, S. 2001. Preliminary phylogeny of *Encarsia* Forster (Hymenoptera: Aphelinidae) based on morphology and 28S rDNA. Molecular Phylogenetics and Evolution 18(2): 306-323. [BabcocHeDe2001]

Notes: Species of *Encarsia* Forster (Hymenoptera: Aphelinidae, Coccophaginae) are economically important for the biological control of whitefly and armored scale pests (Hemiptera: Aleyrodidae, Diaspididae). Whereas some regional keys for identification of *Encarsia* species are now available, few studies have addressed relationships within this diverse and cosmopolitan genus because of unreliable morphological data. Nuclear sequences of the D2 expansion region of 28S rDNA were determined from 67 strains of 24 species representing 10 species groups of *Encarsia*, 2 strains of *Encarsiella noyesi* Hayat, and 1 strain of *Coccophagoides fuscipennis* Girault. Analysis of molecular data alone and combined with morphological data resolves many nodes not resolved by morphology alone and offer insights into which morphological characters are useful for supporting group relationships. All analyses that include molecular data reveal *Encarsia* to be paraphyletic with respect to *Encarsiella*. If monophyly of *Encarsia* is constrained, the relationships are the same but with a different root within *Encarsia*, and these trees are presented as an alternate hypothesis. The luteola and strenua species groups are shown by both morphological and molecular data to be monophyletic, whereas the inaron group, the *E. nigricephala* + luteola group, and the *E. quericola* + strenua group are supported only by molecular data. The aurantii and parvella species groups are not supported in any of the analyses. The utility of morphological characters for defining species group relationships is discussed.

Babu, B.G. & David, P.M.M. 1999. A simple technique for mealybug multiplication on grooveless pumpkins. Journal of Biological Control 13(1-2): 59-63. [BabuDa1999]

Notes: A simple roping technique that facilitates rapid multiplication of mealybugs even on smooth pumpkins (*Cucurbita moschata* Poir) devoid of ridges and furrows is described. After 20-40 days of ovisac inoculation, populations of *Maconellicoccus hirsutus* (Green) were 8-12 times higher on grooveless pumpkins secured vertically across with 4 mm thick ropes at 2-4cm interspacing at the widest girth than that on bare grooveless pumpkins. However, populations increased by only 2-3 times on deep-grooved pumpkins and by 4-5 times on shallow-grooved fruits. Significantly higher populations of mealybugs were found along 4mm thicker top rope than along 2mm thinner twine running vertically across the fruit surface.

Babu, T.R. & Ramanamurthy, G. 1999. Residual toxicity of pesticides to the adults of *Cryptolaemus montrouzieri* Mulsant (Coccinellidae: Coleoptera). International Pest Control 41(4): 137-138. [BabuRa1999]

Notes: Studies on the toxicity of insecticides and fungicides to adult *C. montrouzieri* (a predator of mealybugs, *Saccharicoccus sacchari*), are presented together with details of the persistence of the pesticides. The insecticides monocrotophos (Nuvacron), cypermethrin (Lacer), acephate (Asataf), chlorpyrifos (Radar) [propiconazole] and fenvalerate (Fenval) and the fungicide mancozeb (Indofil M-45) [mancozeb + thiophanate-methyl] recorded 100% mortality of adults in bioassays. Chlorothalonil (Kavach) had the lowest LT50 value of 1.5 days and was least persistent. The pyrethroids, viz. cypermethrin (15.9 days) and invalerate (14.1 days) were highly persistent. The lethal time values (LT) were calculated following probit analysis.

Balikai, R.A. 1999. New record of plants of grapevine mealybug. Insect Environment 5(2): 81. [Balika1999]

Notes: Two weeds, ***Portulaca oleracea*** and ***P. quadrifida***, were recorded as host plants of the polyphagous *Maconellicoccus hirsutus* in and around vineyards in the Bijapur area of Karnataka, India, in September 1996.

Balikai, R.A. 1999a. Seasonal incidence of grapevine mealybug in northern Karnataka. Insect Environment 4(4): 148-149. [Balika1999a]

Notes: Seasonal incidence of ***Maconellicoccus hirsutus*** on Thompson Seedless grapes was studied in farmers' fields at Tikota village, during 1990-92. Mealybug was recorded throughout the year. Following pruning in Oct., the mealybug population started to increase from Jan. and peaked during Feb.-Mar. before harvesting. After harvesting, the mealybug population remained low from May to Dec.

Balikai, R.A. 1999b. Management of grapevine mealybug, ***Maconellicoccus hirsutus*** (Green). Insect Environment 4(4): 149. [Balika1999b]

Notes: Management of mealybug on grapes was studied in farmers' fields at Tikota, Karnataka, following application of treatments during the first 2 weeks of Nov., when average mealybug population was 3.81 colonies/vine. Treatments were: Padan [cartap hydrochloride] at 50 g/vine; phorate at 50 g/vine; Lannate [methomyl] at 3 ml/L; dichlorvos at 2 ml; neem [***Azadirachta indica***] seed extract at 5%; disturbing with toothbrush followed by spraying with dichlorvos at 2 ml; and an untreated control. At 30 and 60 days after treatment (DAT), all treatments were superior to the untreated control. Mealybug populations were lowest (1.17 and 5.9/vine at 30 and 60 DAT, resp.) on grapes disturbed with a toothbrush and then sprayed with dichlorvos.

Balikai, R.A. 1999c. Pest scenario of ber (***Zizyphus mauritiana*** Lamarck) in Karnataka. Pest Management in Horticultural Ecosystems 5(1): 67-69. [Balika1999c]

Notes: A field survey was carried out in ***Ziziphus mauritiana*** crops between 1996 and 1998 in Karnataka, India. A total of 22 pests was identified. Of these, ***Dacus correctus [Bactrocera correcta], Carpomyia vesuviana*** and ***Meridarchis scyrodes*** were found to be major pests, with infestation levels above 51%. ***Maconellicoccus hirsutus, Perissopneumon tamarindus, Aubeus himalayanus, Achaea janata*** and ***Cryptozona semirugata*** were moderate pests, with 31-50% infestation levels. Levels of ***M. hirsutus*** and ***Aubeus himalayanus*** are thought to be increasing.

Baskaran, R.K.M., Lakshmi, L.G. & Uthamasamy, S. 1999. Coccids and their management in guava intercropped with coconut. Pest Management in Horticultural Ecosystems 5(1): 28-31. [BaskarLaUt1999a]

Notes: ***Ferrisia virgata*** was the dominant coccid species, infesting 98% of guava trees, followed by ***Maconellicoccus hirsutus*** (2%) and ***Pericerya purchasi*** [***Icerya purchasi***] (1%), at a site in Tamil Nadu, India, in April 1998. Monocrotophos (0.072%), malathion (0.25%), dimethoate (0.06%) and phosalone (0.175%) were evaluated for ***F. virgata*** control. Dimethoate and malathion were most effective at controlling ***F. virgata***. Guava leaf disks were offered to ***F. virgata*** and ***P. purchasi*** after treating with phosalone (0.175%), phosphamidon (0.086%), monocrotophos (0.072%), dichlorvos (0.1%), malathion (0.25%) and dimethoate (0.06%) by leaf dipping and leaf spraying. The leaf dip assay was most effective, recording 100% mortality to both ***F. virgata*** and ***P. purchasi*** 24 h after treatment.

Bayat, A., Karaca, Y., Ulusoy, M.R. & Uygun, N. 2000. Spray coverage and citrus pest control efficiency with different types of orchard sprayers. AMA, Agricultural Mechanization in Asia, Africa and Latin America 31(2): 45-51. [BayatKaUl2000]

Notes: Spray coverage, droplet size, droplet number density and biological efficiency were determined for three types of sprayers that were operated in four spray application methods (hand gun, air-carrier, and air-carrier sprayers with tower attachment in two different working configurations). The experiment was conducted in a Washington navel orange orchard. Spray coverage and droplet size of sprays were determined by an image

processing computer program using water sensitive papers attached on leaves in the exterior and interior parts of the tree canopy. Pest control efficiency achieved with sprayers were tested for citrus whitefly, *Dialeurodes citri* and California red scale, *Aonidiella aurantii* using petroleum oil sprays. With all the sprayers, spray coverage ratios, droplet number density and sizes varied between the exterior and the interior parts of the tree. Spray coverage on the bottom zone of the tree was higher than coverage on the top zone. A mean coverage ratio of 100% was not provided by all the sprayers. Good biological efficiency was achieved for citrus white-flies with all the tested sprayers. For the California red scale, there appeared to be a better control of the pest in the exterior than in the interior parts of the tree canopy. However, the California red scale is mostly found in the inner parts of the tree, where the air-carrier sprayers achieved lower control than the hand gun applications.

Beardsley, J.W. 1999. A note on the genitalia of some Pacific *Pseudococcus* species (Homoptera: Pseudococcidae) and their potential utilization in systematics. The Scale 23: 7-11. [Beards1999]

Notes: Species discussed are ***Pseudococcus adonidum, P. floriger, P. longispinus, P. nudus, P. orchidicola, P. swezeyi*** and ***P. trukensis***.

Becker, H. 2000. Three imported wasps may curb alien scale pest. Agricultural Research 48(5): 16-17. [Becker2000]

Notes: This report describes a project to identify natural enemies from Mexico of ***Paracoccus marginatus*** in which Avas B. Hamon, Douglass R. Miller, Michael E. Schauff, John S. Noyes, Juan Antonio Villanueva and Héctor González were involved. The three parasites identified were ***Acerophagus, Anagyrus and Apoanagyrus*** spp.

Ben-Dov, Y., Zahavi, T. & Openheim, D. 2000. [New records of soft scale insects on grapevine and plum from the Golan Heights.] (In Hebrew with summary in English). Alon Hanotea 54(4): 142-143. [BenDovZaOp2000]

Notes: ***Pulvinaria vitis*** and ***Parthenolecanium corni*** are recorded for the first time from the Golan Heights. ***P. vitis*** was found to infest only grapevine, on which it develops one annual generation. The population of ***P. corni*** was recorded on plum, developing one annual generation.

Benmessaoud-Boukhalfa, H., Nenon, J.-P. & Le Lannic, J. 2000. [Wax secretions in ***Bemisia tabaci*** (Hemiptera: Aleyrodidae). Evolution during the larval cycle.] Sécrétions cireuses chez ***Bemisia tabaci*** Gennadius (Hemiptera: Aleyrodidae). Évolution au cours du cycle de développement. (In French with summary in English). Annales de la Société Entomologique de France 36(2): 165-170. [BenmesNeLe2000]

Notes: ***Saisettia oleae*** and ***Tachardia lacca*** are mentioned as examples of coccoids with wax glands.

Bento, J.M.S., Moraes, G.J. de., Matos, A.P. de. & Bellotti, A.C. 2000. Classical biological control of the mealybug ***Phenacococcus herreni*** (Hemiptera: Pseudococcidae) in northeastern Brazil. Environmental Entomology 29(2): 355-359. [BentoMoMa2000]

Notes: The effect of native and recently introduced natural enemies of the cassava mealybug ***Phenacoccus herreni*** Cox & Williams in northeastern Brazil is reported in this article. Studies of population fluctuation of the mealybug and its natural enemies were conducted between 1994 and 1997 in three cassava fields located in Muritiba, Itaberaba, and Sao Goncalo, State of Bahia. At least approximately 85% of the parasitoids found in those fields were composed of the recently introduced species ***Apoanagyrus (=Epidinocarsis) diversicornis*** (Howard), ***Aenasius vexans*** (Kerrich), and ***Acerophagus coccois*** Smith. ***A. diversicornis*** was found in all fields during most of the experimental period, whereas ***A. coccois*** and ***A. vexans*** were only found in the fields where they had been released. ***A. diversicornis*** out-competed ***A. vexans*** in Sao Goncalo, but not ***A. coccois*** in Itaberaba. Most predators collected belonged to the genera ***Hyperaspis, Nephus*** and ***Diomus***, all of the family Coccinellidae. The results of this work suggest that the concerted action of the three introduced parasitoids and the native natural enemies was sufficiently efficient to control ***P. herreni*** at low levels, in the fields where the study was conducted.

Bernardo, U. & Viggiani, G. 2000. [Effects of pymetrozine on ***Leptomastix dactylopii*** Howard (Hymenoptera: Encyrtidae) and ***Rodolia cardinalis*** (Mulsant) (Coleoptera: Coccinellidae) beneficial citrus grove arthropods. (In Italian with summary in English). Informatore Fitopatologia 50(6): 39-42. [BernarVi2000]

Notes: [Original title: Effetti di pymetrozine su ***Leptomastix dactylopii*** Howard (Hymenoptera: Encyrtidae) e ***Rodolia cardinalis*** (Mulsant) (Coleoptera: Coccinellidae), artropodi utili dell'agrumeto.] Pymetrozine is a new insecticide with an original mode of action. It is recommended to control several groups of sucking insects (aphids, whiteflies, etc.) and is considered highly selective for beneficial arthropods. To evaluate specifically the potential side effects of pymetrozine on citrus grove entomophagous insects, laboratory, semi-field and field tests were carried out on the parasitoid ***Leptomastix dactylopii*** and the predator ***Rodolia cardinalis***. Results showed high detrimental effect for adults of ***L. dactylopii*** (laboratory mortality 100%; semi-field 92%; and field 78%). On the contrary, the effects on ***R. cardinalis*** were limited and only the adults were affected. Pymetrozine, also according to literature data, is to be considered partially selective for beneficials, but harmful for parasitoids. A reliable evaluation of the side effects of pymetrozine and similar products requires specific methods, with an exposure period to the residues longer than 24 h.

Bertschy, C., Turlings, T.C.J., Bellotti, A. & Dorn, S. 2000. Host stage preference and sex allocation in ***Aenasius vexans***, an encyrtid parasitoid of the cassava mealybug. Entomologia Experimentalis et Applicata 95(3): 283-291. [BertscTuBe2000]

Notes: The solitary endoparasitoid ***Aenasius vexans*** Kerrich (Hymenoptera: Encyrtidae) is used for augmentative releases against the cassava mealybug, ***Phenacoccus herreni*** Cox & Williams (Sternorrhyncha: Pseudococcidae), an important pest on cassava in South America. In light of the need for large numbers of high quality females, experiments were conducted on host stage suitability and sex allocation. In choice and no-choice experiments, individual female wasps were offered second and third instar, as well as adult, hosts. During the first five days after emergence, the wasps showed a steady increase in the number of hosts they successfully parasitized per day, but the respective secondary sex ratio for each instar remained constant. Parasitism was highest for third instar hosts in no-choice tests, while in choice tests parasitism was highest in both third instars and adults. The later the developmental stage of the host at oviposition, the faster the parasitoids developed and emerged, and for each host stage, the development time of males was shorter than for females. The sex ratio of the wasps emerging from hosts that were parasitized as second instars was strongly male-biased, while the apparently preferred later stages yielded significantly more females than males. Female and male ***A. vexans*** emerging from hosts parasitized at the third instar were significantly larger than for the other stages. This may explain the preference for the third instar as well as the female-biased sex ratio, as size is usually positively correlated with higher fitness, especially in females. The results suggest that third instar hosts are the most suitable for rearing high numbers of large females.

Bhagat, K.C., Nehru, R.K. & Koul, V.K. 1999. Sap feeding pests of citrus in Jammu. Insect Environment 5(3): 123. [BhagatNeKo1999]

Notes: ***Diaphorina citri, Aphis traversii, Toxoptera aurantii, Drosicha mangiferae, Scirtothrips citri, Aleurolobus citrifolii, Panonychus citri*** and ***Eutetranychus orientalis*** were recorded on citrus plants in Jammu, India.

Biche, M. & Sellami, M. 1999. [Study of some possible biological variations in ***Parlatoria oleae*** (Colvee) (Hemiptera, Diaspididae).] Étude de quelques variations biologiques possibles chez ***Parlatoria oleae*** (Colvee) (Hemiptera, Diaspididae). (In French with summary in English). Bulletin de la Société Entomologique de France 104(3): 287-292. [BicheSe1999]

Notes: The influence of the host plants potato (***Solanum tuberosum***) and pumpkin (***Cucurbita pepo***) on biological parameters of ***P. oleae*** was investigated. The host plants exerted effects on the duration of oviposition, the sex-ratio and body size.

Bingham, S.J. & Tyman, J.H.P. 2000. The synthesis of kermesic acid by acetylation-aided tautomerism of 6-chloro-2,5,8-trihydroxynaphtho-1, 4-quinone. Chemical Communications No. 11: 925-926 [BinghaTy2000]

Notes: 6-Chloro-2,5,8-trihydroxynaphtho-1,4-quinone does not undergo cycloaddition reactions but the 1,2-diacetate, 2-chloro-5,6-diacetoxy-8-hydroxynaphtho-1,4-quinone, formed by acetylation-aided tautomerism added (E)- and (Z)-3-alkoxycarbonyl-2,4-bis(trimethylsiyloxy)penta-1,3-diene to afford kermesic acid after hydrolysis.

Bishop, D.B. & Bristow, C.M. 2001. Effect of Allegheny mound ant (Hymenoptera : Formicidae) presence on homopteran and predator populations in Michigan jack pine forests. Annals of the Entomological Society of America 94(1): 33-40. [BishopBr2001]

Notes: The impact of different densities of Allegheny mound ant, ***Formica exsectoides***, populations on myrmecophilous (tended) and nonmyrmecophilous (untended) aphid and scale species and their potential predators was examined in jack pine forests of north-central Michigan. A summer-long survey indicated that areas with large populations of *F. exsectoides* had larger populations of the aphid ***Cinara banksiana*** and the soft scale ***Toumeyella parvicornis***, two obligate myrmecophiles, than areas with low or no ***F. exsectoides*** populations. ***Cinara ontarioensis*** was also obligately tended by ants but did not show a significant response to ***F. exsectoides*** densities, having a patchy distribution. In contrast, in areas without ***F. exsectoides***, these homopterans were replaced by the woolly aphid ***Schizolachnus piniradiatae***, a species that never forms ant associations. Mound ant exclusion experiments and observations indicated that ***F. exsectoides*** preyed upon ***S. piniradiatae*** potentially reducing their numbers in areas with this ant. Aphid and scale predators showed a mixed response to ***F. exsectoides*** presence: densities of lacewing larvae and salticid spiders were inversely related to ***F. exsectoides*** populations, whereas mirid populations did not show a response to different ***F. exsectoides*** densities. This study suggests that the presence of large populations of aggressive, honeydew seeking ***F. exsectoides*** can shift the homopteran community from one composed predominantly of nonmyrmecophilous species to one composed of myrmecophilous species.

Blank, R.H., Gill, G.S.C. & Kelly, J.M. 2000. Development and mortality of greedy scale (Homoptera : Diaspididae) at constant temperatures. Environmental Entomology 29(5): 934-942. [BlankGiKe2000]

Notes: Developmental times and mortality were determined for four stages of greedy scale ***Hemiberlesia rapax*** (Comstock), a key pest of kiwifruit, ***Actinidia deliciosa*** variety ***deliciosa***, in New Zealand. Scale were reared on potato tubers at seven constant temperatures and developmental stage and mortality were assessed at regular intervals. This required the removal of the scale cover to enable stage and mortality to be accurately determined. High numbers of scale (>1,400) were required at each temperature to sustain a frequent destructive sampling regime. Scale survival to the reproductive stage ranged from 0% at <12.3 degrees C to 45% at 24.6 degrees C. The time for 50% of the live scale population to reach each developmental stage was determined using a Bayesian smoothing program. A linear model of scale development war; developed for each stage based on a single, temperature-independent distribution of normalized developmental time. A linear regression of development rate against temperature was used to estimate developmental thresholds that were 9.6, 9.7, 10.3, and 10.6 degrees C and it took 257, 552, 882, and 992 degree-days (DD) to reach the second, third instar, mature, and first reproductive stages, respectively.

Blank, R.H., Gill, GSC., McKenna, C.E. & Stevens, P.S. 2000. Enumerative and binomial sampling plans for armored scale (Homoptera: Diaspididae) on kiwifruit leaves. Journal of Economic Entomology 93(6): 1752-1759. [BlankGiMc2000]

Notes: The spatial dispersion of armored scale insects; greedy scale, ***Hemiberlesia rapax*** (Comstock); and latania scale, ***Hemiberlesia lataniae*** (Signoret), was investigated on kiwifruit, ***Actinidia deliciosa***, leaves in New Zealand. A universal description using Taylor's power law, which encompassed a wide range of different orchards, blocks, block sizes, sampling times, scale control practices, regions and seasons. Scale density significantly altered dispersion, especially at the high densities found on unsprayed kiwifruit. Most commercially managed kiwifruit blocks had low densities of <0.5 scale per leaf and had a slightly aggregated scale dispersion. Wilson and Room's binomial model, which incorporates a clumping pattern as a function of density, gave a significant relationship between the proportion of infested leaves and scale density. The optimal leaf sample sizes were estimated for

determined levels of sampling reliability. Where population estimates require a high degree of precision and enumerative sampling methods are used, 2,500 leaves should be sampled when scale densities are near the current spray threshold of 4% infested leaves and 500 leaves at 20% infested leaves. For management-decision sampling, where a lower level of precision was acceptable, enumerative sampling would require that 400 leaves be sampled at 4%; or 85 leaves at 20% infested leaves. With binomial sampling to achieve an equivalent level of precision an increased sample size of 6-11% is required.

Blasco, R., Moore, E., Wray, V., Pieper, D., Timmis, K. & Castillo, F. 1999. 3-nitroadipate, a metabolic intermediate for mineralization of 2,4-dinitrophenol by a new strain of a ***Rhodococcus*** species. Journal of Bacteriology 181(1): 149-152. [BlascoMoWr1999]

Notes: The bacterial strain RB1 has been isolated by enrichment cultivation with 2,4-dinitrophenol as the sole nitrogen, carbon, and energy source and characterized, on the basis of 16S rRNA gene sequence comparison, as a ***Rhodococcus*** species closely related to ***Rhodococcus opacus. Rhodococcus*** sp. strain RB1 degrades 2,4-dinitrophenol, releasing the two nitro groups from the compound as nitrite. The release of nitro groups from 2,4-dinitrophenol occurs in two steps. First, the 2-nitro group is removed as nitrite, with the production of an aliphatic nitro compound identified by 1H NMR and MS as 3-nitroadipate. This metabolic derivative was further metabolized, releasing its nitro group as nitrite. Full nitrite assimilation upon reduction to ammonia requires that an additional carbon source be supplied to the medium.

Bluthgen, N., Verhaagh, M., Goitia, W., Jaffe, K., Morawetz, W. & Barthlott, W. 2000. How plants shape the ant community in the Amazonian rainforest canopy: the key role of extrafloral nectaries and homopteran honeydew Oecologia 125(2): 229-240. [BluthgVeGo2000]

Notes: Ant-plant interactions in the canopy of a lowland Amazonian rainforest of the upper Orinoco, Venezuela, were studied using a modified commercial crane on rails (Surumoni project). Our observations show a strong correlation between plant sap exudates and both abundance of ants and co-occurrence of ant species in tree canopies, Two types of plant sap sources were compared: extrafloral nectaries (EFNs) and honeydew secretions by homopterans, EFNs were a frequent food source for ants on epiphytes (***Philodendron*** spp., Araceae) and lianas (Dioclea, Fabaceae), but rare on canopy trees in the study area, whereas the majority of trees were host to aggregations of homopterans tended by honeydew-seeking ants on 62% of the trees examined). These aggregations rarely occurred on epiphytes. Baited ant traps were installed on plants with EFNs and in the crowns of trees from three common genera, including trees with and without ant-tended homopterans: ***Goupia glabra*** (Celastraceae), ***Vochysia*** spp. (Vochysiaceae), and ***Xylopia*** spp. (Annonaceae). The number of ant workers per trap was significantly higher on plants offering one of the two plant sap sources than on trees without such resources. Extrafloral nectaries were used by a much broader spectrum of ant species and genera than honeydew, and co-occurrence of ant species tin traps) was significantly higher on plants bearing EFNs than on trees. Homopteran honeydew (Coccidae and Membracidae), on the other hand, was mostly monopolised by a single ant colony per tree. Homopteran-tending ants were generally among the most dominant ants in the canopy. The most prominent genera were ***Azteca, Dolichoderus*** (both ***Dolichoderinae***), ***Cephalotes, Pheiciole, Crematogaster*** (ali Myrmicinae), and ***Ectatomma Ponerinae***). Potential preferences were recorded between ant and homopteran species, and also between ant-homopteran associations and tree genera. We hypothesize that the high availability of homopteran honeydew provides a key resource for ant mosaics, where dominant ant colonies and species maintain mutually exclusive territories on trees. In turn, we propose that for nourishment of numerous ants of lower competitive capacity, ***Philodendron*** and other sources of EFNs might be particularly important.

Bobadilla, D., Vargas, H., Jimenez, M., Gallo, P., Sepulveda, G. & Mendoza, R. 1999. [Natural enemies of ensign coccids, ***Orthezia*** spp. (Homoptera: Ortheziidae), detected in North Chile.] Enemigos naturales de las conchuelas móviles, ***Orthezia*** spp. (Homoptera: Ortheziidae), detectados en el Norte de Chile. (In Spanish with summary in English). Idesia 16: 117-123. [BobadiVaJi1999]

Notes: A preliminary list of entomophagous species found during a survey of ***Orthezia*** in the North of Chile is presented. The recorded natural enemies are mainly dipteran species (one species of Chamaemyiidae and another one of Drosophilidae) and coleopteran predators (three species of Coccinellidae), and to a lesser extent there were generalists such as lacewings (Neuroptera: Chrysopidae), and also an entomopathogenic fungus (Phycomycetes).

Bonfanti, R. 1999. [San Jose scale.] La cocciniglia di San Jose. (In Italian). Informatore Agrario 15(5): 24-26. [Bonfan1999]

Notes: Notes are given on the injuriousness, biological cycle and control of the diaspidid ***Comstockaspis perniciosa [Diaspidiotus perniciosus]***, a pest of fruit trees and ornamental plants. A ministerial decree issued in April 1998 has made control of the pest obligatory in Italy.

Bouteillan 1999. (In French). Arboriculture Fruitière No. 533: 71. [Boutei1999]

Notes: The olive cultivar Bouteillan is described. Production starts after 2-3 years, with the majority of French production in the Var region. Flowering starts in June and harvesting is in November-December. The colour of olive oil is yellow-green. This cultivar is resistant to frost and drought, but susceptible to damage by ***Saissetia oleae***, ***Dacus oleae*** [***Bactrocera oleae***] and ***Prays oleae***.

Bream, A.S. 1999. Predaceous insects occurring on lime trees in Keszthely (Hungary), with reference to their abundance. Mededelingen Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent 64(3a): 219-227. [Bream1999]

Notes: During a two-year-survey, 8 families of predaceous insects, belonging to the orders Coleoptera (Staphylinidae, Coccinellidae and Malachidae), Hemiptera (Anthocoridae and Miridae), Diptera, Neuroptera and Dermaptera were collected from ***Tilia*** spp. growing in Keszthely (Hungary). Also, a considerable number of spiders occurred. Predaceous insects, spiders and predatory mites, control the mite pests, especially those of the family Tetranychidae, and other small arthropod pests occurring on lime trees studied (e.g. aphids, scale insects and thrips). In addition, some of these insects were found to be taking the trees as a refuge or a suitable place for reproduction and development, and then spread among adjacent plants to take part in biological control of pests.

CAB International. 1999. ***Planococcus citri*** (Risso). Distribution Maps of Pests, Series A, Agricultural Map no. 43 (2nd rev.): 8 pp. [CABI1999]

Notes: Published in the U.K. by the International Institute of Entomology, an agency of CAB International; map showing distribution of this sp. worldwide; countries listed with references to records; hosts; polyphagous but prefers citrus; often found on cocoa (***Theobroma cacao***), fruit trees and ornamentals under glass; does not often attack grapevines (***Vitis*** spp.).

CAB International. 1999a. ***Parthenolecanium corni*** (Bouche). Distribution Maps of Pests, Series A, Agricultural Map no. 394 (1st rev.): 5 pp. [CABI1999a]

Notes: Published in the U.K. by the International Institute of Entomology, an agency of CAB International; map showing distribution of this sp. worldwide; countries listed with references to records; attacks many woody hosts including fruit and nut trees and ornamentals.

Cailletier 1999. (In French). Arboriculture Fruitière No. 529: 53. [Caille1999]

Notes: Olive cv. Cailletier is described. Trees start to produce after 4 years. Olives are small to average (1.5-3 g), with a fine texture. Olives are susceptible to ***Saissetia oleae, Dacus oleae [Bactrocera oleae]*** and ***Cycloconium oleagina [Spilocaea oleagina]***.

Calatayud, P.A. 2000. Influence of linamarin and rutin on biological performances of ***Phenacoccus manihoti*** in artificial diets. Entomologia Experimentalis et Applicata 96(1): 81-86. [Calata2000]

Notes: The cassava mealybug, ***Phenacoccus manihoti*** (Sternorrhyncha: Pseudococcidae), a serious pest of ***Manihot esculenta***, is an oligophagous insect. Host plant resistance was investigated, focusing on the biochemical

mechanisms involved in antibiosis, defined as the long term interaction affecting insect life history by reducing growth, reproduction or survival.

Calvo, C. & Salvador, A. 2000. Use of natural colorants in food gels. Influence of composition of gels on their colour and study of their stability during storage. (In Portuguese with summary in English). Food Hydrocolloids 14(%): 439-443. [CalvoSa2000]

Notes: Colour measurement was studied in gels prepared with four natural colorants (Annatto, Chlorophyllins, Cochineal and Curcumin), using gelatine or a mixture of xanthan gum and locust bean gum as gelling agent. A good correlation was found between sensory and instrumental evaluation, with the L* and H* parameters providing a good representation of the lightness and hue of the gels. Mathematical equations were developed, relating those parameters to the sugar and colorant concentrations. In all the gels it was found that L* and H* depended almost exclusively on the colorant concentration. The stability of the gelatine gels was studied during storage and was compared with that of commercial jellies. It was concluded that the natural colorants used (cochineal and curcumin) can replace the artificial ones found in commercial jellies.

Canales Canales, A. & Valdivieso Jara, L. 1999. (In Spanish). In: [Handbook for biological control in olives.] Manual de control biológico para la conducción del cultivo del olivo. Servicio Nacional de Sanidad Agraria, Jesus María, Peru. 37 pp. [CanaleVa1999]

Notes: Insect pests causing damage in olive groves in Peru are described, as well as cultural, chemical and biological control methods. ***Palpita persimilis*** is controlled by ***Trichogramma*** spp., ***Chrysoperla externa, Eriborus*** spp., and ***Beauveria bassiana***. ***Pseudococcus adonidum*** is controlled by ***Sympherobius*** spp., ***Ungariela peregrina, Coccophagus*** sp. and ***Anagyrus*** spp. ***Saissetia oleae*** and ***S. coffeae*** are controlled by ***Metaphycus helvolus, M. lounsburyi*** (***S. oleae*** only), ***Coccophagus rusti*** and ***Scutellista cyanea [S. caerulea]***. ***Aspidiotus hederae, Hemiberlesia lataniae, H. cyanophylli, Fiorinia fioriniae, Selenaspidus articulatus*** and ***Pinnaspis strachani*** are controlled by ***Aphytis*** spp., ***Rhizobius pulchellus*** and ***Signiphora*** spp. ***Orthezia olivicola*** is controlled by ***Melaleucopis ortheziavora, Gitona brasiliensis, Nephus*** sp., and ***Hyperaspis*** spp. ***Hylesinus oleiperda*** is controlled by ***Pyemotes ventricosus***. ***Aceria*** spp. and ***Cyclophora serrulata*** are less important insect pests.

Casas, J., Nisbet, R.M., Swarbrick, S. & Murdoch, W.W. 2000. Eggload dynamics and oviposition rate in a wild population of a parasitic wasp. Journal of Animal Ecology 69(2): 185-193. [CasasNiSw2000]

Notes: This paper develops and tests in the field a model that predicts the oviposition rate and the rate of egg maturation of a synovigenic parasitic wasp during a foraging period. The parasitoid is ***Aphytis melinus***, the highly successful biological control agent of California red scale (***Aonidiella aurantii***), a pest of citrus worldwide. The common occurrence of egg-limitation over a single day and the relatively high rate of change of states between egg- and time-limitation imply that the rate of nutrient acquisition and use are likely to be subject to strong evolutionary pressures.

Casu, A.P., Onorato, M. & Gerardi, M.S. 1999. [Pheromone traps for ***Aonidiella aurantii***.] Trappole a feromoni per l'***Aonidiella aurantii***. (In Italian). Informatore Agrario 55(32): 69-72. [CasuOnGe1999]

Notes: The effectiveness of two types of pheromone traps for the diaspidid citrus pest ***Aonidiella aurantii*** was compared in a citrus orchard in Oristano, Sardinia, Italy, in 1998. The advantages and disadvantages of the two types of traps (glass traps and box traps) are discussed. The box trap was found to have more advantages than the glass trap. It is concluded that the use of pheromone traps is essential for technical assistants who integrate monitoring data with forecasting systems based on the elaboration of agrometereorological data. It is recommended that flight monitoring data should be accompanied by visual sampling of the crop to cover limitations in the use of pheromone traps.

Chai, X.M. 1999. [Predatory enemies of ***Matsucoccus matsumurae*** and their population dynamics.] (In Chinese with summary in English). Journal of Zhejiang Forestry College 16(4): 336-340. [Chai1999]

Notes: Investigation on Changle Forest Farm of Yuhang City, Zhejiang Province during 1982-85 indicated that there were 13 families and 31 species of predators of *M. matsumurae*. Seven of them were reported for the first time (ants [Formicidae] and spiders [Araneae]). Ladybugs and ants were the most important predators in percentage terms, 35%-51% and 30%-35%, respectively. *Exochomus mongol, Sticholotis punctata, Harmonia axyridis* and *H. obscurosignata* were observed in large populations. When the density of *M. matsumurae* increased, the number of coccinellids increased; at low densities of *M. matsumurae*, the number of mites and pentatomids increased. When *M. matsumurae* and the aphid *Cinara pinitabulaeformis* developed in *Pinus massoniana* stands at same time, the number of ants, mites and pentatomids increased but those of coccinellids and chrysopids decreased.

Chai, X.M., Hu, R.D., Ruan, Z.M. & Xu, Y.C. 1999. [Coccids endangering pines in Zhejiang.] (In Chinese with summary in English). Journal of Zhejiang Forestry Science and Technology 19(2): 1-6. [ChaiHuRu1999]

Notes: Ten species of coccids endangering *Pinus massoniana, P. taeda* and *P. elliottii* in Hangzhou, Zhejiang, China are recorded. The biological characteristics of *Ceroplastes rubens, Lepidosaphes pini* and *Chrysomphalus* sp. are briefly described. The natural enemies of the coccids are listed, and some prevention and control measures are proposed.

Charles, J.G., Froud, K.J. & Henderson, R.C. 2000. Morphological variation and mating compatibility within the mealybugs *Pseudococcus calceolariae* and *P. similans* (Hemiptera: Pseudococcidae), and a new synonymy. Systematic Entomology 25(3): 285-294. [CharleFrHe2000]

Notes: A laboratory study of isolines of *Pseudococcus calceolariae* (Maskell) and *P. similans* (Lidgett) collected from Hawke's Bay and Auckland, two widely separated regions in the North Island of New Zealand, threw doubt on the validity of the defining characters of these species. For *P. similans*, the number and position of oral rim tubular ducts varied widely and sometimes fell outside the defined limits for the species, and characteristic 'stout abdominal setae' were lost in the F1 generation. The morphological characters that separate one species from the other were manipulated by changing the temperature at which the mealybugs developed, such that cohorts of F1 sisters reared in the laboratory contained phenotypes of both *P. calceolariae* and *P. similans*. No impediments were found to breeding among populations of *P. calceolariae* and *P. similans* from Hawke's Bay and Auckland. All combinations of crosses between virgin females and males produced viable progeny. Those reared at 16 degrees C laid more eggs than those reared at 23 degrees C. The data did not suggest the existence of cryptic or sibling species, and contrasted with experiments elsewhere which quite clearly showed species incompatibility of closely related mealybugs. Examination of 160 'wild' specimens of *P. calceolariae* from New Zealand, Australia and California (U.S.A.) and *P. similans* from New Zealand and Australia showed a morphological continuum from one species to the other. It is concluded that *P. calceolariae* and *P. similans* merely represent the phenotypic extremes of one widely polymorphic species, with the morphological characters of individual adults determined by the microenvironment in which they developed. *Pseudococcus calceolariae* is thus the senior synonym of *P. similans*.

Chauvel, G. 1999. [What is your diagnosis?] Quel est votre diagnostic? (In French). PHM Revue Horticole (No. 408): 44-46. [Chauve1999]

Notes: Damage (caused by *Unaspis euonymi*) to spindle tree [*Euonymus europaeus*] in France is described. The life cycle and spatial distribution of larvae and adults on plants are described. Factors influencing development are briefly outlined, including high temperature, age of plants (more damage on old plants), stressed plants (drought), and protected sites (no wind or rain). Biological control by *Chilocorus kuwanae* was successful in NE USA. The use of bifenthrin, diesel oil, and rapeseed oil is authorized in France.

Chauvel, G. 2000. [Lepidoptera damaging green spaces, nurseries and urban forests.] Lepidopteres ravageurs en espaces verts, pepiniere et forêts peri-urbaines. (In French). PHM Revue Horticole No. 416: 18-20. [Chauve2000]

Notes: The biology and damage caused by *Coccus cossus* and other pest species are described.

Chen, X.M. 1999. [The present situation and prospects of utilization of resource insects in China.] (In Chinese with summary in English). World Forestry Research 12(1): 46-52. [Chen1999]

Notes: China has a long history of using insects as natural resources, and many types of insect resources have been utilized and cultivated, leading to the development of an industry with great economic and social benefits. This paper analyzes research and the present situation in the field, and prospects of development. Specific aspects covered include lac production (by ***Kerria*** spp.), white wax scale production (by ***Ericerus pela***), gall producing insects, and the use of insects as food.

Chung, K., Baker, J.R., Baldwin, J.L. & Chou, A. 2001. Identification of carmine allergens among three carmine allergy patients. Allergy 56(1): 73-77. [ChungBaBa2001]

Notes: There have been several reports of carmine allergy; however, identification of the responsible carmine allergens has not been widely documented. Three female patients presented with a history of anaphylaxis and/or urticaria/angioedema after ingestion of carmine-containing foods. All three patients had 4 + skin prick tests to carmine. Among them, two patients were confirmed to have carmine allergy by blinded, placebo-controlled food challenges to carmine. SDS-PAGE of cochineal insects and carmine, immunoblotting for IgE antibody with sera from all three patients, and immunoblotting inhibition with carmine were performed. SDS-PAGE of minced cochineal insects revealed several protein bands of 23-88 kDa. Several of these bands were variably recognized by our three patients' sera, and this reactivity was inhibited by carmine. Although no protein bands could be visualized on SDS PAGE of carmine in Coomassie brilliant blue staining, three protein bands were recognized by two of the three patients' serum. These results suggest that commercial carmine retains proteinaceous material from the source insects. These insect-derived proteins (possibly complexed with carminic acid) are responsible for IgE-mediated carmine allergy. Patient reactivity to these proteins may vary.

Ciampolini, M., Guarnone, A. & Mozzo, G. 2000. [Infestation of oak by ***Nidularia pulvinata***.] Infestazioni su leccio di ***Nidularia pulvinata***. (In Italian). Informatore Agrario 56(7): 100-107. [CiampoGuMo2000]

Notes: Biology, epidemiology, morphology and distribution as well as damage to ***Quercus ilex*** is discussed. This species was previously included in the Coccidae family, then transferred to Acanthococcites (=Eriococcidae), and, later, Kermesidae.

Clifford, M.N. 2000. Miscellaneous phenols in foods and beverages - nature, occurrence and dietary burden. Journal of the Science of Food and Agriculture 80(7): 1126-1137. [Cliffo2000]

Notes: This paper considers the occurrence, dietary burden and biological significance of those classes of phenols that have not been covered in the associated papers. Some of these compounds are permitted food additives (eg cochineal, cinnamoylmethanes). It is a cause for concern that the margin of safety between a safe dose and the minimum dose producing significant adverse effects is narrower in some cases than would be tolerated for a food additive (eg psoralen). For others such as the alkenylresorcinols, capsaicins, and phlorotannins, little or nothing is known about the burden, metabolism and biological effects.

Cloyd, R.A. & Sadof, C.S. 2000. Effects of plant architecture on the attack rate of ***Leptomastix dactylopii*** (Hymenoptera: Encyrtidae), a parasitoid of the citrus mealybug (Homoptera: Pseudococcidae). Environmental Entomology 29(3): 535-541. [CloydSa2000]

Notes: Attack rates of the parasitoid ***Leptomastix dactylopii*** (Howard) were examined in petri dishes and on caged plants that varied in architectural characteristics. Individual female parasitoids were placed into petri dishes containing a range of densities of the citrus mealybug, ***Planococcus citri*** (Risso). Green and yellow-variegated coleus, ***Solenostemon scutellarioides*** (L.) Codd, were used to determine the effects of plant architecture on the rate at which ***L. dactylopii*** parasitized citrus mealybugs. Coleus plants were categorized into size classes based on height, number of leaves, leaf surface area, and number of branches. A single mated female ***L. dactylopii*** was placed into each plastic observation cage containing a plant with 1, 8, or 16 third- to early fourth-instar mealybugs

and allowed to forage for 24 h. After this time, citrus mealybugs were removed from coleus plants and placed into petri dishes that were checked after 10 d for mummified citrus mealybugs, the measure of a successful attack. *L. dactylopii* were unable to find a host after 24 h when only one citrus mealybug was present in the searching environment. Higher attack rates occurred as the number of mealybugs increased in the petri dishes. *L. dactylopii* attacked an average of 15.6 ± 2.3 mealybugs within a 24-h period. Higher attack rates were evident as the number of citrus mealybugs increased on caged plants. Plant color had no effect on the attack rate of *L. dactylopii*. All architectural characterizations of plant size, height, leaf number, leaf surface area, and branch number were negatively correlated with parasitoid attack rate. These findings suggest that biological control practitioners may use any convenient measure of plant size (e.g., height) to modify the release rate of *L. dactylopii* in a citrus mealybug management program.

Cook, L.G. 2000. Extraordinary and extensive karyotypic variation: A 48-fold range in chromosome number in the gall-inducing scale insect *Apiomorpha* (Hemiptera : Coccoidea: Eriococcidae). Genome 43(2): 255-263. [Cook2000]

Notes: Chromosome number reflects strong constraints on karyotype evolution, unescaped by the majority of animal taxa. Although there is commonly chromosomal polymorphism among closely related taxa, very large differences in chromosome number are rare. This study reports one of the most extensive chromosomal ranges yet reported for an animal genus. *Apiomorpha* Rubsaamen (Hemiptera: Coccoidea: Eriococcidae), an endemic Australian gall-inducing scale insect genus, exhibits an extraordinary 48-fold variation in chromosome number with diploid numbers ranging from 4 to about 192. Diploid complements of all other eriococcids examined to date range only from 6 to 28. Closely related species of *Apiomorpha* usually have very different karyotypes, to the extent that the variation within some species-groups is as great as that across the entire genus. There is extensive chromosomal variation among populations within 17 of the morphologically defined species of *Apiomorpha* indicating the existence of cryptic species-complexes. The extent and pattern of karyotypic variation suggests rapid chromosomal evolution via fissions and (or) fusions. It is hypothesized that chromosomal rearrangements in *Apiomorpha* species may be associated with these insects' tracking the radiation of their species host genus, *Eucalyptus*.

Cook, L.G., Gullan, P.J. & Stewart, A.C. 2000. First-instar morphology and sexual dimorphism in the gall-inducing scale insect *Apiomorpha* Rubsaamen (Hemiptera: Coccoidea: Eriococcidae). Journal of Natural History 34(6): 879-894. [CookGuSt2000]

Notes: Sexual dimorphism among crawlers of the scale insect family Eriococcidae is reported for the first time. The general morphology of crawlers of the gall-inducing genus *Apiomorpha* (Eriococcidae) is presented and sexual dimorphism described. Sexual dimorphism appears to be associated with differential dispersal and settling-site preference of the sexes during the crawler stage. First-instar males of the *A. pharetrata* and *A. munita* species-groups settle only on the galls induced by their mothers or, in the case of *A. munita*, also galls of nearby females, whereas female crawlers disperse. Female crawlers of all species of *Apiomorpha*, and male crawlers of most species, are well suited for air-borne dispersal. It is suggested that sexual dimorphism among crawlers of *Apiomorpha*, and some other scale insects, is the result of loss or reduction of those morphological features associated with dispersal. In addition, male crawlers of some species of *Apiomorpha* have sensory structures which may assist in the detection of sex-specific settling sites.

Coronado Blanco, J.M. & Ruiz Cancino, E. 1999. [First record of *Atomosia macquarti* Bellardi (Diptera: Asilidae) as predator of *Unaspis citri* (Comstock) (Homoptera: Diaspididae).] Primer registro de *Atomosia macquarti* Bellardi (Diptera: Asilidae) como depredador de *Unaspis citri*. (In Spanish). Folia Entomologica Mexicana No. 105: 81-82. [CoronaRu1999]

Notes: *Atomosia macquarti* (a predator of *Unaspis citri*) was found for the first time in Mexico in 1997 on *Citrus sinensis* cv. Valencia.

Coronado Blanco, J.M., Ruiz Cancino, E. & Jarillo, A.M. 2000. [The predator-prey association of ***Zagloba beaumonti*** (Coleoptera, Coccinellidae) with ***Unaspis citri*** (Homoptera, Diaspididae).] (In Spanish with summary in English). Acta Zoologica Mexicana Nueva Serie (79): 277-278. [CoronaRuJa2000]

Notes: The predator - prey association of ***Zagloba beaumonti*** with the citrus snow scale, ***Unaspis citri*** is registered. Besides, ***Z. beaumonti*** is a new record for Mexico.

Costa Comelles, J., Rodriguez, J.M., Alonso, A., Santamaria, A., Alonso, D., Granda, C., Sanz, E., Marzal, C. & Garcia Mari, F. 1999. [The influence of application date on the efficiency of pesticides on the citrus scales ***Parlatoria pergandii*** Comstock and ***Cornuaspis beckii*** (Newman).] (In Spanish). Boletín de Sanidad Vegetal, Plagas 25(2): 115-124. [CostaCRoAl1999]

Notes: [Original title: Influencia del momento del tratamiento en la eficacia de los plaguicidas sobre los diaspinos de cítricos piojo gris ***Parlatoria pergandii*** Comstock y serpeta gruesa ***Cornuaspis beckii*** (Newman).] The optimum insecticide application date for maximum control of the chaff scale ***Parlatoria pergandii*** Comstock and the mussel scale ***Cornuaspis beckii*** (Newman) was studied in four field trials in Spain in 1995-97. The treatment efficacy decreased as the scale infestation increased, so as a whole the efficacy on the chaff scale in the three trials was lower (41%) than on the mussel scale (58%). The comparison of the mean efficacy in the two periods, June and August, showed that the June spray is clearly better for the chaff scale, whereas for the mussel scale no significant differences appeared between the two periods. Chlorpyrifos and pyriproxyfen showed higher efficacy than pirimiphos-methyl and malathion, specially for the control of the chaff scale. The mineral oil provided results similar to the two best chemicals for control of the chaff scale, and seemed to be less effective for the mussel scale. In August, the mineral oil surpassed chlorpyrifos for control of the chaff scale and both chemicals gave similar results for control of the mussel scale.

Cranshaw, W., Jevremovic, Z., Sclar, D.C. & Mannix, L. 2000. Observations on the biology and control of the hawthorn (two-circuli) mealybug, ***Phenacoccus dearnessi*** (King). (In English with summaries in French, German and Spanish). Journal of Arboriculture 26(4): 225-229. [CranshJeSc2000]

Notes: ***P. dearnessi*** is a serious woody plant pest of ***Crataegus*** pp. in Colorado. Studies were conducted to understand its biology and to evaluate management strategies.

Cross, J.V., Solomon, M.G., Babandreier, D., Blommers, L., Easterbrook, M.A., Jay, C.N., Jenser, G., Jolly, R.L., Kuhlmann, U., et al. 1999. Biocontrol of pests of apples and pears in northern and central Europe: 2. Parasitoids. Biocontrol Science and Technology 9: 277-314. [CrossSoBa1999]

Notes: Scale hosts discussed include ***Lepidosaphes ulmi, Quadraspidiotus ostreaeformis, Q. pyri*** and ***Q. perniciosi***.
Cruickshank, R.H. & Thomas, R.H. 1999. Evolution of haplodiploidy in dermanyssine mites (Acari: ***Mesostigmata***). Evolution 53(6): 1796-1803. [CruickTh1999]

Notes: Haplodiploidy, a widespread phenomenon in which males are haploid and females are diploid, can be caused by a number of different underlying genetic systems. In the most common of these, arrhenotoky, males arise from unfertilized eggs, whereas females arise from fertilized eggs. In another system, pseudoarrhenotoky, males arise from fertilized eggs, but they eliminate the paternal genome at some point prior to spermatogenesis, with the consequence that they do not pass this genome to their offspring. In 1931 Schrader and Hughes-Schrader suggested that arrhenotoky arises through a series of stages involving pseudoarrhenotokous systems such as those found in many scale insects (Homoptera: Coccoidea), however, their hypothesis has been largely ignored. We have used a phylogenetic analysis of 751 base pairs of 28S rDNA from a group of mites (Mesostigmata: Dermanyssina) that contains arrhenotokous, pseudoarrhenotokous, and ancestrally diplodiploid members to test this hypothesis. Neighbor-joining, maximum-parsimony, and maximum-likelihood methods all indicate that the arrhenotokous members of this group form a clade that arose from a pseudoarrhenotokous ancestor, rather than directly from a diplodiploid one. This provides unequivocal support for the hypothesis of Schrader and Hughes-Schrader. The wider implications of this result for the evolution of uniparental genetic systems are discussed.

Cuautle, M., Rico Gray, V., Garcia Franco, J.G., Lopez Portillo, J. & Thien, L.B. 1999. [Description and seasonality of a Homoptera-ant-plant interaction in the semiarid Zapotitlan Valley, Puebla, Mexico.]. (In English with summary in Spanish) 10th International Conference of Plant Protection No. 78: 73-82. [CuautlRiGa1999]

Notes: Unspecified coccids were present in 35 (21.9%) of the *Agave kerchovei* individuals sampled in Puebla, Mexico. Homopteran honeydew is foraged year-around by ants (*Camponotus rubrithorax*), the surplus either moves down-leaf and is used as a substrate by sooty moulds, or actively foraged by an assorted collection of insect species (Diptera and Hymenoptera). Ants are significantly more abundant in the drier and colder portion of the year, and they also varied in a significant way with precipitation and homopteran density. Flies (Diptera), wasps [Vespidae], and bees [Apidae] were more abundant during the warmer and more humid period of the year. The number of flying insects occurring during any month was significantly associated with temperature and plant diameter. Flies were more abundant during the warmer months, and their numbers also increased with homopteran density. The number of ants and flies present on agave individuals depends in part on homopteran densities, but also on environmental factors. Honeydew attracts a variety of insects generating interactions among organisms that would otherwise be a part of different component communities. Most visitors are predators, parasites or parasitoids; they forage for honeydew but are evidently attracted by a large quantity of possible prey or hosts.

Cunningham, C.J. 1999. Care needed to slow mealybug spread. California Grower 23(9): 8-9. [Cunnin1999a]

Notes: The vine mealybug (species not named) is a native of the Black Sea area and an established pest of grapes, date palms and figs in South Africa, Egypt, India and Israel. Research briefly reviewed and techniques for slowing its spread are mentioned.

Cunningham, C.J. 1999. Cottony cushion scale booming. California Grower 23(8): 20-21. [Cunnin1999b]

Notes: *Icerya purchasi.*

Danzig, E.M. 2000. A new species of gall-forming armored scale insect from Israel (Homoptera, Coccinea: Diaspididae). Zoosystematica Rossica 8(2): 287-289. [Danzig2000]

Notes: *Diaspidiotus roseni*, new sp., living on *Nitraria retusa* is described from Israel and compared with *D. nitrariae.*

Das, S. & Ghose, S.K. 1999. Biology of orange mealybug, *Pseudococcus mandarinus* Das and Ghose (Homoptera : Pseudococcidae). Proceedings of the Zoological Society (Calcutta) 52(1): 53-57. [DasGh1999]

Notes: The female and male nymphs of *Pseudococcus mandarinus* Das and Ghose, reared in mass on sprouted potato tubers (*Solanum tuberrosum (tuberosum?* L.) at 27-32 degree C and 74-96% R. H., completed ecdysis at the age of 20-27 (23.29 +- 3.97) and 17-22 (19.35 +- 1.28) days. The mode of reproduction is sexual and ovoviviparous. The preoviposition-and oviposition period, fecundity and incubation period of eggs are : 5-8 (6.43 +- 0.90) and 5-12 (8.42 +- 2.06) days, 42-222 (128.28 +- 55.51) eggs/female and 20.65 hour.

De Haro, M.E. & Claps, L.E. 1999. [First record of *Dactylopius coccus* (Hemiptera: Dactylopiidae) to the Argentine Republic.] (In Spanish with summary in English). Revista de la Sociedad Entomológica Argentina 58 (3-4): 128. [DeHaroCl1999]

Dejean, A. & Gibernau, M. 2000. A rainforest ant mosaic: The edge effect (Hymenoptera : Formicidae). Sociobiology 35(3): 385-401. [DejeanGi2000]

Notes: The ant mosaic in the edge of a Cameroonian rainforest was studied along 500m of a dirt road in order to compare it to that of the canopy in the same forest (Dejean et al. 2000; 167 trees studied). The plant species diversity was low (369 plant individuals belonging to 48 species and 28 families). The Euphorbiaceae *Alchornea cordifolia* was the most frequent species. The ant assemblage was characterized by high abundance but low diversity (22 species in total) with eight "dominant" species, and seven sub-dominant as well as non-dominant species. The dominant species occupied only 69.9% of the plants. The most frequent species, *Crematogaster*

striatula, Pheidole megacephala, Oecophylla longinoda, and ***Tetramorium aculeatum*** occupied 25.5%, 18.2%, 13%, and 9.2% of the plants, respectively. Among the sub-dominant species, ***Camponotus brutus*** was by far the most frequent (12.2% of the plants). The associated homopterans recorded on 30.6% of the plants belonged to eight families with Stictococcidae and Membracidae being the most frequent. As a result, the main differences with the canopy of the same forest consisted in a lower plant diversity, more dominant ant species (eight vs, four), a larger diversity and greater influence of sub-dominant species (4.8% of the trees vs. 24.7% of the plants), and a larger diversity of attended Homoptera, including aphids and pseudococcids among the Sternorrhyncha, and several famililies of Auchenorrhyncha absent or very rare if present at canopy level.

Dejean, A., Bourgoin, T. & Orivel, J. 2000. Ant defense of ***Euphyonarthex phyllostoma*** (Homoptera: Tettigometridae) during trophobiotic associations. Biotropica 32(1): 112-119. [DejeanBoOr2000]

Notes: The trophobiotic relationships between ants and homopterans seem to be well known but studies principally have concerned the Sternorrhyncha (aphids and coccids).

Dejean, A., McKey, D., Gibernau, M. & Belin, M. 2000. The arboreal ant mosaic in a Cameroonian rainforest (Hymenoptera: Formicidae Sociobiology 35(3): 403-423. [DejeanMcGi2000]

Notes: The ant mosaic of the canopy of a Cameroonian rainforest was studied by directly sampling 167 large trees and 20 vines reaching the canopy level using a dirigible and the "canopy raft", the "canopy sled", and, when necessary, the single rope technique. Although plant species diversity was high (trees: 63 species from 29 families; vines: 9 species from 7 families), our results show an ant assemblage characterized by high abundance but low diversity (28 ant species in total). We recorded only four "dominant" ant species (i.e., species with populous colonies that build their own nests, exhibit strong territoriality, and have mutually exclusive territories distributed in a mosaic pattern). The most frequent species, ***Crematogaster depressa***, occupied 87.4% of the trees and 85% of the vines, and its colonies reached several million workers. Other dominants were recorded at low frequencies (***Crematogaster*** sp.1: 1.8% of the trees; ***Oecophylla longinoda***: 6.0%; ***Tetramorium aculeatum***: on one vine). Among the nine ant species tolerated on the territories of ***Cr. depressa*** (i.e., "non-dominant" species with smaller colonies), the workers of three species shared their trails with ***Cr. depressa***, while ***Camponotus brutus***, with colonies sometimes able to occupy the entire crown of a tree, rather had the status of "subdominant". Extrafloral nectaries (EFN) played a role in ant species distribution. The large ecological success of ***Cr. depressa*** is probably due to its ability to nest on trees with or without EFN. ***O. longinoda***, which rarely tolerated non-dominant ant species, was significantly more frequently recorded on trees without EFN. While dominant ants depended principally on attended homopterans (Coccidae and Stictococcidae; globally: 300,000 to 700,000 individuals per tree), nondominant species depended primarily on EFN. Scale species mentioned include ***Coccus*** sp., ***Couturierina piptadeniastri, Houardia*** sp., ***Parasaissetia nairobica. Saissetia*** sp., ***Udinia farquharsoni, Stictococcus intermedius, Ceroplastes*** sp. and ***Aspidiotini*** sp.

Deka, M.K., Gupta, M.K. & Singh, S.N. 1999. Effect of different dust formulation of insecticides on the incidence of sugarcane insect pests. Indian Sugar 49(5): 357-361. [DekaGuSi1999]

Notes: Field experiments were conducted during 1996-97 with different formulations of insecticides (fenvalerate 0.4% dust, malathion 10% dust and sugarcane pressmud) to control sugarcane pests. Field trials were carried out in Assam, India, using sugarcane variety CoBln9102. The tested insecticides showed very good results, with malathion 10% dust at 2.0 kg ai/ha reducing pests most. The percentages of top borer (***Scirpophaga excerptalis***) and plassey borer (***Chilo tumidicostalis***) after treatment with 2 kg ai/ha malathion were 15.71 and 16.25%, respectively, compared with 57.59 and 66.42% in untreated controls. Malathion at 1.50 kg ai/ha also significantly reduced of both pests. Fenvalerate also reduced pests on sugarcane. Termite (***Odontotermes obesus***) and mealy bug [***Saccharicoccus sacchari***] were also significantly reduced by both malathion and fenvalerate. The highest yield (105.32 t/ha) was recorded from the plots which received malathion 10% dust at 2.0 kg ai/ha. Sugarcane pressmud did not show a significant reduction of pests.

Devasahayam, S. & Koya, K.M.A. 1999. Integrated management of insect pests in spices. Indian Journal of Arecanut, Spices and Medicinal Plants 1(1): 19-23. [DevasaKo1999]

Notes: Infestation by insect pests is a major factor responsible for the low productivity of spices in India. Excessive and indiscriminate use of pesticides could lead to pesticide residues in spices and other environmental hazards. Hence, adoption of environment-friendly strategies such as Integrated Pest Management in spices is of great relevance. The technologies available for the integrated management of insect pests of major spices such as black pepper (*Longitarsus nigripennis* and scale insects), cardamom (*Sciothrips cardamomi, Conogethes punctiferalis* and *Basilepta fulvicorne [B. fulvicornis]*), and ginger and turmeric (*C. punctiferalis* and *Aspidiella hartii*), in India, are discussed.

DiGregorio, L.M., Krasny, M.E. & Fahey, T.J. 1999. Radial growth trends of sugar maple (*Acer saccharum*) in an Allegheny northern hardwood forest affected by beech bark disease. Journal of the Torrey Botanical Society 126(3): 245-254. [DiGregKrFa1999]

Notes: In many forests of the northeastern US, canopy gaps are the predominant mode of disturbance and thus regulate future forest structure and species composition. Radial growth trends were examined in canopy and subcanopy sugar maple (*Acer saccharum*) trees growing in gaps and non-gap areas in three second-growth, Allegheny northern broadleaved forest stands in central New York. The objective was to determine if a recent diffuse disturbance of the canopy caused by beech bark disease (caused by a combination of the beech scale insect *Cryptococcus fagisuga* and the fungal pathogens *Nectria* spp. attacking *Fagus grandifolia*) stimulated growth of sugar maple trees in gaps and throughout the forest. Annual radial growth (mm/year) of canopy gap-edge trees and subcanopy trees in gaps was significantly greater than that of canopy trees and subcanopy trees in non-gap areas. During the period of beech bark disease-induced canopy decline, non-gap subcanopy trees exhibited an annual radial growth 30% higher and a radial growth rate (mm/year per annum) four times greater than during the years prior to the disturbance. In contrast, canopy trees not adjacent to gaps showed no change in radial growth coincident with the disturbance. These results suggest that in forests with significant canopy deterioration, differences in tree growth between gap and non-gap environments can be expected; however, positive growth responses among sub-canopy trees may not be limited to the area directly in gaps and instead may occur throughout the forest.

Dunkelblum, E., Harel, M., Assael, F., Mori, K. & Mendel, Z. 2000. Specificity of pheromonal and kairomonal response of the Israeli pine bast scale *Matsucoccus josephi* and its predator *Elatophilus hebraicus*. Journal of Chemical Ecology 26(7): 1649-1657. [DunkelHaAs2000]

Notes: It has been demonstrated previously that the sex pheromone of the Israeli pine bast scale, *Matsucoccus josephi*, 2E,5R,6E,8E)-5,7-dimethyl-2,6,8-decatrien-4-one (1) is also a potent kairomone of the scale insect's predator *Elatophilus hebraicus*. Surprisingly, the sex pheromones of *M. feytaudi* (2) and *M. matsumurae* (3) also attract *E. hebraicus*. These results have prompted us to prepare a series of analogs of 1 with variations in the two moieties attached to the C=O group (4-9) in order to probe the structure-activity relationship of the pheromonal/kairomonal response of *M. josephi* and *E. hebraicus*. The most selective and active pheromone analog is 8, attracting only *M. josephi* males and the most selective and active kairomone analog is the *M. feytaudi* pheromone 2, attracting only adults of *E. hebraicus*. A dose-response field test of these analogs and the chiral and racemic *M. josephi* pheromone 1 indicates that the specificity is maintained at a broad range between 25 and 400 mu g corresponding to 1. Analog 5, which is neither a parapheromone nor a kairomone, and analog 8, which is only a parapheromone, are not inhibitory to *M. josephi* or to *E. hebraicus*. Our study indicates that alterations in the diene side chain of 1, common to all three *Matsucoccus* pheromones, strongly reduce the kairomonal activity while structural changes in the second side chain significantly reduce the pheromonal activity. The discovery of selective analogs of 1 has practical implications and enables specific monitoring of *M. josephi* or *E. hebraicus*. Particularly important is the possibility to mass-trap males of *M. josephi* without reducing the population of *E. hebraicus*.

Dziedzicka, A. & Madro, D. 1999. Three species of scale insects (Coccinea) new to Polish greenhouses. Acta Biologica Cracoviensia Series Zoologia 41: 15-18. [DziedzMa1999]

Notes: ***Coccus perlatus, Carulaspis juniperi*** and ***Rhizoecus dianthi*** are briefly described, illustrated and compared to similar species. Brief biological notes and host plants are provided.

Edmonds, J. 1999. The red dyes: Cochineal. 34 In: The history and Practice of Eighteenth Century Dyeing (Historic Dyes Series, No. 2). Available from Chiltern Open Air Museum, Bucklinghamshire, UK. 53 pp. [Edmond1999]

Notes: A brief paragraph summarizing the history and use of cochineal as a dye.

El Sayed, N.H., Emam, S.S., Mogahed, M.I., Yousef, A.K. & Mabry, T.J. 1999. Flavonoids and other constituents from ***Cleome africana*** and their insecticidal activities. Revista Latinoamericana de Química 27(1): 9-12. [ElSayeEmMo1999]

Notes: Eleven flavonoids, an alkaloid, 9 volatile oils, 6 hydrocarbons and 3 sterols were identified from aerial parts of ***C. africana***. Chloroform, ethyl acetate, alcohol and water extracts of ***C. africana*** were sprayed on ***I. aegyptiaca***-infested guava trees in Cairo, Egypt. The chloroform extract (at 5 and 10% concentrations) was highly active against ***I. aegyptiaca*** larvae.

Fabbri, D., Chiavari, G. & Ling, H. 2000. Analysis of anthraquinoid and indigoid dyes used in ancient artistic works by thermally assisted hydrolysis and methylation in the presence of tetramethylammonium hydroxide. Journal of Analytical and Applied Pyrolysis 56(2): 167-178 [FabbriChLi2000]

Notes: Thermally assisted hydrolysis and methylation (THM) in the presence of tetramethylammonium hydroxide (TMAH) was applied to the analysis of red dyes. Carminic acid is the principal coloured compound of cochineal red. Carminic acid produced a series of methylated fragments deriving from both the substituted anthraquinoid moiety and the glycosidically-Clinked glucose.

Fabre, J.P., Menassieu, P., Foing, J.J. & Chalon, A. 2000. Biology and ecology of ***Elatophilus nigricornis*** Zetterstedt (Hemiptera: Anthocoridae) predator of ***Matsucoccus feytaudi*** Ducasse (Homoptera: Matsucoccidae) in the South-East of France. Annals of Forest Science 57(8): 777-792. [FabreMeFo2000]

Notes: The pine scale ***Matsucoccus feytaudi*** was accidentally introduced into the maritime pine stands of the Maure and Esterel Forests. It is the primary cause of the dieback of 120,000 ha stands and its specialist predator ***Elatophilus migricornis*** has been studied. It is possible to maintain and raise it in laboratory conditions but its output is not prolific enough to envisage propagation which would allow it to be released in natural conditions. When raised in laboratory conditions the time required for its development and fecundity have been determined. In natural conditions, nymphs develop in trunk bark cracks, adults mate, but females insert eggs in needles. The population of the eggs is distributed according to two gradients: a decreasing gradient from the bottom to the top of the trees and a decreasing gradient from the trunk to the extremities of the branches. The distribution of its nymph populations on the trunk and branches is different before and after the invasion of ***M. feytaudi***. In reality, the distribution of the predator nymph populations always coincides with that of its host even when that of the latter changes. ***E. nigricornis*** produces at least three generations a year for ***M. feytaudi***) and overwinters at the fertilized female stage. Two sampling methods have allowed us to estimate the population levels which have developed during and after the pine scale invasion. Even when there was widespread destruction of the trees attacked due to the action of the xylophagous, there is a link between the size of the ***E. nigricornis*** populations on the trees and the capacity of the tree to survive. In stands where more than half the trees survived it was found that in 6 years the level of weekly captures was multiplied by 26. Finally, on regeneration trees which replaced the old stands that had been destroyed or felled, the population levels are three times greater.

Feng, Y., Chen, X.M., Ye, S.D., Wang, S.Y., Chen, Y. & Wang, Z.L. 1999. [Records of four species of edible insects in the Homoptera and the analysis of their nutritive value. (In Chinese with summary in English). Forest Research 12(5): 515-518. [FengChYe1999]

Notes: Seven species of edible Homoptera are recorded from forests in Yunnan Province, China, 4 for the first time. The 7 species include 3 species of cicadas (Cicadidae: ***Cicada flammata [Tibicen flammatus], Cryptotympana atrata, Platypleura kaempferi***) and 4 species of scale insects (***Ericerus pela, Lawana imitata, Darthula hardwickii, Phenacoccus prunicola***). Nutrient analyses are reported for 3 of the species (*L. imitata, D. hardwickii, E. pela*), and show that they are rich in protein (protein contents are >50%), amino acids, fats, microelements and vitamins.

Fernandes, I.M. 1999. [New data for the entomofauna of Cape Verde.] Novos dados para o conhecimento da quermofauna do Arquipelago de Cabo Verde. (In Portuguese with summary in English). García de Orta, Serie de Zoologia. Lisboa 23(1): 85-89. [Fernan1999]

Notes: The author studied some scale insects from Santiago Island (Cape Verde), of the families Pseudococcidae, Coccidae, Asterolecaniidae and Diaspididae. ***Radionaspis indica*** (Marlatt), on mangoes, was recorded for the first time.

Fernando, L.C.P. & Walter, G.H. 1999. Activity patterns and oviposition rates of *Aphytis lingnanensis* females, a parasitoid of California red scale *Aonidiella aurantii*: implications for successful biological control. Ecological Entomology 24(4): 416-425. [FernanWa1999]

Notes: Activity patterns of *Aphytis lingnanensis* females were determined. *A. lingnanensis* females showed a repeatable pattern of activity during the course of the day, ovipositing actively during the first 1.5 h of their 7 h exposure to hosts. Thereafter, activity levels decreased sharply and females spent relatively long intervals resting. Activity occurred in fairly discrete bouts, with long periods of inactivity, ranging from 12 to 231 min between bouts. Once females completed a bout of oviposition in the laboratory, they moved away from the hosts even though many suitable hosts remained. They stood immobile, sheltering, until they matured more eggs. These results suggest how general biological control models and dynamic state variable models of behaviour can be made more realistic. In particular, the behaviour of females does not remain constant over extended periods, particularly because of egg depletion, which suggests that the interaction between the ovipositional history of the individual and its physiological capabilities dictates the response of females to particular circumstances, and thus contributes to patterns of parasitism in the field. It is predicted that *A. lingnanensis* females in the field are inactive at night and begin ovipositing when it becomes light enough in the morning. Egg depletion is likely if enough hosts are available, but should occur later in the day than was recorded in the laboratory. Egg-depleted females are likely to shelter while they mature more eggs, but may undertake interpatch movement.

Foldi, I. 1999. [A new name to replace ***Hodgsonius*** Foldi, 1998 (Hemiptera: Coccoidea: Margarodidae)]. Un nouveau nom pour remplacer ***Hodgsonius*** Foldi, 1998 (Hemiptera: Coccoidea: Margarodidae). (In French). Annales de la Société Entomologique de France 35(3-4): 348. [Foldi1999a]

Notes: Brief note advocating ***Neohodgsonius*** over ***Hodgsonius***, which was originally erected for the species ***Hodgsonius phaenicuroides*** in 1851.

Foldi, I. 2000. Diversity and modification of the scale insects communities of the Hyeres islands in natural and man-modified environments (Hemiptera: Coccoidea). (In French). Annales de la Société Entomologique de France 36(1): 75-94. [Foldi2000]

Notes: The species diversity and the composition of populations of scale insects in natural and man-modified environments in the French Mediterranean Hyeres Islands is analysed. Of the total of 101 species collected, 63 are new records to the islands, 6 of which are new to the French fauna: ***Aclerda berlesii, Neomargarodes europaeus, Antonina graminis, Ferrisia virgata, Geococcus coffeae, Pure palinuri***. The new records are of Palaearctic (mostly Euro-Siberian and Mediterranean) origin or cosmopolitan; most are polyphagous, specialising in living on branches.

The most common coccoid species on the islands is *Saissetia oleae*. *Trionymus lanatus* seems to be endemic. Thirty five pest species are recorded, of which 21 are probably recent introductions. Both descriptive and evolutionary aspects of scale insect biodiversity were studied. Comparison of the results with data from 67 year ago shows that the modification of populations differs between natural and man-modified environments. In the natural environment of Port-Cros National Park the fauna remained quite stable, changing only from 44 to 51 species. However, in man-modified environments there has been a marked increase in the number of species: from 14 to 77 in Porquerolles, and from 18 to 30 in Levant. These results show that human activities does not reduce, on the contrary, it increases, species diversity, by facilitating introduction of alien species to the islands; among them are numerous cosmopolitan and polyphagous species which are indicators for a disturbed environment. One of the detrimental effects of human activity is the fragmentation of vegetation in fragile habitats, which particularly affects rare and monophagous species. A list of scale insect species recorded in the islands is provided, together with some biological and biogeographical data.

Follett, P.A. & Gabbard, Z. 1999. Efficacy of the papaya vapor heat quarantine treatment against white peach scale in Hawaii. HortTechnology 9(3): 506. [FolletGa1999]

Notes: A heat treatment that killed all eggs, crawlers and hardshell stages of ***Pseudaulacaspis pentagona*** on pawpaw fruits (cv. Kopoho Solo from Hawaii) is presented.

Fortusini, A., Scattini, G., Prati, S., Cinquanta, S. & Belli, G. 1999. Transmission of grapevine leafroll virus 1 (GLRV-1) and grapevine virus A (GVA) by scale insects. International Council for the study of Viruses and Viruslike diseases of the Grapevine 12th ICVG Meeting: 121-122. [FortusScPr1999]

Notes: [Meeting held in Lisbon, Sept. 28 - Oct. 2, 1997.] ***Neopulvinaria innumerabilis, Parthenolecanium corni, P. persicae*** and ***Pulvinaria vitis*** were present in the vinyards and tested in these experiments to verify their ability to transmit viruses.

Fowjhan, M.A. 1999. Effect of some traditional and IDRD insecticides against ***Unaspis euonymi*** and ***Carulaspis juniperi*** (Homoptera: Coccoidea). Acta Phytopathologica et Entomologica Hungarica 34(1/2): 137-147. [Fowjha1999]

Notes: Some traditional and several nontoxic new selective compounds were tested against ***Unaspis euonymi*** and ***Carulaspis juniperi***. The effectiveness of Agrol (cosmetic vaseline oil) was between 75 and 85% with a spring treatment. In the summer, treatments of Zolone (fozalon) greatly reduced the number of eggs, but selective compounds only reduced egg numbers by c. 50%. Zolone, Applaud (bubrofezin) and Aware (dioxalane) significantly reduced the number of all instars, and even in autumn there were significantly fewer overwintering females after treatments. Vektoricid (summer oil) showed a similar effect. Insegar (fenoxycarb), in some cases, was less efficient. Infestation with natural enemies of ***U. euonymi*** was extremely low, and ***C. juniperi*** showed a medium-high level of infestation with natural enemies.

Fowjhan, M.A. & Kozár, F. 1999. Scale insects on stone fruits in Afghanistan and Iran. IOBC-WPRS Bulletin 22(11): 119-123. [FowjhaKo1999]

Notes: Six species of scale insects were found in Afghanistan, including 5 species belonging to Diaspididae and one species to Coccidae. Eight species were found in Iran: six species of Diaspididae and two species of Coccidae.

Garcia, J.F. & O'Neil, R.J. 2000. Effect of ***Coleus*** size and variegation on attack rates, searching strategy, and selected life history characteristics of ***Cryptolaemus montrouzieri*** (Coleoptera: Coccinellidae). Biological Control 18(3): 225-234. [GarciaAc2000]

Notes: Twenty-four-hour attack rates and the search strategy of third instar ***Cryptolaemus montrouzieri*** Mulsant (Coleoptera: Coccinellidae) attacking 1 to 16 third instar ***Planococcus citri*** Risso (Homoptera: Pseudococcidae) were measured on green and yellow-variegated ***Solenostemon scutellarioides*** (L.) Codd (= ***Coleus blumei*** (Bentham)) (Labiatae) plants of different sizes. Selected life history characteristics of ***C. montrouzieri*** fed different

amounts of *P. citri* as prey from third instar to adults were also examined. On average, predators attacked 1 to 4 mealybugs, depending on the number of mealybugs and plant size. There was no effect of plant color on attack rates. Attack rates were positively related to prey density, whereas the estimated area searched by predators was inversely related to prey density. Analyses suggest that leaf area was the plant characteristic that most affected attack rates. Predators fed few prey had a decrease in body weight and survival. The implications for the use of *C. montrouzieri* in biological control are discussed.

Garcia, M.F. 1999. *Asterolecanium pustulans* Ckll. (Homoptera, Coccoidea, Asterolecaniidae): Biological study. (In Spanish). Revista de la Facultad de Ciencias Agrarias Universidad Nacional de Cuyo 31(2): 7-12. [Garcia1999]

Notes: *Asterolecanium pustulans* Cockerell was studied to know its behavior under conditions of controlled temperature and humidity, using different hosts for its multiplication. In this way it is possible to know the oviposition and its determinism, main tools to study its pullulation. It was determined that the host influences the degree of evolution of the scales, being the time recquired for a generation shorter on fruits of *Citrullus vulgaris* L., than on *Solanum tuberosum* L. Its reproduction is exclusively by parthenogenesis, with no male presence already determined.

Gaume, L., Matile-Ferrero, D. & McKey, D. 2000. Colony formation and acquisition of coccoid trophobionts by *Aphomomyrmex afer* (Formicinae): co-dispersal of queens and phoretic mealybugs in an ant-plant-homopteran mutualism? Insectes Sociaux 47(1): 84-91. [GaumeMaMc2000]

Notes: In coastal forests of Cameroon, colonies of the ant *Aphomomyrmex afer* are found in hollowed twigs of two species of trees, most commonly the myrmecophyte *Leonardoxa africana* T3. Established colonies of this ant are always associated with coccoid homopterans (the pseudococcid *Paraputo anomala* or the coccid *Houardia abdita*, or both) within hollow twigs, and ants appear to be dependent on these sap-sucking trophobionts. We dissected domatia of juvenile host-plants that had not yet acquired an established colony to determine (1) how colonies are founded, and (2) when and how trophobionts are acquired. Colony foundation is claustral. A single queen chews an entrance hole into an unoccupied domatium that serves as the founding chamber. The entrance hole is partially closed by debris and later by callus growth. Nineteen foundresses were located while still in the claustral phase, with no workers or a few nanitic workers. Of the 19 foundresses, 12 had at least a single *Paraputo anomala* individual in the same domatium. One of the queens had two female *P. anomala* nymphs attached to her body. The remaining 7 foundresses were not associated with coccoids. These results indicate that mealybug and ant may codisperse by phoresis of juvenile female mealybugs on founding queens. Association with mealybugs should provide foundresses with a food source during claustral foundation. The coccid *Houardia* does not seem to co-disperse with ants, and foundresses originating from adult colonies that tend only coccids must acquire trophobionts later.

Geiger, C.A. & Daane, K.M. 2001. Seasonal movement and distribution of the grape mealybug (Homoptera: Pseudococcidae): Developing a sampling program for San Joaquin Valley vineyards. Journal of Economic Entomology 94(1): 291-301. [GeigerDa2001]

Notes: The grape mealybug, *Pseudococcus maritimus* (Ehrhorn), is an important pest of table grapes in California's San Joaquin Valley. The mealybug causes direct damage by infesting grape bunches, resulting in very low economic injury levels. To develop a sampling program to help growers predict damage and make control decisions, we destructively sampled six entire grapevines each month to determine mealybug abundance and within-vine distribution. These absolute counts were then used to evaluate several relative sampling methods: sticky tape barriers on canes, excised spur samples, standard-sized pieces of bark, timed counts, and nondestructive counts on spurs. At midseason we sampled additional vines to correlate mealybug numbers with economic damage at harvest. Finally, mealybug life stages and natural enemies were recorded throughout the study. Timed 5-min counts show the strongest correlation with total mealybug numbers, and a simple count of mealybugs on three spurs per vine at midseason is the best predictor of economic damage. Mealybugs completed approximate to 2.5 generations in

1998. Comparison to data on mealybug development suggests that exceptionally long growing seasons could exacerbate infestations by allowing the completion of a third generation. No mealybugs were found on bunches before early August, when second-generation crawlers moved out of the bark. Grape bunches that touched old wood had significantly higher damage and mealybug densities. The majority of mealybugs were always found in protected locations (under the bark of the trunk, spurs or canes), indicating the need for chemical or biological controls that can penetrate these refugia.

Geraud-Pouey, F. & Chirinos, D.T. 1999. [Population growth of cottony scale, ***Capulinia*** sp. (Hem.: Eriococcidae) on three ***Psidium*** species under laboratory conditions.] Desarrollo poblacional de la mota blanca, ***Capulinia*** sp. sobre tres especies de ***Psidium*** bajo condiciones de laboratorio. (In Spanish with summary in English). Revista de la Facultad de Agronomia, Universidad del Zulia Suppl. 1, 23-29. [GeraudCh1999]

Notes: Population development of cottony scale, ***Capulinia*** sp., was studied in July-October 1996 on ***Psidium guajava, P. friedrichsthalianum*** and ***P. guineense*** species to evaluate host suitability. ***Psidium*** spp. were infested with approximately 300 ***Capulinia*** sp. eggs per plant. Counts were taken of 1st- and 2nd-instar males and females, 3rd- and 4th-instar males and adult females. All evaluated instars were present in significantly greater numbers on ***P. guajava***. The mean populations were 541.16 on ***P. guajava***, 6.57 on ***P. friedrichsthalianum*** and 0.00 on ***P. guineense***. These results suggest a high susceptibility of ***P. guajava*** to ***Capulinia*** sp. infestation.

Gertsson, C.A. 2000. [New species and new province records of scale insects from Sweden (Homoptera: Coccoidea) up to the year 2000.] Nya arter och nya landskapsfynd av sköldlöss från Sverige fram till år 2000. (In Swedish with summary in English). Entomologisk Tidskrift. Stockholm 121(4): 147-153. [Gertss2000]

Notes: This work represents a continuation of the studies of the Swedish scale insect fauna. 45 new Swedish province records of scale insects (Coccoidea) belonging to eight families are presented. Seven species, ***Ortheziola britannica, Dysmicoccus walkeri, Euripersia europea, Planococcus vovae, Phenacoccus hordei, Trionymus radicum*** and ***T. dactylis*** are new records for Sweden. ***D. walkeri, E. europea, T. radicum*** and ***T. dactylus*** are also new to Fennoscandia and Denmark. ***O. britannica*** is the first find outside of the U.K.

Ghabbour, M.W. 1999. Systematic status of the family Diaspididae based on the adult males (Homoptera: Coccoidea). (In English with summary in Arabic). Journal of the Egyptian German Society of Zoology 28(E), Entomology: 85-89. [Ghabbo1999]

Notes: Descriptions and illustrations are given to the adult males of three species, belonging to three genera of subfamily Diaspinini: ***Aulacaspis tubercularis, Diaspis boisduvalii*** and ***Fiorinia linderae***. A key is provided for differentiation among them. ***Lepidosaphes beckii*** is also described and illustrated. A key is provided to identify five subfamilies of Diaspididae: Aspidiotinae, Diaspidinae, Lepidosaphedinae, Leucaspidinae and Parlatoriinae.

Gill, R.J. 2000. Necrology. The Scale 24: 6-7. [Gill2000]

Notes: Brief notice announcing the death of John Steinweden in May of 1999. He was an Entomologist with the California Department of Food and Agriculture for 35 years. His study of ***Pulvinaria*** is mentioned.

Gill, S., Clement, D.L. & Dutky, E. 1999. In: Pests & Diseases of Herbaceous Perennials: the Biological Approach. Ball Publishing (GrowerTalks Bookshelf), Batavia. xvi + 304 pp. [GillClDu1999]

Notes: This book is designed to help professional growers diagnose problems with herbaceous perennials. Information is given on monitoring techniques, and options for cultural and biological control. Detailed identification and monitoring methods specific to individual pests in the major groups of insects and mites, including scale insects (***Antonina pretiosa, Asterolecanium bambuscae, Chrysomphalus aonidum, Coccus hesperidum, Miscanthiococcus miscanthi, Pinnaspis aspidistrae, Planococcus citri, Pseudococcus longispinus, Rhizoecus falcifer*** and ***Saissetia coffeae***. The disease symptoms caused by bacteria, blights, foliar diseases, nematodes [Nematoda], phytoplasmas, root, stem and crown rots, vascular wilts and viruses, are also described. Monitoring techniques and control of plant diseases are discussed. A pictorial guide is given to the major diseases,

and insect- and mite-damage symptoms on major herbaceous perennial species.

Gomez i Vives, S., Ferry, V.M. & Caballero Ruano, M. 1999. A peculiar use of date palm (*Phoenix dactylifera*) leaves in Elche, Spain: "la palma blanca". Acta Horticulturae No. 486: 285-290. [GomeziFeCa1999]

Notes: [Proceedings of the Second International Symposium on Ornamental Palms and other Monocots from the Tropics, Tenerife, Spain February 1997.] The process used to produce white palm leaves, which are used for religious purposes on Palm Sunday, is described. The production of white palm leaves is an ancient, traditional and family business. White palm leaves are obtained by excluding light from the leaves and inhibiting chlorophyll production by the formation of cones of old leaves which protect the new leaves (January-May). Between July and September, the cones are covered by a cowl of black plastic. After harvesting (January to Easter) the leaves are graded according to size and whiteness, then bleached before storage under conditions of high humidity in the presence of burning sulfur. Leaves may then be sold without further treatment or plaited. The costs and returns associated with white palm leaf production, the market and production problems, in particular the new pest *Phoenicococcus marlatti* (red scale), are discussed.

Goolsby, J.A., Rose, M., Morrison, R.K. & Woolley, J.B. 2000. Augmentative biological control of longtailed mealybug by *Chrysoperla rufilabris* (Burmeister) in the interior plantscape. Southwestern Entomologist 25(1): 15-19. [GoolsbRoMo2000]

Notes: Periodic releases of a green lacewing, *Chrysoperla rufilabris*, reduced populations of the longtailed mealybug *Pseudococcus longispinus*, in the interior plantscape. Paper masking-tape strips bearing ca. 150 *C. rufilabris* eggs mixed with eggs of the Angoumois gain moth, *Sitotroga cerealella*, as initial food for newly eclosed lacewing larvae, were placed one per six-inch pot of pothos ivy, *Epipremnum aureum*. Each such release of lacewing eggs kept longtailed mealybug populations below aesthetic injury levels for four weeks. Aesthetic qualities require the plant to retain basal leaves and have no obvious evidence of mealybug infestation such as yellow leaves or honeydew.

Gould, W.P. & McGuire, R.G. 2000. Hot water treatment and insecticidal coatings for disinfesting limes of mealybugs (Homoptera: Pseudococcidae). Journal of Economic Entomology 93(3): 1017-1020. [GouldMc2000]

Notes: Hot water immersion and insecticidal coatings were tested to determine if they could be used to disinfest Persian limes, *Citrus latifolia* Tanaka, of the mealybug pests *Planococcus citri* Risso and *Pseudococcus odermatti* Miller & Williams. A 20-min 49°C hot water immersion treatment is effective in killing mealybugs and all other arthropods tested found externally on limes, or under the calyx. No insects or mites were found to survive after the 20-min hot water treatment. In this test, 7,200 limes were treated with 1,308 insects killed and zero survivors. Treatment at 49°C for 20 min did not significantly affect quality when treated fruit were compared with untreated control fruit. Four coatings were tested at a 3% rate: two petroleum-based oils (Ampol and Sunspray oil), a vegetable oil (natural oil), and a soap (Mpede). The coatings gave up to 94% kill (Ampol) of mealybugs, which is not sufficient to provide quarantine security. The coatings might be effective as a postharvest dip before shipment.

Grafton-Cardwell, E. 1999. Killing vedalia beetles can cause cotton cushion scale outbreak. California Grower 23(10): 6-7. [Grafto1999]

Notes: *Icerya purchasi.*

Grafton-Cardwell, E.E., Millar, J.G., O'Connell, N.V. & Hanks, L.M. 2000. Sex pheromone of yellow scale, *Aonidiella citrina* (Homoptera: Diaspididae): Evaluation as an IPM tactic. Journal of Agricultural and Urban Entomology 17(2): 75-88. [GraftoMiOC2000]

Notes: The effects of dose and field longevity of lures treated with synthetic female yellow scale sex pheromone ((5E)-6-isopropyl-3,9-dimethyl-5,8-decadienyl acetate) were evaluated for monitoring flight activity of male yellow scale, *Aonidiella citrina* (Coquillett). Pheromone doses of 1-200 mu g per lure attracted large numbers of males. Lower doses (1-5 mu g per lure) generally attracted fewer males, but trap counts unequivocally showed the

beginnings and peaks in male flight activity at both low and high population densities. Furthermore, the low-dose pheromone traps that collected fewer individuals were easier and less time-consuming to assess, and so the lower doses are recommended for monitoring phenology and population densities. In field longevity tests, pheromone lures continued to attract sufficient numbers of male scale to follow population trends for up to 4 months. Insecticide applications suppressed the number of male scale captured on pheromone cards. A 1989 pheromone trap survey of yellow scale in Tulare County, California demonstrated that yellow scale was distributed throughout the citrus growing region of that county, and was especially heavy in the area between Porterville and Terra Bella.

Graviano, O., Cossu, B., Serra, M., Cardu, P. & Fancello, A. 1999. [The role of some cultural techniques on yield and quality control in the warm-arid environment of Sardinia (Italy).] Importanza di alcune tecniche colturali nel controllo della produzione e della qualita in un ambiente caldo-arido dell'Italia insulare. (In Italian with summary in English). Rivista di Viticoltura e di Enologia 52(1): 75-86. [GraviaCoSe1999]

Notes: The effects of training system (traditional Guyot with upward orientated shoots and a modified Guyot system with downward orientated shoots), bud load (6 or 12 buds per vine), and irrigation volume (applied at 30 and 70% ET), on Chardonnay grapes grafted onto 1103 Paulsen rootstocks were investigated in split plot experiments in Cagliari province in 1994-96. Over the experimental period some of the lowest productivity parameters (shoot length, bunch weight, yield, pruned weight) and the largest accumulation of sugar were noted with the modified Guyot training system. Both agronomic and wine tasting observations indicated that in warm-arid conditions, best results could be obtained with the traditional Guyot training system, largest bud load and low irrigation volume. Data on annual precipitation, productivity parameters, susceptibility to downy mildew, grape moth or Coccidae, and wine quality parameters are tabulated and shown in graphs.

Grossane 2000. (In French). Arboriculture Fruitière No. 538, 59. [Grossa2000]

Notes: The black olive cv. Grosanne is described. Trees start producing after 3-4 years and olives are harvested in November-December. Average olive weight is 4-6 g, and olives produce very good olive oil. Frost resistance is good, but the species is susceptible to ***Prays oleae*** and ***Saissetia oleae***.

Growers can control scale with esteem. 2000. California Grower 24(9): 6. [GrowerCaCo2000]

Notes: Esteem is a new insect growth regulator for scales that such as cottony-cushion scale and California red scale that are found on citrus in California. Esteem has not been found to affect most beneficial insects. Recommendations are made for timing of applications.

Guerrieri, E. & Noyes, J.S. 2000. Revision of European species of the genus *Metaphycus* Mercet (Hymenoptera: Chalcidoidea: Encyrtidae), parasitoids of scale insects (Homoptera: Coccoidea). Systematic Entomology 25(2): 147-222. [GuerriNo2000]

Notes: Fifty-three European species of *Metaphycus* are revised. Three generic synonymies are proposed, nine species are described as new, sixteen new specific synonymies and four new combinations are proposed and lectotypes are designated for three species (***lounsburyi, philippiae, timberlakei***). A dichotomous key to the species is provided, each species is further characterized by a description and notes are provided on their distribution and known hosts. A host-parasitoid index for all known European species is provided in an appendix. Hosts include ***Antonina graminis, Aspidiotus*** sp., ***Asterodiaspis ilicicola, A. quercicola, A. variolosa, Asterolecanium ilicicola, A. minus, A. quercicola, A. variolosum, Aulacaspis rosae, Carulaspis visci, Ceroplastes brevicauda, C. floridensis, C. helichrysi, C. destructor, Chionaspis pinifoliae, Chloropulvinaria floccifera, C. psidii, C. urbicola, Chrysomphalus dictyospermi, Coccus alpinus, C. capparidis, C. celatus, C. hesperidum, C. perlatus, C. proteae, C. pseudomagnoliarum, C. subhaemisphaericus, C. viridis, Diaspidiotus bavaricus, D. cecconii, D. gigas, D. labiatarum, Ericerus pela, Eriococcus agropyri, E. greeni, E. insignis, E. spuria, E. jorgensenii, Eucalymnatus tessellatus, Eulecanium douglasi, E. kunoense, E. rugulosum, E. secretum, E. tiliae, Filippia folicularis, Gossyparia spuria, Lecanium corni, L. prunastri, Lichtensia chilianthi, L. viburni, Luzulaspis luzulae, Parasaissetia litorea, P. nigra, Parthenolecanium corni, P. persicae, P. pomeranicum, P. rufulum, Phenacoccus***

manihoti, Protopulvinaria pyriformis, Pulvinaria acericola, P. aethiopica, P. convexa, P. elongata, P. flavescens, P. floccifera, P. iceryi, P. maxima, P. minuta, P. platensis, P. urbicola, P. vitis, Pulvinariella mesembryanthemi, Quadraspidiotus perniciosus, Q. zonatus, Rastrococcus mangiferae, Rhodococcus bulgariensis, R. perornatus, R. turanicus, Saissetia coffeae, S. nigrella, S. oleae, S. somereni, Sphaerolecanium prunastri, Stictolecanium sp., and *Toumeyella liriodendri.*

Gullan, P.J. 2000. Identification of the immature instars of mealybugs (Hemiptera: Pseudococcidae) found on citrus in Australia. Australian Journal of Entomology 39: 160-166. [Gullan2000]

Notes: An identification guide is provided to most of the immature stages of six mealybug species (Hemiptera: Coccoidea: Pseudococcidae) that might be collected from citrus (Rutaceae) in Australia. This information is important for foreign quarantine inspections because mealybugs intercepted on Australian citrus exports are often nymphs. A key and a table, based on microscopic features, allow separation of the first-, second- and third-instar nymphs and identification to species for second- and third-instar females. Selected diagnostic features of second-instar females are illustrated. Second-instar male nymphs also can be identified as they resemble the second-instar females of their species except for the possession of dorsal ducts that secrete the wax of the male cocoon. Immatures stages are diagnosed for the pink hibiscus mealybug ***Maconellicoccus hirsutus*** (Green), the spherical mealybug ***Nipaecoccus viridis*** (Newstead), the citrus mealybug ***Planococcus citri*** (Risso), the citrophilous mealybug ***Pseudococcus calceolariae*** (Maskell), the longtailed mealybug ***Pseudococcus longispinus*** (Targioni Tozzetti), and the tuber mealybug ***Pseudococcus viburni*** (Signoret) [formerly ***Pseudococcus affinis*** (Maskell)].

Guo, D.W. 1999. [Experiment of control of plum mulberry scales.] (In Chinese). South China Fruits 28(4): 40. [Guo1999]

Notes: Experiments conducted with 6 to 7-year-old trees of Naili plum showed that 20% Rongshajieman and 95% mechanical oil were the most effective insecticides against mulberry scales (***Pseudaulacaspis pentagona***).

Hammond, D.G., Rangel, S. & Kubo, I. 2000. Volatile aldehydes are promising broad-spectrum postharvest insecticides. Journal of Agricultural and Food Chemistry 48(9): 4410-4417. [HammonRaKu2000]

Notes: Twenty-nine compounds of naturally occurring aldehydes common in plants have been evaluated for their insecticidal activity and for phytotoxicity to postharvest fruits, vegetables, and grains. Although originally intended against aphids, preliminary assays indicate that similar doses are also effective against mealybugs.

Handa, S. & Dahiya, K.K. 1999. Chemical management of mango scales. Agricultural Science Digest 19(2): 112-114. [HandaDa1999]

Notes: The efficacy of nine insecticides was evaluated against scale insects (***Aspidiotus destructor***) on mangoes during 1992-93 in Buria, India. All insecticides reduced the pest population by >60%. Fenvalerate was the most efficacious, followed by methyl parathion [parathion-methyl], quinalphos, diazinon and monocrotophos (mortality averaged 85.3-93.8%).

Hassan, T.A. 1999. Joint action of certain insecticides on the California Red Scale Insect, ***Aonidiella aurantii*** (Mask). (In English). Journal of Natural and Applied Sciences (University of Aden) 3(2): 23-29. [Hassan1999]

Notes: The joint action of certain insecticide compounds, summer oil (98% EC), diazinon (60% EC) and dimethoate (40% EC), were investigated in a field strain of California Red Scale Insect (CRS), ***Aonidiella aurantii***, collected in Sana'a city, Yemen. The data revealed that high levels of synergism were obtained by mixing low concentrations together. This showed that in preparing binary insecticide mixtures, concentration-ratio relationships should be considered.

Hassan, T.A. 1999a. Evaluation of some insecticides for the control of scale insects and mealy bugs in Yemen. (In Arabic in summary in English). Journal of Natural and Applied Sciences (University of Aden) 3(1): Ar33-Ar50. [Hassan1999a]

Notes: Diazinon (60% e.c.), dimethoate (40% e.c.), malathion (50% e.c.), Summer Oil [mineral oil] (98% e.c.) and KZ Oil [mineral oil] (95% e.c.) were compared for their efficacy against the California Red Scale Insect (***Aonidiella aurantii***) and the Cottony Cushion Scale Insect (***Icerya purchasi***) under standard laboratory conditions. Emulsion stability tests were carried out under standardized conditions. Diluted water solutions of the tested insecticides were used to obtain LC50 values. Diazinon was the most potent insecticide, followed by dimethoate, malathion, Summer Oil and KZ Oil. The advantages of using mineral spray oils alone to control these insect pests is discussed.

Helms, K.R. & Vinson, S.B. 2000. New host records for "legless" mealybugs of Texas (Homoptera: Pseudococcidae: ***Antonina, Antoninoides***). Southwestern Entomologist 25(3): 229-231. [HelmsVi2000]

Notes: Four species of mealybugs occur on Texas: ***Antonina graminis, Antoninoides boutelouae, Antoninoides nortoni*** and ***A. parrotti***. 14 new host records are listed for these four species.

Hendricks, H. & Kosztarab, M. 1999. In: Revision of the Tribe Serrolecaniini (Homoptera: Pseudococcidae). de Gruyter, Berlin & New York. xiv, 213 pp. [HendriKo1999]

Notes: A comprehensive revision of 62 unusual mealybug species typically assigned to the subfamily Sphaerococcinae (Pseudococcidae). Features include a comprehensive review of structural terminology, in-depth description of 15 genera and their species, 23 illustrations and 4 distribution maps, identification keys to genera and species and indices of taxa.

Hertel, H., Kaetzel, R. & Guttenberger, H. 1999. Susceptibility of Norway spruce clones (***Picea abies*** (L.) Karst.) to insects and roe deer in relation to genotype and foliar phytochemistry. Phyton Horn. 39(4): 65-72. [HertelKaGu1999]

Notes: [Special issue: Tree growth at high altitude and high latitude. 3rd EUROSILVA Workshop, Obergurgl, Austria, September 10-14, 1998.] In a 20-year-old clonal test plantation of Norway spruce (***Picea abies***) near Waldsieversdorf, Brandenburg, Germany, the amount of herbivory from insect pests, as well as browsing by roe deer (***Capreolus capreolus***) was studied in June 1995 in relation to clone. Degree of infestation by the following pests was investigated on a total of 1150 trees belonging to 46 clones: spruce gall aphids (***Sacchiphantes*** sp. [***Adelges*** sp.], ***Adelges laricis***); red and grey forms of the bark louse (***Cinaropsis pilicornis [Cinara pilicornis]*** and ***Gilletteella cooleyi [Adelges cooleyi]***); leaf wasp (***Pristiphora abietina***); and ***Epinotia tedella***. Genotypes of all 46 clones were characterized by isoenzyme markers at 23 polymorphic loci, and 12 clones were also described by chemical composition of foliage (e.g., amino acids, carbohydrates, and phenols). Among the genotypes, there were strong relationships between single isoenzyme loci and foliar chemical composition and degree of insect or deer attack. The results emphasize the need to maintain high genetic variability in forest tree populations. Genetic variation in predisposition to insect and mammal attack is one precondition for long-term stability of forest ecosystems.

Hix, R.L., Pless, C.D., Deyton, D.E. & Sams, C.E. 1999. Management of San Jose scale on apple with soybean-oil dormant sprays. HortScience 34(1): 106-108. [HixPlDe1999]

Notes: The objective of this study was to examine efficacy of soybean oil dormant sprays to manage San Jose scale (***Quadraspidiotus perniciosus*** Comstock) on apple (***Malus domestica*** Borkh,). 'Bounty' apple trees were: 1) left unsprayed (control) or sprayed to runoff with: 2) 3% (v/v) or 3) 6% degummed soybean oil with 0.6% (v/v) Latron B-1956 sticker spreader, or 4) 3% 6E Volck Supreme Spray petroleum oil. Both 3% petroleum oil and 6% soybean oil sprays reduced the numbers of first- and second-generation crawlers by 93% in 1994 and first-generation crawlers by 98% in 1995, The 3% soybean oil treatment reduced first- and second-generation crawlers by 60% in 1994 and first-generation crawlers by 83% in 1995. Also in 1995, apple fruit infestations by first-generation scales on the 3% soybean-, 6% soybean-, and 3% petroleum oil-treated trees did not differ significantly, but all fruit were significantly less infested than the controls.

Hodgson, C.J. & Henderson, R.C. 2000. In: Coccidae (Insecta: Hemiptera: Coccoidea). Manaaki Whenua Press, Lincoln, Canterbury, NZ. 259 pp. [HodgsoHe2000]

Notes: [Series title: Fauna of New Zealand; No. 41] The adult females of all Coccidae (Hemiptera: Coccoidea) known from New Zealand are described and illustrated. In addition to the four indigenous genera previously known (***Ctenochiton, Inglisia, Lecanochiton*** and ***Pounamococcus***), seven new genera are described (***Aphenochiton, Crystallotesta, Epelidochiton, Kalasiris, Plumichiton, Poropeza*** and ***Umbonichiton***), all of which are considered to be fairly closely related to ***Ctenochiton*** and all endemic to New Zealand. Within these eleven indigenous genera, 25 new species are described and 12 species are transferred to new genera, bringing the total to 43 species. ***Ctenochiton elongatus*** Maskell is designated a ***nomen dubium***. None of the species currently included in the genera ***Ctenochiton*** and ***Inglisia*** described from outside new Zealand are here considered to be congeneric. In addition, all known adventive (exotic) species found in New Zealand are reviewed and briefly described. ***Lecanium (Eulecanium) spinosum*** Brittin is synonymised with ***Parthenolecanium persicae*** (Fabricius), and the synonymy of ***Lecanium cassiniae*** Maskell with ***Saissetia oleae*** (Oliver) is upheld. ***Pulvinaria psidii*** (Maskell) has not been recorded in New Zealand and its inclusion in previous checklists is erroneous. Keys to adult females are included for the separation of all genera and species, and also for preliminary instar separation. Earlier work done on the superfamily Coccoidea in New Zealand is briefly reviewed and the present classification of the Coccidae and closely related families is outlined. Their biology, distribution, host-plant interactions, parasites and predators, and economic importance are also described. The current methods for collecting and mounting specimens on slides for the New Zealand Arthropod Collection are outlined, followed by a description of the morphology of adult female Coccidae, introducing the terminology used. A list of host plants is included in an appendix.

Hole, U.B. & Salunkhe, G.N. 1999. Relationship between the population build up of ***Aonidiella aurantii***(Maskell) on rose and weather parameters. Indian Journal of Agricultural Research 33(2): 93-102. [HoleSa1999]

Notes: The incidence of ***Aonidiella aurantii*** was observed on thirty rose cultivars during winter and summer seasons of 1991 to 1992 at Pune, Maharashtra, India. The pest build-up started in the last week of January and increased gradually, reaching its peak (65.33 scales/stem) in the first week of March, and declined thereafter. Maximum temperature (Tmax), minimum temperature (Tmin), relative humidity in the morning (RH-I), relative humidity in the afternoon (RH-II) and bright sunshine hours (BSH) in the range of 30.3 to 34.5°C, 9.7 to 11.7°C, 77 to 91%, 17 to 31% and 9.7 to 10.1 h, respectively, prevailed during the 5th to 9th meteorological weeks (MW) and appeared to be favourable for the multiplication of the pest. Increases in scale population were found to be positively and highly significantly, positively and significantly, and positively correlated with maximum temperature, bright sunshine hours and minimum temperature, respectively, during phase I, while maximum temperature and minimum temperature were found to be negatively and highly significantly correlated with an increase in the scale population in phase II.

Howard, F.W. & Caballero Ruano, M. 1999. An introduction to insect pests of palms. Proceedings of the Second International Symposium on Ornamental Palms and other Monocots from the Tropics (No. 486): 133-139. [HowardCa1999]

Notes: [Conference held at Tenerife, Spain, 3-6 February 1997.] Insects significantly represented on palms are concentrated in certain families of the orders Orthoptera, Phasmida, Thysanoptera, Hemiptera, Coleoptera and Lepidoptera. Lepidoptera and Coleoptera are among the principal pests of palms grown as crop plants. Aphids, aleyrodids and pseudococcids are the most widespread insect pests of ornamental palms and have the greatest potential for introduction into new areas. The relationships between representative species of these insect taxa and palms are discussed.

Hua, F.M., Ni, L.C. & Jin, M.X. 1999. [Pesticide effectiveness test of several insecticides to control *Icerya purchasi* endangering ***Liquidambar formosana***.] (In Chinese). Journal of Zhejiang Forestry Science and Technology 19(6): 46-47. [HuaNiJi1999]

Notes: *Icerya purchasi* is the main insect pest of ***Liquidambar formosana*** in Zhejiang Province, China. Several insecticides were screened for their effectiveness in the prevention and control of the pest.

International Commission on Zoological Nomenclature. 1999. In: International Code of Zoological Nomenclature Adopted by the International Union of Biological Sciences. London. 306 pp. [ICZN1999]

Isidorov, V., Jaroszynska, J., Piroznikow, E., Krajewska, U. & Kolk, A. 1999. [Certain diseases of coniferous trees and essential oil compositions.] Zaleznosci miedzy chorobami drzew iglastych a skladem olejkow eterycznych. (In Polish). Sylwan 143(8): 87-93. [IsidorJaPi1999]

Notes: Investigations on the chemical composition of the essential oils extracted from needles of spruce (***Picea abies***), pine (***Pinus sylvestris***) and larch (***Larix europaea*** [***L. decidua***]) are reported. The composition of the essential oils from healthy trees and trees infected by fungi or insects was compared. Spruces and larches infested by insect pests produced large quantities of monoterpenoids and small quantities of monoterpenes in comparison with non-infested trees. In contrast, in the case of pine infected by fungal pathogens, contents of sesquiterpenoids were decreased by half compared with the contents in healthy trees. The results indicate that essential oil composition could be an important bioindicator in the ecological monitoring of forest condition. ***Physokermes piceae*** is mentioned as a pest.

Islam, K.S. & Copland, M.J.W. 2000. Influence of egg load and oviposition time interval on the host discrimination and offspring survival of ***Anagyrus pseudococci*** (Hymenoptera: Encyrtidae), a solitary endoparasitoid of citrus mealybug, ***Planococcus citri*** (Hemiptera: Pseudococcidae). Bulletin of Entomological Research 90(1): 69-75. [IslamCo2000]

Notes: Oviposition and host discrimination behaviour of unmated ***Anagyrus pseudococci*** (Girault), an endoparasitoid of the citrus mealybug ***Planococcus citri*** (Risso), were investigated in the laboratory. Female parasitoids were able to discriminate between parasitized hosts and healthy ones. The mean number of ovipositions was significantly higher in unparasitized than in parasitized hosts. Conspecific-superparasitism occurred more often than self-superparasitism. Changes in consecutive ovipositions over three hours by ***A. pseudococci*** suggested that egg load influenced the discrimination behaviour of the parasitoids, with females which had low egg loads mostly avoiding oviposition in already parasitized hosts at time intervals ranging from 0 h to 96 h, and distributing their eggs in the high quality (unparasitized) hosts. The parasitized hosts were rejected more commonly through antennal perception of external markers than during ovipositor probing which could have encountered internal markers but this relationship changed with increasing time after oviposition. The parasitoid's oviposition rate in unparasitized and conspecific-parasitized hosts varied at the different oviposition time intervals when the females had fewer eggs in the ovaries. Percentage emergence of parasitized offspring was not significantly influenced by whether they developed in single or superparasitized mealybugs. The significance of host discrimination by ***A. pseudococci*** is discussed.

Izhar, J. 1999. [Preliminary experiment to control ants as a transferring factor of millibug [mealybug] (***Pseudococcus citriculus, Planococcus citri***) in persimmon.] (In Hebrew with summary in English). Alon Hanotea 53(12): 490-492. [Izhar1999]

Notes: In recent years, an increase in the damage from mealybugs in persimmon fruits was observed. The mealybugs settle under the sepal and the connection between fruit and leaves. It sucks the fruits and the honeydew causes black knots. Ants are the main transferring factor of the mealybugs and they protect them against predators and parasites. Dorsan [chlorpyrifos] 5% and diazinon 4% applied around the trunk gave excellent results against ants. Marshal [carbosulfan] 2% was not as effective. All the treatments greatly reduced the population of mealybugs.

Jahn, G.C. & Beardsley, J.W. 2000. Interactions of ants (Hymenoptera: Formicidae) and mealybugs (Homoptera: Pseudococcidae) on pineapple. Proceedings of the Hawaiian Entomological Society 34: 181-185. [JahnBe2000]

Notes: Discussion of *Dysmicoccus brevipes* and *D. neobrevipes*.

Jalali, S.K., Singh, S.P. & Biswas, S.R. 1999. Effect of temperature and female age on the development and progeny production of *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae). Entomon 24(3): 293-296. [JalaliSiBi1999]

Notes: Effect of temperature and female age on the development, progeny production, longevity and mortality of *Cryptolaemus montrouzieri* Mulsant was studied in the laboratory. Temperature ranges between 25° and 30°C were most ideal for development, and progeny production of the predator. *C. montrouzieri* could produce sizable progeny even when it was deprived of the host mealybug *Maconellicoccus hirsutus* (Green) for 15 days. Regression analysis revealed significant relationship between various parameters viz. developmental time, fecundity and longevity with temperature with R2 values of 0.82, 0.98, and 0.91 and between parameters like mortality, developmental time, and fecundity with female age with R2 values of 0.92, 0.92 and 0.91, respectively.

Jalaluddin, S.M. 1999. Preliminary screening of betelvine cultivars against scale insect. Insect Environment 4(4): 150. [Jalalu1999]

Notes: Betelvine [*Piper betle*] cultivars Vellakodi, Karpoori and SGM1 were screened against *Lepidosaphes cornutus*. Average numbers of scale populations/vine were 29.96, 2.04 and 1.01, respectively.

Jancar, M., Seljak, G. & Zezlina, I. 1999. [Distribution of *Ceroplastes japonicus* Green in Slovenia and data of host plants.] Razsirjenost japonskega kaparja (*Ceroplastes japonicus* Green) v Sloveniji in pregled gostiteljskih rastlin. (In Slovenian with summary in English). Zbornik predavanj in referatov 4. Slovenskega Posvetovanja o Varstvu Rastlin v Portorozu 3/4: 443-449. [JancarSeZe1999]

Notes: *Ceroplastes japonicus* was first observed in Slovenia in 1990 in Primorska on persimmon (*Diospyros kaki*) and provisionally identified as *Ceroplastes rusci*. It was observed later in Slovenian Istria and Goriska Brda. The pest has since been observed on a number of agricultural and ornamental trees, mostly on persimmon and laurel (*Laurus nobilis*). The origin of the pest, current distribution, biological cycle and morphological characteristics are discussed. The host plants were determined and the control measures were tested.

Jashenko, R.V. 1999 (1998). Fauna, natural enemies, agricultural harm and possibility of industrial use of margarodids (Coccinea, Margarodidae) in East Europe and North Asia. (In English with summary in Russian). Selevinia 43-50. [Jashen1999]

Notes: A list of 64 species is given from 13 genera and 3 subfamilies. Six species are found to be synonyms: *Pseudaspidoproctus armeniaca* to *P. hyphaeniacus, Drosicha media* to *D. turkestanica, Marchalina caucasica* to *M. hellenica, Neomargarodes balachowskyi* to *N. aristidae, N. borchsenii* to *N. festucae* and *Porphyrophora georgica* to *P. monticola*.

Jashenko, R.V. 1999a. [Interspecific morphological variability of the Polish carmine scale, *Porphyrophora polonica* (L.) (Coccinea, Margarodidae).] (In Russian). Tethys Entomological Research 1: 103-132. [Jashen1999a]

Notes: Distribution, hostplants and morphology discussed.

Jashenko, R.V. 1999b. [Natural enemies of Margarodids in northern Eurasia.] (In Russian). 160-162 In: [Problems of Conservation and Sustainable Use of Animal Biodiversity in Kazakhstan. (Proceedings of an International Scientific Conference.] Tethys Society, Almaty. 198 pp. [Jashen1999b]

Notes: [Conference held April 6-8, 1999.] *Icerya purchasi* mentioned.

Jashenko, R.V. 1999c. [Dye plants as potential host plants of the genus *Porphyrophora* (Coccinea, Margarodidae).] (In Russian). 162-163. In: [Problems of Conservation and Sustainable Use of Animal Biodiversity in Kazakhstan. (Proceedings of an International Scientific Conference.] Tethys Society, Almaty]. [Jashen1999c]

Notes: [Conference held April 6-8, 1999.]

Jashenko, R.V. & Ambartsumyan, A.A. 1999. [On the problem of carmine from the point of view of entomologist and philologist.] (In Russian). Tethys Entomological Research 1: 47-58. [JashenAm1999]

Notes: This paper discusses mistakes in some ethnographic, entomological and linguistic publications as well as the etymological analysis of the words "kermes, carmine, cerviec and cochineal".

Jiao, Y. & Zhao, P. 1999. [Bionomics of *Metaphycus ericeri* Xu et Jiang (Hymenoptera: Encyrtidae).] (In Chinese with summary in English). Acta Entomologica Sinica 42(2): 166-171. [JiaoZh1999]

Notes: *M. ericeri* is an important parasitic wasp of the female white wax insect, ***Ericerus pela. M. ericeri*** has 5 generations per year in Kunming, China, and overwinters as 3rd-, 4th- and 5th-instar larvae and pupae in the host body.

Jinnouchi, H., Noguchi, H., Nakasima, M. & Yamaguchi, M. 1999. [Occurrence of the citrus ground mealy bug, *Rhizoecus kondonis* Kuwana, in citrus greenhouses in Saga [Japan].] (In Japanese). Proceedings of the Association for Plant Protection of Kyushu 45: 116-118. [JinnouNoNa1999]

Joubert, P.H., Daneel, M.S., Grove, T., & Pichakum, A. 2000. Progress towards integrated pest management (IPM) on mangoes in South Africa. Acta Horticulturae No. 509: 811-817. [JouberDaGr2000]

Notes: [Proceedings of the Sixth International Symposium on Mango, Pattaya City, Thailand, 6-9 April, 1999, Volume 2.] In South Africa, several insect pests are important in the production of mangoes. The mango scale, ***Aulacaspis tubercularis***, mango seed weevil, ***Sternochetus mangiferae***, and the fruit flies ***Ceratitis capitata, C. rosa*** and ***C. cosyra*** are all key pests and have to be controlled regularly. For the biocontrol of mango scale, an *Aphytis* sp. parasitoid and a predatory beetle, ***Cybocephalus binotatus***, were imported from Thailand and established in several areas. Up to 46.3% parasitism of the mango scale occurred, while ***C. binotatus*** dispersed to several orchards surrounding the original release sites. Fenthion, which is used to control mango seed weevil, is extremely toxic to beneficial insects and alternative control measures were evaluated. Several methods e.g. systemic insecticides and egg parasitoids proved to be non-viable and finally a softer insecticide viz. endosulfan 475 g/kg SC, was evaluated for registration. For fruit fly control, most producers refrain from using full cover sprays and more IPM compatible bait sprays are applied. A monitoring system was developed for the important pests and the more judicious use of insecticides now facilitates IPM on mangoes in South Africa.

Karamaouna, F. & Copland, M.J.W. 2000. Oviposition behaviour, influence of experience on host size selection, and niche overlap of the solitary ***Leptomastix epona*** and the gregarious ***Pseudaphycus flavidulus***, two endoparasitoids of the mealybug ***Pseudococcus viburni***. Entomologia Experimentalis et Applicata 97(3): 301-308. [KaramaCo2000]

Notes: Oviposition behaviour and host size selection of the solitary parasitoid ***Leptomastix epona*** (Walker) and the gregarious ***Pseudaphycus flavidulus*** (Brethes) [both Hymenoptera: Encyrtidae] were examined on five size classes of the mealybug ***Pseudococcus viburni*** (Signoret) [Hemiptera: Pseudococcidae]. The host size classes mostly consisted of one stage (first, second, third instar nymph, young adult and preovipositing adult) and were presented together to wasps of either parasitoid species. Both parasitoid species locate the host by drumming the surface of the patch with the antennae. ***Leptomastix epona*** seems to use mainly the antennae to examine the host but ***P. flavidulus*** may accept or reject a host for oviposition after antennation or insertion of the ovipositor ***Leptomastix epona*** attempts oviposition in all the host stages from second instar nymphs but ***P. flavidulus*** includes first instar. Both parasitoid species select mainly larger hosts (>1 mm, third instar nymphs) to oviposit but ***P. flavidulus*** is able to parasitize more second instar nymphs compared to ***L. epona***. Female wasps of ***L. epona*** may host feed on small mealybugs (second and third instar nymphs) that they do not use for oviposition. Oviposition experience of either parasitoid species for 24 hours does not influence host size selection on patches with hosts of similar mixed sizes. Oviposition decisions are independent of the host sizes of the preceding ovipositions.

Implications about stability of a single parasitoid - host system and the success of biological control of the mealybug were discussed with respect to the developmental refugia of the two parasitoid species. Niche overlap of the two parasitoid species was discussed with a view to giving insight into a single or multiple introductions.

Karamaouna, F. & Copland, M.J.W. 2000a. Host suitability, quality and host size preference of *Leptomastix epona* and *Pseudaphycus flavidulus*, two endoparasitoids of the mealybug *Pseudococcus viburni*, and host size effect on parasitoid sex ratio and clutch size. Entomologia Experimentalis et Applicata 96(2): 149-158. [KaramaCo2000a]

Notes: Five host size classes which mostly consisted of one host stage (first, second, third instar nymph, young adult and preovipositing adult) of the mealybug *Pseudococcus viburni* (Signoret) Fernald, 1903 (Hemiptera: Pseudococcidae) were tested for susceptibility and suitability for the solitary parasitoid *Leptomastix epona* (Walker) Graham, 1969 and the gregarious *Pseudaphycus flavidulus* (Brethes) De Santis, 1964 (both of them Hymenoptera: Encyrtidae) in no choice experiments. Hosts larger than 1 mm (third instar) were suitable for the development of the parasitoids. Choice experiments with all the host size classes offered simultaneously showed that *L. epona* and *P. flavidulus* are parasitoids of mainly larger hosts (>1 mm, third instar nymphs) therefore the parasitoids exploit the same host range. In *L. epona*, a faster development and a larger size of wasps occurred in host size class 1.83-2.33 mm (young adult mealybugs) indicating a greater host quality compared to other sizes. Proportion of male offspring decreased with the host size following the host size distribution models. In *P. flavidulus* there was no effect of host quality (size at parasitism) on developmental time, sex ratio or parasitoid size and fecundity. Larger clutch sizes of *P. flavidulus* emerged from larger hosts but overall this parasitoid was able to parasitize smaller hosts (<1 mm, second instar nymphs) compared to *L. epona*. Experience of oviposition for 24 h does not seem to affect host size preference or sex ratio of the offspring in *L. epona*. Implications of the findings for mass-rearing and single applications of the parasitoids for the purpose of a biological control programme are discussed.

Kasuya, E. 2000. Kin-biased dispersal behaviour in the mango shield scale, *Milviscutulus mangiferae*. Animal Behaviour 59(3): 629-632. [Kasuya2000]

Notes: When fitness decreases with increasing density in a habitat, dispersal behaviour is expected to evolve. To avoid competition between kin, dispersal behaviour based on kin recognition should be more likely to occur when the individuals in a habitat are closely related. This prediction was tested with first-instar larvae (crawlers) of the mango shield scale, *Milviscutulus mangiferae*. The body size of adult females, a measure of fecundity, was larger when only one female was present on a leaf than when two were present. When I placed two crawlers on a leaf, they emigrated more frequently when they were siblings than when they were not related. The implications of these results for kin recognition in thelytokous parthenogenetic animals are discussed.

Klein, H. & Hill, M.P. 1999. Biological control of three cactaceous weeds, *Pereskia aculeata* Miller, *Harrisia martinii* (Labouret) Britton and *Cereus jamacaru* De Candolle in South Africa. Biological Control of Weeds in South Africa, 1990-1998; African Entomology Memoir (No. 1): 3-14. [KleinHi1999]

Notes: This review deals with three cactaceous species that have been the focus of biocontrol efforts in South Africa because of their increasing importance. The programme against the primitive climbing cactus, *Pereskia aculeata*, has involved the release of the flea beetle *Phenrica guerini* (Chrysomelidae, Alticinae). Despite earlier failures to establish them, the beetles have become abundant at one locality in the Eastern Cape, but it is still too early to assess their impact. Host specificity tests on additional agents for *P. aculeata* resulted in the rejection of two moth species. The leaf feeding *Epipagis cambogialis* (Pyralidae) displayed an unacceptably broad host range, while tests on the stem boring *Maracayia chlorisalis* (Crambidae, Pyraustinae), which proved difficult to culture in quarantine, were inconclusive. The programme against *Harrisia martinii (=Eriocereus martinii* (Labouret) Riccobono) has been successful and the weed can be completely controlled by the mealybug *Hypogeococcus festerianus* (Pseudococcidae) and the stem-boring beetle *Alcidion cereicola* (Cerambycidae) if the insects are regularly

redistributed to uncontaminated or new infestations. Both of these insects also attack the related ***Cereus jamacaru*** in the field and have controlled the weed successfully in at least one area where both insects are present. However, it needs to be determined whether the insects can be successfully integrated with the current chemical control programme against ***C. jamacaru***.

Kosztarab, M. 2000. Hungarian Coccidology. The Scale 24: 13-17. [Koszta2000]

Notes: Review of research and researchers active in coccidology in Hungary.

Kosztarab, M. & Rhoades, M.H. 1999. Disjunct distribution and endemism in the Appalachian scale insect fauna (Homoptera: Coccinea). 121-124. In: Eckerlin, R.P., Ed., Proceedings of the Appalachian Biogeography Symposium. Special Publication Number 7 (Virginia Museum of Natural History). 257 pp. [KosztaRh1999]

Notes: Apparent disjunct distribution was noted for eight species representing five families: Margarodidae (***Xylococcus betulae***), Pseudococcidae (***Peliococcus flaveolus, P. serratus, Phenacoccus minimus*** and ***Puto kosztarabi***), Cryptococcidae (***Cryptococcus williamsi***), Kermesidae (***Allokermes nivalis***) and Diaspididae (***Abgrallaspis oxycoccus***). Endemism to the Appalachians was found in Ortheziidae (***Newsteadia americana***), Pseudococcidae (***Dysmicoccus patulae, Peliococcus saratogensis, Phenacoccus hortonorum, Puto kosztarabi, Trionymus lowryi***), Kermesidae (***Kermes prinus, Nanokermes folium***) and Eriococcidae (***Acanthococcus chilos***).

Koteja, J. 2000. Scale insects (Homoptera, Coccinea) from Upper Cretaceous New Jersey amber. 147-229 In: Grimaldi, D. (Ed.), Studies on Fossils in Amber, with Particular Reference to the Cretaceous of New Jersey. Backhuys Publishers, Leiden, The Netherlands. [Koteja2000]

Notes: Results of comprehensive studies on Cretaceous insects in New Jersey amber (Turonian, 90-95 Ma) are presented, based on 56 amber pieces containing 72 coccid inclusions, all collected at the White Oaks Pits (Sayreville, Middlesex Co.), and housed at the American Museum of Natural history. Eight groups at family level have been recognized in the material, four being new taxa, three extant, and one unnamed: Jersicoccidae fam. n. with ***Jersicoccus kurthi*** gen. et sp.n.; Grimaldiellidae fam.n. with ***Grimaldiella*** gen.n.; Labiococcidae fam.n. with ***Labiococcus joosti*** gen.et sp.n. and ***Colicoccus nascimbenei*** gen. et sp.n.; Eriococcidae with ***Keithia luccii*** gen. et sp.n. Except for five specimens (in ***Labiococcus*** and ***Keithia***) the inclusions represent alate males. Ca. 20% of amber pieces contain more than one coccid inclusion.

Koteja, J. 2000a. [Scale insects (Hemiptera: Sternorryncha: Coccinea).] Czerwce (Hemiptera: Sternorryncha: Coccinea). (In Polish with summary in English). Flora i Fauna Pienin -- Monografie Pininskie 1: 169-173. [Koteja2000a]

Notes: About 150 scale insects occur in Poland. A list is provided of the 50 or so species discovered during a survey in the Pieniny Mountains in 1960-64. Eight families are represented including Ortheziidae, Xylococcidae, Margarodidae, Pseudococcidae, Eriococcidae, Cryptococcidae, Coccidae and Diaspididae.

Koteja, J. 2000b. Essays on coccids (Hemiptera: Coccinea). Paleontology without fossils? (In English with summary in Polish.) Prace Muzeum Ziemi No. 46: 31-43. [Koteja2000b]

Notes: Only a few phylogenetic conceptions that consider time were proposed for the scale insects, and they have been critically reviewed on the basis of the currently available fossils. Evident pre-Cretaceous coccid fossils are still lacking. Scale insects appeared "suddenly" as a large and diverse group in early cretaceous.

Koteja, J. 2000c. Advances in the study of fossil coccids (Hemiptera: Coccinea). (In Polish with summary in English.) Polskie Pismo Entomologiczne 69: 187-218. [Koteja2000c]

Notes: Twenty-year studies (1981-2000) on fossil scale insects, in cooperation with the late Dr. Roza Kulicka from the Museum of the Earth, are reviewed in this paper. The main task of this work was gathering fossils and information on their distribution among collections worldwide to prepare a catalogue of coccid fossils. The number of registered coccid fossils has increased ten times for the past twenty years, reaching now about 1300 specimens.

A few original papers on scale insects from Balitc, Bitterfeld, Taymyrian, new Jersey and Alaskan amber, and Lower Cretaceous impressions were published during that time, but most articles were devoted to popularization of amber inclusions and fossil scale insects. Systematics of fossil scale insects is discussed, and a revised list of already described taxa is provided. An outline of coccid phylogeny, based on fossil record, is presented. Species listed, many extinct or extanct, include *Acreagris crenata, Arctorthezia antiqua, Aspidiotus proteus, Baisococcus victoriae, Balticoccus oblicus, B. spinosus, Cancerococcus apterus, Coccus termitinus, Dorthezia* sp., *Electrococcus canadensis, Eomatsucoccus andrewi, E. casei, E. popovi, E. sukachevae, Gedanicoccus gracilis, Grimaldiella gregaria, G. resinophila, Jersicoccus kurthi, Jutlandicoccus pauper, J. perfectus, Keithia luzzii, Kuenowicoccus pietrzeniukae, Labiococcus* sp., *Matsucoccus apterus, M. electrinus, M. larssoni, M. saxonicus, Mesococcus asiaticus, Monophlebus simplex, Newsteadia succini, Palaeonewsteadia humaniae, Protorthezia aurea, Puto* sp., *Solicoccus nascimbenei, Sucinikermes kulickae, Turonicoccus beardsleyi* and *T. grimaldii*.

Kotikal, Y.K. & Sengonca, C. 1999. Olfactory responses of mealybug predator, *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae) to the kairomones of prey arthropods, their host plants and the predator itself. Journal of Biological Control 13(1-2): 1-6. [KotikaSe1999]

Notes: The studies made under laboratory conditions using olfactometer indicated that the larvae as well as adults of *Cryptolaemus montrouzieri* Mulsant could sense the prey liberated chemicals and use them in reaching the source. The first instar larvae and adults were attracted to the kairomones of *Planococcus citri* (Risso) in significantly more numbers than to the kairomones of other preys and non-preys namely *Pulvinaria regalis* Canard, *Mamestra brassicae* (Linnaeus), *Acyrthosiphon pisum* (Harris), *Aphis fabae* Scopoli and *Myzus persicae* (Sulzer). The predator did not respond to the kairomones of preys' hosts significantly but the presence of prey on the host plants enhanced the olfaction as indicated by the more number of predators attracted to them. Furthermore, the adults were lured to the odour of their own individuals in significant numbers but not the larvae.

Koul, V., Masoodi, M.A., Bhagat, K.C. & Bhat, O.K. 2000. Biology, behaviour and biocontrol agents of *Drosicha dalbergia* (Green) infesting almonds in Kashmir. Annals of Plant Protection Sciences 8(1): 24-26. [KoulMaBh2000]

Notes: *Drosicha dalbergia [Drosicha dalbergiae]* overwintered as a first instar nymph in the rhizosphere of almond trees and resumed activity in the subsequent year during March-April in Jammu and Kashmir, India. The nymph ascended the host plant and clustered in the axil of twigs, cracks/crevices in numbers ranging from 10-50. In the laboratory, the bug passed through five nymphal instars with the overwintering first instar occupying 170-180 days. Natural enemies, *Coccinella septempunctata, Harmonia dimidiata, Chrysoperla carnea* and a potential parasitoid, *Cryptochetum* sp., were found associated with the pest.

Kozár, F. 1999. Activity and selectivity of pheromone traps of Diaspididae (Homoptera: Coccoidea). 125 In: 51st International Symposium on Crop Protection. [Kozar1999]

Notes: [Conference held in Ghent, Belgium on 4 May 1999.] Abstract only. In central Europe, the pheromone compounds of *Quadraspidiotus perniciosus* and *Pseudaulacaspis pentagona* are used for monitoring and for quarantine survey. The pheromone compounds of *Q. perniciosus* are very efficient collecting the males of this pest as well as for collecting the most important introduced parasitoid *Encarsia (Prospaltella) perniciosi*. However, they were not attractive for the local parasitoid (*Aphytis proclia*). In the last years we found in these pheromone traps high numbers of males of other scale insect species (*Q. zonatus*). This shows that the compounds are not selective, as was earlier believed, which causes problems in the identifications of scale insect males caught. The pheromone compound of *P. pentagona* is very efficient collecting the males of this pest. However, it was not efficient for collecting the most important introduced parasitoid *Encarsia (Prospaltella) berlesei*. The compound was not attractive to the males of *Unaspis euonymi, Carulaspis juniperi* and *Q. perniciosus*. The pheromone extract of *Epidiaspis leperii* was attractive to the males as well as the parasitoid *Aphytis mytilaspidis*.

Kozár, F. 1999a. Data to the scale insect (Homoptera: Coccoidea) fauna of the Aggtelek National Park. The Fauna of the Aggtelek National Park 137-142. [Kozar1999a]

Notes: 46 scale insect species are reported from the area of the National Park; 29 species are new for the region. Species are from Ortheziidae, Pseudococcidae, Eriococcidae, Cryptococcidae, Coccidae, Cerococcidae, Asterolecaniidae and Diaspididae. ***Dysmicoccus walkeri*** is a new species for Hungarian fauna. The paper presents data on the localities (collecting places), host plants, instars and also on species density.

Kozár, F. & Foldi, I. 2000. ***Matileortheziola angolaensis*** n.gen., n.sp. [Hemiptera, Coccoidea, Ortheziidae]. (In English with summary in French). Revue Française d'Entomologie 22(4): 251-254. [KozarFo2000]

Notes: Description and illustration of this new species reported from Angola.

Kozár, F. & Konczné Benedicty, Z 1999. ***Ortheziola*** (Homoptera: Coccoidea) of Africa with descriptions of new species. Acta Phytopathologica et Entomologica Hungarica 34(1/2): 127-136. [KozarKo1999]

Notes: Three new ***Ortheziola*** species are described from Africa. By these descriptions the number of the known ***Ortheziola*** species of the world increased to 20. Distribution records and zoogeographical considerations are given. One new species represents a link between Palaearctic and Ethiopian Regions. The data give a new insight about species richness of this genus. The new data indicate that this group needs further study in other regions of the world.

Kozár, F. & Konczné Benedicty, Z. 1999a. Revision of ***Newsteadia*** (Homoptera: Coccoidea) of Oriental and Palaearctic regions, with description of new species. Folia Entomologica Hungarica 60: 165-178. [KozarKo1999a]

Notes: The five new species that are described and illustrated are ***Newsteadia topali, N. leobli, N. koeroesicsomai, N. vasarhelyii, N. vietnamensis. N. floccosa*** and ***N. kanayana*** and also reviewed and a key is presented.

Kozár, F. & Konczné Benedicty, Z. 2000. Revision of ***Newsteadia*** of the Australian and Pacific regions, with description of eleven new species (Homoptera : Coccoidea, Ortheziidae). Acta Zoologica Academiae Scientiarum Hungaricae 46(3): 197-229. [KozarKo2000]

Notes: New species of Newsteadia are described and illustrated (***N. australiensis, N. baloghi, N. biroi, N. caledoniensis, N. endroedyi, N. guineensis, N. gullanae, N. martini, N. milleri, N. monikae*** and ***N. tasmaniensis***) and the already known four species (***N. guadalcanalia, N. myersi, N. samoana*** and ***N. zimmermani***) are redescribed from the regions studied. A key is presented for the identification of 15 species currently included in the genus from these regions. A modified concept of the genus is presented and several new characters are given as diagnostic of the genus. The genus ***Trans-newsteadia*** is synonymized. The zoogeography of the genus is discussed.

Kozár, F. & Konczné Benedicty, Z. 2000a. Carayonemidae of the Neotropical Region with the descriptions of new genera and species (Homoptera: Coccoidea). Folia Entomologica Hungarica 61: 71-82. [KozarKo2000a]

Notes: ***Mahunkacoccus mexicoensis, Baloghicoccus costaricaensis*** and ***Foldicoccus monikae*** are described and illustrated. The zoogeography and phylogenetic relationship are discussed.

Kozár, F., Konczné Benedicty, Z. & Schmera, D. 1999. [Records on the grass-infesting scale insects (Homoptera: Coccoidea) in the Körös National Park, with special attention to the Blaskovics-pusita experimental land.] (In Hungarian). Crisicum II Suppl. 111-114. [KozarKoSc1999]

Notes: Scale species listed include ***Atrococcus cracens, Balanococcus boratynskii, Chaetococcus phragmitis, C. sulci, Dysmicoccus walkeri, Euripersia europea, Heterococcus nudus, Longicoccus festucae, L. psammophilus, Phenacoccus evelinae, P. hordei, P. interruptus, Rhizoecus albidus*** and ***Trionymus perrisii*** in the Pseudococcidae. ***Eriopeltis festucae, Lecanopsis festucae, L. formicarum, L. porifera*** and ***Vittacoccus longicornis*** are listed from

Coccidae. *Acanthococcus desertus, A. greeni, Kaweckia glyceriae, Rhizococcus agropyri, R. insignis* and *R. pseudinsignis* are listed from Eriococcidae.

Krabel, D. & Petercord, R. 2000. Genetic diversity and bark physiology of the European beech (*Fagus sylvatica*): A coevolutionary relationship with the beech scale (*Cryptococcus fagisuga*). Tree Physiology 20(7): 485-491. [KrabelPe2000]

Notes: In 1994 and 1995, the degree of infestation by the beech scale (*Cryptococcus fagisuga* Lind.) was recorded on 120 beech trees (*Fagus sylvatica* L.) in the Pless Forest near Goettingen, Germany. Simultaneously, the trees were characterized genetically and compounds of primary and secondary metabolism of beech bark were analyzed. A correlation was established between beech scale infestation and the genotype of the host trees, based on gene locus A of isocitrate dehydrogenase (IDH-A). The fraction of infested beech trees was higher in the heterozygous genotype A2A3 group than in the homozygous genotype A2A2 and A3A3 groups, whereas the fraction of beech trees with decreasing infestation from one year to the next was lower in the heterozygous genotype A2A3 group than in the homozygous genotype A2A2 and A3A3 groups. Concentrations of soluble carbohydrates, protein amino acids and proanthocyanidins were determined in the inner and outer bark of trees with differing degrees of infestation. The results indicate that the defense reaction of beech against infestation by beech scale comprises multiple processes in which nutrient availability to the beech scale is reduced by concentration shifts and by the formation of inhibiting compounds.

Kreiter, P., Panis, A. & Tourniaire, R. 1999. [Morphological variability in a population of *Pseudaulacaspis pentagona*(Targioni Tozzetti) (Hemiptera : Diaspididae) from the Southeastern France.] (In French). Annales de la Société Entomologique de France 35(Suppl. S): 33-36. [KreitePaTo1999]

Notes: The population of the white peach scale ***Pseudaulacaspis pentagona*** (Targioni-Tozzetti) (Hemiptera, Diaspididae) has a morphological variability in the same population that has been reared since more than a hundred generations on potato tubers. Among them, some specimens have the same characteristics as a related species, ***Pseudaulacaspis prunicola*** (Maskell). We conclude that it must be the same species.

Krishnamoorthy, A. & Rajagopal, D. 1999. Selection of host for mass production of California red scale. Insect Environment 5(2): 86-87. [KrishnRa1999]

Notes: ***Eryngiopus*** sp. was recorded preying on ***Aonidiella aurantii***, a pest of citrus and rose, in and around Bangalore, Karnataka, India, during 1990-92. This is the first record of the mite preying on ***A. aurantii***.

Krishnamoorthy, A. & Rajagopal, D. 1999a. Record of predatory mite, ***Eryngiopus*** sp. on ***Aonidiella aurantii*** (Maskell). Insect Environment 5(2): 92. [KrishnRa1999a]

Notes: ***Eryngiopus*** sp. was recorded preying on ***Aonidiella aurantii***, a pest of citrus and rose, in and around Bangalore, Karnataka, India, during 1990-92. This is the first record of the mite preying on ***A. aurantii***.

Kuznetsov, V.N. 1999. Employment of Coccinellidae in biological control of plant pests. Research Progress in Plant Protection and Plant Nutrition pp. 219-227 [Kuznet1999]

Notes: The Coccinellidae have been used in the control of aphids, mealybugs and coccids of fruit and field crops. This article discusses the introduction and establishment of exotic species, mass rearing of local and introduced species in the laboratory for field release, collecting from mass overwintering aggregations for release on crops infested with pests, increasing survival and fecundity, and enhancing local species to increase effectiveness.

Kutscher, M. & Koteja, J. 2000. Coccids and aphids (Hemiptera: Coccinea, Aphidinea), prey of ants (Hymenoptera: Formicidae): evidence from Bitterfeld amber. Polskie Pismo Entomologiczne 69: 179-185. [KutschKo2000]

Notes: A Bitterfeld amber syninclusion of an ant that holds a coccid in its mouth, an evident instance of predation, is described. Relations of aphids and coccids (*Matsucoccus* sp.) with ants, either symbiotic or predatory, as represented by the fossil record, are discussed.

Labanowski, G. 1999. [Scale insects - dangerous pests of *Dracaena*.] Tarczniki - grozne szkodniki draceny. (In Polish). Ochrona Roslin 43(6): 14-15. [Labano1999]

Notes: Two diaspidid species, ***Chrysomphalus aonidum*** and ***Pinnaspis aspidistrae***, are regularly imported into Poland on decorative pot plants, including ***Dracaena marginata, Aralia sieboldii [Fatsia japonica], Citrus*** spp., *Ficus* spp., ***Monstera deliciosa, Photinia serrata, Strelitzia*** sp. and others. They quickly spread in commercial greenhouses and cause serious damage to a variety of ornamentals. The life cycle of both pests is described and their photographs are shown. Actellic 500 EC [pirimiphos-methyl], combined with the wetting agent Citowett AL, are recommended for chemical control.

Labanowski, G.S. 1999a. Occurrence and chemical control of introduced ornamental glasshouse pests in Poland. Bulletin OEPP 29(1-2): 73-76. [Labano1999a]

Notes: Fourteen new pests were found in Polish commercial glasshouses on ornamental crops in 1982/1998 as a result of international trade with EU countries. They included: the insects ***Bemisia tabaci, Chaetanaphothrips orchidii, Frankliniella occidentalis, Lichtensia viburni, Liriomyza trifolii, Liriomyza huidobrensis, Opogona sacchari*** and ***Spodoptera littoralis***; the mites ***Cecidophyopsis hendersoni, Polyphagotarsonemus latus, Steneotarsonemus laticeps*** and ***Tyrophagus neiswanderi***; the nematodes: ***Paratylenchus besoekianus*** and ***Radopholus similis***. The actual situation of these pests in Poland and recommended methods for their control are given.

Labanowski, G. & Soika, G. 1999. [The greenhouse scale - a potential pest of ***Schefflera*** and ***Ilex*** in Poland.] Przylepnica szklarniowa - potencjalny szkodnik szeflery i ostrokrzewu w Polsce. (In Polish). Ochrona Roslin 43(4/5): 14-16. [LabanoSo1999]

Notes: Brief details are given of the morphology, harmfulness, biology and host plants of ***Chloropulvinaria floccifera***, which was first recorded in greenhouses in Poland in 1969 and is a potential pest of ***Schefflera*** and ***Ilex***.

Lai, Z.L., Xu, Y.Z. & Tong, A.Z. 2000. [Chemical control of ***Ceroplastes rubens***.] (In Chinese). Journal of Zhejiang Forestry Science and Technology 17(1): 59-62. [LaiXuTo2000]

Notes: Chemical control of ***Ceroplastes rubens***, which damages ***Cedrus deodara***, was conducted in the Jinhua district of Zhejiang Province, China, during 1996-1998. Control of ***C. rubens*** was conducted at the initial nymph stage by spraying tree crowns with 437 and 267 mg.L-1 omethoate 40 EC or 437 and 267 mg.L-1 omethoate + buprofezin 35EC, which resulted in >80% control.

Landmann, G. 1999. [Forest health in France: major events in 1997 and new knowledge.] La santé des forêts Françaises: actualites de l'année 1997 et nouveaux acquis. (In French with summary in English). Revue Forestière Française 51(1): 7-19. [Landma1999]

Notes: This paper summarizes the 1997 annual report on the condition of French forests (Les Cahiers du DSF 1-1998). It includes brief notes on: frost damage to lowland broadleaves and high altitude beech [***Fagus sylvatica***] stands; snow breakage of maritime pine [***Pinus pinaster***] in the Landes; the first real damage to poplars [***Populus*** spp.] caused by rust diseases (especially the new E4 strains of ***Melampsora*** sp.); damage by the maritime pine bast scale [*Matsucoccus feytaudi*] in Corsica, discovered in 1994; extensive alder [***Alnus*** sp.] dieback affecting riparian woodlands (especially in NE France and the Charentes).

Le Ru, B. & Makaya-Makosso, J.P. 1999. [Importance of semiochemicals in prey habitat location by the coccinellid predator *Exochomus flaviventris* (Coleoptera : Coccinellidae).] (In French with summary in English). Annales de la Société Entomologique de France 35(Suppl. S): 203-205. [LeRuMa1999]

Notes: The response of experienced gravid female coccinellids to odor of cassava plant, cassava mealybugs (*Phenacoccus manihoti*) and plant mealybug complex was investigated in Y-tube olfactometer. Dual-choice tests revealed that mealybug-infested plant was the major source of volatiles that attract female coccinellids to the microhabitat of its prey.

Le Ru, B. & Mitsipa, A. 1999. [Influence of the host plant resistance of *Phenacoccus manihoti* Matile-Ferrero (Hemiptera: Pseudococcidae) on life history parameters of the predator *Exochomus flaviventris* (Coleoptera: Coccinellidae)]. (In French). Annales de la Société Entomologique de France 35(Suppl. S): 93-96. [LeRuMi1999]

Notes: The influence of the antibiotic resistance of the host plant on the biological and demographic parameters of the Coccinellid predator *Exochomus flaviventris* Mader was studied in the laboratory. Our results showed that most life history parameters of the predator varied with the plant the cassava mealybug fed on and were negatively affected by the most resistant varieties. Nevertheless, they suggest the use of cassava varieties with a high antibiotic level of resistance might synergistically interact with the predator to provide a significant cassava mealybug control.
Le Ru, B. & Mitsipa, A. 2000. Influence of the host plant of the cassava mealybug *Phenacoccus manihoti* on life-history parameters of the predator *Exochomus flaviventris*. Entomologia Experimentalis et Applicata 95(2): 209-212. [LeRuMi2000]

Notes: Most life history parameters of this generalist predator *E. flaviventris* were greatly affected by the host plant of the cassava mealybug. When foraging for prey, predators prefer those that maximise larval development and reproduction. Our results suggest that cassava mealybugs fed on Faux-Caoutchouc and Incoza were less suitable prey for *E. flaviventris* than those that fed on *Talinum* and Zanaga. Whether or not low quality food of mealybugs reared on Incoza or Faux-Caoutchouc is a consequence of chemical (flavonoid compounds) and/or morphological (waxy leaf surface, leaf toughnesss) plant attributes has to be clarified. however, among cassava varieties ladybird voracity was two times greater on the most antibiotic cassava variety Incoza than on the less antibiotic Zanaga, showing that the use of cassava varieties such as Incoza might synergistically interact with *E. flaviventris* to provide a significant cassava mealybug control.

Leddel, M., Hines, E. & Rodriguez, G. (Eds.) 2000. The Golden Bug: The Story of the Red Cochineal. Century High School, Alhambra, California. 50 pp. [GoldenBuSt2000]

Notes: The result of a high school class project, it covers uses of cochineal (*Dactylopius coccus*), history of the cochineal trade, brief taxonomic and biological notes and works of fiction inspired by the project. It received the Entomological Society of America President's Award in 2000, given to a secondary school teacher using insects as an educational tool. Supervised by Michelle Leddel, teacher.

Lee, S.G., Park, J.D. & Ahn, Y.J. 2000. Effectiveness of neem extracts and carvacrol against *Thecodiplosis japonensis* and *Matsucoccus thunbergianae* under field conditions. Pest Management Science 56(8): 706-710. [LeePaAh2000]

Notes: The effectiveness of two neem extracts, Neem-Azal (containing 10 mg azadirachtin ml-1) and neem extract (containing 45 mg azadirachtin ml-1, Neem-45) and carvacrol against larvae of *Thecodiplosis japonensis* and intermediate nymphs of *Matsucoccus thunbergianae* was field evaluated by the trunk implantation method and compared with that of the systemic insecticide phosphamidon 500 g litre-1 SL. As a naturally occurring insecticide, neem extract alone and in mixture with phosphamidon and a mixture of carvacrol and phosphamidon could be useful as a new preventive agent against damage caused by *T. japonensis* and *M. thunbergianae*.

Leschen, R.A.B. 2000. Beetles feeding on bugs (Coleoptera, Hemiptera): repeated shifts from mycophagous ancestors. Invertebrate Taxonomy 14(6): 917-929. [Lesche2000]

Notes: A review of the literature shows that predation on Hemiptera (mainly Sternorrhyncha) by Coleoptera is widespread in the order, but little understood, even from a biocontrol perspective. Phylogenetic information indicates that feeding on hemipterans evolved predominantly in lineages containing fungus feeders (Derodontidae,

Silvanidae, Laemophloeidae, Nitidulidae, Endomychidae, Anthribidae) and whose ancestors were fungus feeders (Coccinellidae) or were sap feeders (cetoniine Scarabaeidae). Other predators on Hemiptera whose ancestry could not be determined unequivocally (predatory/phytophagy or phytophagy/mycophagy) are included in families that contain a large number of species that are mycophagous (Trogossitidae, Mycetophagidae, and Salpingidae). Because changes in diet to feeding on hemipterans have repeatedly occurred in mycophagous taxa, and this shift is not present in other largely predatory groups of beetles, it is presumed that certain preconditions, which have promoted this specialised behaviour, only exist in these lineages. Ancestral associations with sooty moulds that grow on honeydew may have mediated shifts from mycophagy to predation, rather than having ancestors that were predatory and attracted to a novel prey type. Natural history data show that species that prey on Hemiptera also feed on honeydew and sooty moulds and a model is presented for the host shift from mycophagy to feeding on Hemiptera. An annotated list of Hemiptera prey for beetles (exclusive of Coccinellidae) includes records for species in the families Adelgidae, Aleyrodidae, Aphididae, Coccidae, Diaspididae, Kermesidae, Kerriidae, Margarodidae, Membracidae, Phoenicococcidae, and Pseudococcidae.

Liang, T., Ai, S.J., Zhang, Q.X., Chen, H.M., Tuo, H.T. & Li, Z.G. 1999. [Study on the biological characteristics of scales, their dominant natural enemies and control on pear trees in Xinjiang.] (In Chinese). China Fruits (No. 2): 29-30. [LiangAiZh1999]

Notes: Six species of scales, the most important of which were ***Quadraspidotus perniciosus*** and ***Parlatoria oleae***, and two dominant natural enemies, ***Chilocorus geminus*** and ***Aphytis proclia***, were recorded in pear orchards in Xinjiang, China. Besides applying winter pruning and using the natural enemies to kill the scales, the most effective chemical method was spraying a 200x solution of detergent at the end of February and spraying a 25x mixed solution of 2 kg water + 0.5 kg wheat flour + 200 g soap and + 200 g petroleum during the vegetative period.

Longo, S., Marotta, S., Pellizzari, G., Russo, A. & Tranfaglia, A. 1999. A zoogeographical analysis of the Italian scale insect fauna. (In English). Bollettino di Zoologia Agraria e Bachicoltura. Milano Ser. II, 31(2): 139-151. [LongoMaPe1999]

Notes: [This work has been presented at the VIII International Symposium on Scale Insects Studies, Wye (U.K.), August-September, 1998.] This paper presents the results of a zoogeographical analysis of the Italian scale fauna encompassing, to date, 365 species. Eleven species have not been included in the present analysis because their original description was poor, their identity is doubtful and they have not been recorded since. Italian scale insect fauna is grouped into several fundamental groups and subgroups and distribution analyzed.

Longo, S., Marotta, S., Pellizzari, G., Russo, A. & Tranfaglia, A. 1999a. A zoogeographical analysis of the Italian scale insect fauna. 25 In: VIIIth International Symposium on Scale Insect Studies. 41 pp. [LongoMaPe1999a]

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. This paper presents the results of a zoogeographical analysis of the Italian scale insect fauna, which includes 365 species to date. Eleven species have not been included in the present analysis because their original description was poor, their identity is doubtful and they have not been recorded since. Italian scale insect fauna is grouped into several fundamental groups and subgroups and distribution analyzed.

Lu, Y.M. & Lai, F.F. 1999. An effective method for control of pineapple powdery scales. South China Fruits 28(3): 33. [LuLa1999]

Notes: Pineapple powdery scale (***Pseudococcus brevipes***) is a key pest of pineapple in southern China, usually causing decreases in production and fruit quality. Clearing weeds and bushes around the plantation, applying lime in the planting holes to kill ants, decreasing the acidity of the red soil and spraying an 800-1000x solution of 40% Supracide [methidathion] controlled the pest completely.

Lunderstadt, J. & Wagner, M.R. 1999. Induced resistance against insects in European forest ecosystems. Les Colloques (INRA) No. 90: 363-368. [LunderWa1999]

Notes: [International Symposium held at Gujan, France, 31 August-5 September, 1997.] Passive and induced resistance are presented as defence mechanisms against insect feeding using the examples: ***Fagus sylvatica*** and ***Phyllaphis fagi, Fagus sylvatica*** and ***Cryptococcus fagisuga, Larix decidua*** and ***Coleophora laricella, Larix decidua*** and ***Ips cembrae, Picea abies*** and ***Ips typographus***, and ***Pinus sylvestris*** and ***Lymantria monacha***. The dependence of the type of resistance with respect to genotype and physiological age of the host tree, intensity of the attack by phytophages, site stand treatment, and weather are discussed from an ecosystemic point of view.

Luo, H., Tang, H.Q., Lang, H.Q., Jiang, X.Q., Qian,G.P., Zhang,C.F. & Huang, S.M. 1999. [Studies on prevention and control techniques of ***Kuwanaspis pseudoleucaspis*** in ***Phyllostachys*** f. ***pervernalis*** Base.] (In Chinese with summary in English). Journal of Zhejiang Forestry Science and Technology 19(3): 49-52. [LuoTaLa1999]

Notes: In 1995, ***Kuwanaspis pseudoleucaspis*** was found infesting ***Phyllostachys*** f. ***pervernalis*** [***Phyllostachys praecox*** f. ***pervernalis***] in Xindong town, Fuyang, China. After two years of investigations and prevention tests, some prevention and control techniques were found.

Luo, Q.H., Xie, X.L., Zhou, L., Wang, S.W. & Xu, Z.Y. 2000. [A study on the dynamics and biological characteristics of ***Eriococcus lagerostroemiae*** Kuwana population in Guiyang.] (In Chinese with summary in English). Acta Entomologica Sinica 43(1): 35-42. [LuoXiZh2000]

Notes: Biology, distribution in Guizhou Province, the effect of temperature, natural enemies and chemical control was discussed.

Magagula, C.N. & Samways, M.J. 2000. Effects of insect growth regulators on ***Chilocorus nigritus*** (Coleoptera: Coccinellidae), a non-target natural enemy of citrus red scale, ***Aonidiella aurantii*** (Homoptera: Diaspididae), in southern Africa: evidence from laboratory and field trials. African Entomology 8(1): 47-56 [MagaguSa2000]

Notes: ***Chilocorus nigritus*** (Fabricius) is one of the major coccinellid predators of the citrus pest ***Aonidiella aurantii*** (Maskell) in southern Africa. Laboratory and field experiments were carried out on eggs, larvae and adults of this ladybird to determine the effects of three insect growth regulators (IGRs) used against citrus pests in the region. Two chitin synthesis inhibitors, buprofezin and teflubenzuron, and a juvenile hormone analog, pyriproxyfen, were applied to ***C. nigritus*** populations at the recommended dosages. Mortality and development of egg and larval stages, as well as mortality and fecundity of the adults were recorded. Laboratory experiments indicated that, of the three IGRs tested, buprofezin was the most detrimental compound, especially to larval stages, irrespective of whether the larvae were fed IGR-treated ***A. aurantii*** directly or sprayed with IGRs. Immediate larval mortality from pyriproxyfen and teflubenzuron was not significantly different from the controls. None of the larvae that were fed with ICR-treated ***A. aurantii*** pupated. By contrast, larvae that had only been sprayed with IGRs pupated, but no adults emerged. Adult fecundity was not affected by exposure to IGRs, either in the laboratory or in the field, but all eggs exposed to IGRs failed to hatch. Although larvae developed to the adult stage in the feld experiments, the IGRs' ovicidal activity and effects on immature stages still had a detrimental effect on ***C. nigritus*** population levels. As a result, spraying of IGRs is likely to impede ***C. nigritus*** population increases in citrus orchards. This emphasizes the need to avoid spraying during ***C. nigritus*** population increases should the use of IGRs be unavoidable. Insect growth regulator's impact on non-target species still requires further consideration, especially with the incorporation of these chemicals into integrated pest management programmes.

Magro, A. & Hemptinne, J.L. 1999. The pool of coccinellids (Coleoptera: Coccinellidae) to control coccids (Homoptera: Coccoidea) in Portuguese citrus groves. Boletín de Sanidad Vegetal, Plagas 25(3): 311-320. [MagroHe1999]

Notes: Integrated Pest Management programmes in Portugal pay most attention to coccids. The study of coccinellids for the biological control of those pests was undertaken. The first goal of this paper was to determine which coccidophagous ladybirds are more likely to control coccids by examining dominance, constancy and persistence during the year. A second goal was to shed some light on the feeding regime of several species of the Scymnini tribe. Eight coccidophagous ladybirds were observed to have a strong presence in Portuguese citrus groves. They correspond to species regularly considered as important for the biological control of coccids in other Mediterranean countries. Five species of the ***Scymnus*** genus were also very important in the sampled orchards. Although usually considered as aphidophagous, their abundance is correlated to the appearance of coccinellids which are predators of coccids. A first large scale phenology of the most important ladybird beetles in citrus orchards is provided which can help to schedule chemical interventions.

Maheswari, T.U. & Purushotham, K. 1999. Widespread occurrence of scale insect on papaya. Insect Environment 5(1): 17. [MaheswPu1999]

Notes: ***Aspidiotus destructor*** was observed damaging pawpaws in Andhra Pradesh, India, during July-August 1997-98.

Malipatil, M.B., Dunn, K.L. & Smith, D. 2000. In: An Illustrated Guide to the Parasitic Wasps Associated with Citrus Scale Insects and Mealybugs in Australia. Natural Resources and Environment, Agriculture Resources Conservation Land Management, Agriculture, Victoria. 152 pp. [MalipaDuSm2000]

Notes: This publication aims to help the citrus integrated pest management (IPM) consultant, field worker and specialist entomologist with identification keys, less technical diagnostic characters, and, where possible, photographs of individual species. Sources of origins, descriptions, combinations and synonyms, diagnosis and biological notes, particularly host lists, and key references are provided for each species. Scale insects and mealybugs are the dominant pest group in Australian citrus. Twenty three species of scale (15 soft scales and eight armoured) and six mealybugs are recorded (Table 1). All but three of four of these have been accidentally introduced, most probably with original citrus importations from southern China last century. ***Aonidiella aurantii, Ceroplastes destructor, Chrysomphalus aonidum, Coccus hesperidum, C. pseudomagnoliarum, Planococcus citri, Pseudococcus calceolariae, P. longispinus, Saissetia oleae*** and ***Unaspis citri*** are pointed out as major pests.

Malleshaiah, Rajagopal, B.K. & Gowda, K.N.M. 2000. Feeding potential of ***Chrysoperla carnea*** (Neuroptera: Chrysopidae) of different stages of citrus mealybug, ***Planococcus citri*** (Hemiptera: Pseudococcidae). Crop Research Hisar 20(1): 126-129. [MallesGo2000]

Notes: The feeding potential of ***Chrysoperla carnea*** was studied on the eggs, nymphs and adult females of ***Planococcus citri*** under laboratory conditions for the first time. The grubs were found active predators on mealybugs, and the predatory grub preyed on all the stages of the mealybug. The chrysopid larva consumed a total of 3783.73 eggs or 728.52 nymphs, or 96.39 adult females of ***P. citri***.

Malleshaiah, Rajagopal, B.K. & Gowda, K.N.M. 2000a. Biology of citrus mealybug, ***Planococcus citri*** (Risso.) (Hemiptera: Pseudococcidae). Crop Research Hisar 20(1): 130-133. [MallesGo2000a]

Notes: Studies on the biology of ***Planococcus citri*** (Risso.) showed that the incubation period lasted 3.35 days. The female had three while the males had four nymphal instars. The nymphal development in male and female was completed in 20.05 and 28.10 days, respectively, when reared on pumpkin fruits in the laboratory. Fecundity ranged from 152 to 356 eggs. These studies were carried out in the laboratory at a temperature ranging from 25 to 29 degree C and relative humidity from 65 to 70%.

Mani, M. & Krishnamoorthy, A. 1999. ***Maconellicoccus hirsutus*** on acid lime in India. Insect Environment 5(2): 73-74. [ManiKr1999]

Notes: *M. hirsutus* was recorded from acid lime for the first time in India in January 1999, at Bangalore, Karnataka. A parasitoid and a predator were recorded, but their effect was negligible. *Cryptolaemus montrouzieri* was released twice at 25 individuals/plant on 29 January and 15 February 1999, which resulted in a reduction of the mealybug population from 39.40/shoot in January to 1.30/shoot in mid-March.

Mani, M. & Krishnamoorthy, A. 1999a. Suppression of green shield scale *Chloropulvinaria psidii* (Maskell) with Australian ladybird beetle on lemon. Insect and Environment 4(4): 116-117. [ManiKr1999a]

Notes: Suppression of green shield scale (*Chloropulvinaria psidii [Pulvinaria psidii]*) on lemon by Australian ladybird beetle (ALB; *Cryptolaemus montrouzieri*) was studied following release of ALB in the second week of Nov. 1997. The number of scale ovisacs had declined from 42.5 to less than 1.0 by the third week of December.

Mani, M. & Krishnamoorthy, A. 1999b. The nigra scale, *Parasaissetia nigra* and its natural enemy on custard apple in Karnataka. Insect and Environment 5(1): 20. [ManiKr1999b]

Notes: *Parasaissetia nigra* was collected from *Annona squamosa* in Bangalore, India, during January-March 1997. *Scutellista cyanea [S. caerulea]* caused 18.5% parasitism in January, which increased to 42% in March.

Margina, A., Lecheva, I., Craker, L.E., Zheljazkov, V.D. & Giulietti, A. 1999. Diseases and pests on Bulgarian oil-bearing rose (*Rosa kazanlika* V.T.=*Rosa damascena* Mill. var. kazanlika). Acta Horticulturae No. 502: 237-241. [MarginLeCr1999]

Notes: Oil-bearing rose is the most important essential oil crop in Bulgaria. During the period 1993-1996, regular observations were conducted at 10-day intervals in the experimental field of the Research Institute for Roses, Aromatic and Medicinal Plants in Kazanlik, and in the adjacent rose plantations, to clarify pest and disease appearance, development, density, distribution and damage on roses. The most severe diseases on roses were caused by rust (*Phragmidium mucronatum*) and black spot (*Diplocarpon rosae*). Of the rose-attacking pests, the cane borer (*Agrilus cuprescens*), rose curculio (*Homalorhynchites hungaricus*), rose scale insect (*Rhodococcus bulgariensis*), rose chafer (*Epicometis hirta*) and *Phyllopertha horticola* proved to be the most destructive. A tendency towards a gradual increase of the population density of pests of no economic significance was also recorded.

Marotta, S., Ripullone, F. & Tranfaglia, A. 1999. [Bio-ethological observations on *Kermes vermilio* (Planchon) (Homoptera Coccoidea Kermesidae) harmful to *Quercus ilex* in Basilicata region (Italy).] (In Italian with summary in English). Phytophaga. Palermo 9: 63-83. [MarottRiTr1999]

Notes: [Original title: Osservazioni bio-etologiche su *Kermes vermilio* (Planchon) (Homoptera Coccoidea Kermesidae) dannoso ai lecci in Basilicata.] *Kermes vermilio* is a gall-like scale insect reported as a pest on ornamental *Quercus ilex* in some central and southern Italy urban environments. Its life cycle, behaviour and natural enemies were studied on scale insect colonies living on ornamental oaks in Rapolla, Basilicata region, southern Italy. The species is oviparous and monovoltine, showing one generation per year, overwintering as first instar. Geographical distribution and host plants are reported. Behavioral data such as active dispersal, developmental and feeding sites, and biological data such as fecundity, correlation between post-reproductive female size and egg number, emergence time of crawlers, female growth rate, male development and adult longevity are studied under field and laboratory conditions. The complex of natural enemies includes *Aenasiodea hispanica, Cheiloneurus claviger* and *Metaphycus hirtipennis*.

Martínez, M.A. & Surís, M. 2000. [Bioecological basis for the management of mealybugs in the coffee crop in Cuba.] Bases bioecológicas para el manejo de chinches harinosas en el cultivo del café en Cuba. (In Spanish with summary in English). Manejo Integrado de Plagas 57: 58-64. [MartinSu2000]

Notes: Mealybugs are a species complex composed of the genera *Planococcoides, Pseudococcus* and *Planococcus*. These form a serious problem on the coffee crop by causing damage to plants, principally galling of the roots.

Taxonomic studies confirmed the presence of the three genera, but also determined morphological differences in the specimens of ***Planococcus***, which through evaluation of biological parameters was differentiated into three species (***P. minor*** and two undescribed). A sampling procedure was designed that was shown to be 95% efficient and made it possible to determine the dispersal pattern and the level of activity of the pest and its natural enemies. Of the natural enemies associated with the pest 90% were parasitoids and of these 86% corresponded to the family Encyrtidae. However, parasitism was not greater than 20%, which indicates the need to establish conservation strategies for natural enemies. Also, a population of greater than 600 specimens was determined as a damage threshold. An integrated management programme for these pests on coffee in Cuba was designed based on the bioecological information of the pest.

Matile-Ferrero, D., Legrand, J. & Riffet, X. 1999. [A surprising infestation of the Australian scale insect ***Icerya purchasi*** Maskell throughout Paris [Hemiptera, Margarodidae].] Une surprenante infestation de la cochenille Australienne ***Icerya purchasi*** Maskell en plain Paris [Hemiptera, Margarodidae]. (In French with summary in English). Revue Française d'Entomologie 21(4): 175-178. [MatileLeRi1999]

Notes: The cottony cushion scale severely infests the ornamental plans that grow in the dry sunny area named "Le Saut-du-Loup" in the Jardin des Plantes, Paris. Biological control with the beetle ***Rodolia cardinalis*** will be undertaken in early spring.

Mazzeo, G., Russo, A. & Suma, P. 1999. ***Phenacoccus solani*** Ferris (Homoptera Coccoidea) on ornamental plants in Italy. (In English with summary in Italian). Bollettino di Zoologia Agraria e Bachicoltura. Milano 31(1): 31-35. [MazzeoRuSu1999]

Notes: A new record in Italy (Sicily) of the mealybug, ***Phenacoccus solani***, on ***Encephalartos*** sp. (Cycadaceae) is reported in a cold greenhouse. Some comments on morphology, geographical distribution and host plants, are given.

McIntyre, N.E. 2000. Ecology of urban arthropods: a review and a call to action. Annals of the Entomological Society of America 93(4): 825-835. [McInty2000]

Notes: A review of the entomological literature revealed relatively few general studies on arthropods in urban environments, excluding those in the context of pest control or epidemiology, and all were limited in scope and duration. Most studies documented the presence and abundance of species in a variety of poorly quantified urban categories. There also were a number of studies on the effects of urban pollution and changes in arthropod community composition over time (particularly in urban green areas). From these studies, three groups of arthropods could be identified: (1) "rural" taxa not present (or at lower abundance) in urban settings. (2) "urban" taxa present only (or at higher abundance) in urban settings, and (3) taxa present in both rural and urban settings with no particular affinity for either. The lack of a basic understanding of the mechanisms accounting for distributional and abundance patterns of urban arthropods illustrates the many opportunities for entomological research that exist in urban settings. Some of these opportunities are outlined to encourage further work on the ecology of urban arthropods. ***Pulvinaria regalis*** is mentioned as an example of a species for which density varies depending on whether it occurs in an urban or rural setting.

McKenna, C.E. & Retamales, J. 1999. Evaluation of vegetable oils for armoured scale control in kiwifruit orchards. Acta Horticulturae (No. 498): 365-370. [McKennRe1999]

Notes: [Proceedings of the Fourth International Symposium on Kiwifruit, Santiago, Chile, 11-14 January 1999.] In laboratory tests, an emulsified rapeseed oil (erso) and an emulsified reconstituted vegetable oil (evo) were compared with a commercially used mineral oil (Sunspray Ultra-fine) for efficacy against ***Hemiberlesia rapax***. At 2.0%, erso and evo achieved 100 and 99% mortality, respectively, compared with 92.5-95.8% mortality with 1.0% mineral oil. On kiwifruits (cv. Hayward) at Te Puke, New Zealand, applications of the vegetable oil formulations at 2% provided good control of ***H. rapax*** on kiwifruit vines (2.1 and 8.0% fruit infestation for erso and evo, respectively), equivalent to that achieved using the mineral oil at a rate of 1% (6.3% fruit infestation). In contrast,

significantly higher levels of scale-infested fruit were recorded after sprays of the plant oil formulations at 1% (10.3 and 16.5% for erso and evo, respectively). All plant oil treatments resulted in high levels of fruit with phytotoxic damage and there was a significant rate effect. At 2%, the plant oils caused 63.8% of the fruit to be rendered unfit for export. No damage was observed in the mineral oil treatments. An alkylsilicone adjuvant had no insecticidal benefit, nor did it reduce the risk of phytotoxicity.

Melzer, M.J., Karasev, A.V., Sether, D.M. & Hu, J.S. 2001. Nucleotide sequence, genome organization and phylogenetic analysis of pineapple mealybug wilt-associated virus-2. Journal of General Virology 82(1): 1-7. [MelzerKaSe2001]

Notes: The genome of pineapple mealybug (***Dysmicoccus brevipes***) wilt-associated closterovirus-2 (PMWaV-2) was cloned from double-stranded RNA isolated from diseased pineapple and its sequence determined. The 3'-terminal 14861 nt of the single-stranded RNA genome contains ten open reading frames (ORFs) which, from 5' to 3', potentially encode a >204 kDa polyprotein containing papain-like protease, methyltransferase and helicase domains (ORF1a), a 65 kDa RNA-dependent RNA polymerase (ORF1b), a 5 kDa hydrophobic protein (ORF2), a 59 kDa heat shock protein 70 homologue (ORF3), a 46 kDa protein (ORF4), a 34 kDa coat protein (ORF5), a 56 kDa diverged coat protein (ORF6), a 20 kDa protein (ORF7), a 22 kDa protein (ORF8) and a 6 kDa protein (ORF9). A 132 nt untranslated region was present at the 3' terminus of the genome. This genome organization is typical of the monopartite closteroviruses, including the putative +1 ribosomal frameshift allowing expression of ORF1b. Phylogenetic analysis revealed that within the family Closteroviridae the mealybug-transmitted PMWaV-2 is more closely related to other mealybug-transmitted members than to those which are transmitted by aphids or whiteflies. Within this group, PMWaV-2 shares the greatest sequence identity with grapevine leafroll-associated virus-3, another mealybug-transmitted closterovirus.

Mendel, Z. 2000. The phytophagous insect fauna of ***Pinus halepensis*** and ***P. brutia*** forests in the Mediterranean. 217-236 In: Ne'eman, G. & Trabaud, L., Eds., Ecology, Biogeography and Management of ***Pinus halepensis***. Backhuys Publishers, Leiden, The Netherlands. [Mendel2000]

Notes: Scale species discussed include ***Leucaspis pusilla, Marchalina hellenica, Matsucoccus josephi*** and ***Phenacoccus yerushalmi.***

Michaud, J.P. & Evans, G.A. 2000. Current status of pink hibiscus mealybug in Puerto Rico including a key to parasitoid species. Florida Entomologist 83(1): p. 97-101. [MichauEv2000]

Notes: The impact of ***Maconellicoccus hirsutus*** has been minimized due to parasitoid species. Key to parasitoids provided.

Miele, A., Tonietto, J., Rizzon, L.A. & Manfredini, S. (Eds.) 1999. (In Portuguese). In: VII Congresso Brasileiro de Viticultura e Enologia. Bento Gonçalves e Garibaldi, Brazil. 101 pp. [MieleToRi1999]

Notes: [Conference held 14 to 16 July, 1993.] Two papers that are included are A Field assessment of varietal resistance of American vine rootstocks of the Brazilian ground pearl, ***Eurhizococcus brasiliensis***, (Hempel in Wille, 1922) (Homoptera: Margarodidae) in southern Brazil by S.J. Soria, et al. and Artificial rearing of ***Eurhizococcus brasiliensis*** (Homoptera: Margarodidae) on Irish potato tubers ***Solanum tuberosum*** in the laboratory by S.J. Soria and L.C. Braghini.

Mifsud, D. & Watson, G.W. 1999. Introduced sap-feeding insect pests of crop plants in the Maltese Islands. The Central Mediterranean Naturalist 3(1): 29-34. [MifsudWa1999]

Notes: Sap-feeding insects within Hemiptera and Thysanoptera are some of the most important crop pests world-wide. Apart from the loss of yield they cause by sap depletion, saliva toxicity and soiling of the leaves, some species transmit serious plant virus diseases. Important sap-feeding species that have been introduced to the Maltese Islands include the scale insects ***Pseudococcus longispinus, Planococcus citri*** and ***Icerya purchasi***. For each of these pests information is provided on area of origin, present distribution, host-plant range and virus disease transmission.

Control strategies undertaken in the Maltese Islands are described where relevant. Some general considerations on quarantine measures are discussed.

Miller, D.R. & Gimpel, M.E. 2000. In: A Systematic Catalogue of the Eriococcidae (Felt Scales) (Hemiptera: Coccoidea) of the World. Intercept Ltd., Andover, U.K. 589 pp. [MillerGi2000]

Notes: Felt scales include many serious pests, particularly of ornamental plants such as azaleas, elms, beech trees, and cacti. This book is a synthesis and catalogue of all the taxonomic information published on felt scales worldwide up to April 2000, and gives information on their correct scientific name, common names, synonyms, host plants, distribution, biology, economic importance and published references. This information will benefit all who are interested in the control, ecology, life history, pest exclusion, and pest management of extension agents, and state and university researchers.

Minks, A.K. 1999. In: Hardie, J. (Ed.), Pheromones of Non-lepidopteran Insects Associated with Agricultural Plants. CABI Publishing, Wallingford, U.K. xi + 466 pp. [Minks1999]

Notes: The history and current progress in the elucidation of the biology and chemistry of pheromones from non-lepidopteran agricultural pests and beneficial insects is reviewed. The pheromones and kairomones of hosts and prey of beneficial insects are also included. Insects important in agriculture, horticulture, forestry and stored products are covered. Chapters are dedicated to the following insects: fruit flies (Tephritidae), gall midges (Cecidomyiidae), scarab beetles (Scarabaeidae), sap beetles (Carpophilus spp.), weevils (Curculionidae), forest beetles (Coleoptera), stored-product beetles (Coleoptera), sawflies and seed wasps (Hymenoptera), aphids (Aphidoidea), scale insects (Coccoidea), phytophagous bugs (Heteroptera), grasshoppers and locusts (Acrididae), termites (Isoptera), beneficial predators, parasitoids and parasitoid hosts and bees (Apidae).

Mishra, Y.D., Kumar, S., Sushil, S.N., Bhattacharya, A. & Singh, B.P. 1999. Development of Kusmi lac insect, *Kerria nagoliensis* (Mahdihassan), on different hosts. Insect and Environment 5(3): 130-131. [MishraKuSu1999]

Notes: Observation of the postembryonic growth and development of the lac insect ***K. nagoliensis*** indicated that the time to reach sexual maturity varied with host species (***Flemingia macrophylla, Zizyphus mauritiana, Acacia catechu*** or ***A. auriculaeformis [A. auriculiformis]***). No difference was observed during the winter cycle. It is concluded that the growth and development of the lac insect was affected by the physiological state of the plants.

Mishra, Y.D. & Sushil, S.N. 2000. A new trivoltine species of *Kerria* Targioni-Tozzetti (Homoptera: Tachardiidae) on *Schleichera oleosa* (Lour.) Oken from eastern India. Oriental Insects. New Delhi (34): 215-220. [MishraSu2000]

Notes: A new trivoltine lac insect species, ***Kerria sharda***, sp. nov. (Homoptera: Tachardiidae) infesting ***Schleichera oleosa*** (Lour.) Oken is reported from eastern ghat region of Orissa, India. It differs from the closest species *K. albizzae* (Green), by having marginal ducts numbering 24-30 in each of 6 clusters, subequal branchial and supra-anal plates and 3-4 segmented antennae, as against 10-15 marginal ducts, branchial plate longer than supra anal plate and 2 segmented antennae of albizzae.

Mishra, Y.D., Sushil, S.N., Kumar, S. & Bhattacharaya, A. 2000. Variability in lac productivity and related attributes of *Kerria* spp. (Homoptera: Tachardiidae) on ber (***Zizyphus mauritiana***). Journal of Entomological Research. New Delhi 24(1): 19-26. [MishraSuKu2000]

Notes: Naturally occurring eleven lac insect stocks of ***Kerria*** spp. were studied on ber, (***Zizyphus mauritiana***) for their performance with respect to ten productivity linked characters, viz., density of settlement, per cent initial mortality, sex-ratio, number of females/cm2 at sexual maturity, live cell weight, dry cell weight, resin/female, number of females at crop maturity, life period, and sticklac productivity in terms of sticklac output/meter/day. Estimates of phenotypic coefficient of variance, genotypic coefficient of variance, heritability and genetic advance calculated were found to be in the range of 18.26 to 61.31, 18.00 to 58.92, 0.57 to 0.99, and 5.65 to 14.99, respectively. The productivity of lac ranged from 0.214 to 0.670 g/day/meter in the case of stock nos. LR-5101 and LR-5316, respectively. Of the former aforesaid nine parameters, resin output per female was the highest and sex

ratio the lowest value of genotypic correlation coefficient to the extent of 0.9889 and 0.0630, respectively, with productivity of lac.

Moghaddam, M. 1999. The record of ***Dysmicoccus brevipes*** (Cockerell) (Coccoidea: Pseudococcidae). Journal of Entomological Society of Iran 18(1/2): 44. [Moghad1999]

Notes: This species was intercepted at the airport in Tehran on pineapples and suspected of being introduced from Kenya or Uganda in 1999. A brief description is given.

Momen, F. & Hussein, H. 1999. Relationships between food substances, developmental success and reproduction in ***Typhlodromus transvaalensis*** (Acari: Phytoseiidae). (In English with summary in French). Acarologia 40(2): 107-111. [MomenHu1999]

Notes: The predacious mite, ***Typhlodromus transvaalensis*** (Nesbitt) [***Clavidromus transvaalensis***] completed its life cycle when fed on the eriophyid mites ***Eriophyes dioscoridis*** Soliman and Abou-Awad [***Aceria dioscoridis***] and ***Eriophyes olivi*** Zaher & Abou-Awad [***Aceria olivi***], eggs of the scale insect ***Parlatoria zizyphus*** (Lucas) [***Parlatoria ziziphi***] and pollen of ***Ricinus communis*** (L.) under experimental conditions. The percentage of individuals attaining maturity was <20% when nymphs of ***Tetranychus urticae*** Koch, were provided. Development was faster and reproduction was greater when ***C. transvaalensis*** was fed on eriophyid mites. The daily reproductive rate was as low as 0.4 and 0.8 eggs per female per day when females were maintained on a diet of ***R. communis*** pollen grains and ***P. zizyphi*** eggs. On average, adult females daily consumed 126, 97 and 6 individuals of ***A. olivi, A. dioscoridis*** and ***T. urticae***, respectively.

Moraal, L.G., Goedhart, P.W. & Wagner, M.R. 1999. Differences in palatability of ***Fraxinus excelsior*** L., for the vole, ***Microtus arvalis***, and the scale, ***Pseudochermes fraxini*** L. Les Colloques (INRA) No. 90: 111-120. [MoraalGoWa1999]

Notes: [Physiology and genetics of tree-phytophage interactions, an International Symposium held at Gujan, France, 31 August-5 September, 1997.] In wintertime, when population densities are high and food is scarce, small rodents, such as voles, consume the bark of young trees, which may then die. Severe vole damage has occurred to trees over large areas in the Netherlands in recent years. It has been known for some years that rabbits show a preference for the bark of certain clones of ***Fraxinus excelsior***. Therefore, choice-tests were made with the common vole, ***Microtus arvalis*** and 32 provenances of ***F. excelsior***. Significant differences were observed in palatability of the bark of individual trees. In a separate experiment, the bark-sucking insect pest ash scale (***Pseudochermes fraxini***) appeared to respond to an antifeedant in the bark of ***F. excelsior***, and the bark of a progeny which was infested by the ash scale was preferred in choice-tests with voles. There was some evidence that these effects are related to differences in the concentrations of bitter tasting coumarin derivatives in the bark. These findings might be of interest for genetic improvement in order to select resistant trees.

Morse, S., Acholo, M., McNamara, N. & Oliver, R. 2000. Control of storage insects as a means of limiting yam tuber fungal rots. Journal of Stored Products Research 36 (1): 37-45. [MorseAcMc2000]

Notes: Yam rots caused by fungal pathogens (mostly ***Fusarium*** spp.) are a major cause of storage losses, and previous work has shown that fungal lesions were only found if there was pre-existing physical damage to the tuber. The general perception is that damage inflicted in the field prior to storage is far more important in this regard than damage caused during storage, and this has led to much research directed at the minimization of field damage with relatively little work on the amelioration of insect damage during storage. This study examined whether insect damage inflicted on yam (cvs. Akpaji and Ekpe) tubers during storage in specialized barns near Idah, Kogi State, Nigeria, is an important agent in the incidence of fungal disease. It was found that treatment of tubers with insecticide dust (Actellic 2% Dust; ai=pirimiphos-methyl) significantly reduced fungal infections (caused by ***Fusarium*** spp., ***Penicillium*** spp., ***Aspergillus*** spp., ***Curvularia*** spp., ***Epicoccum*** spp. and ***Helminthosporium*** spp.) resulting from insect attack (mainly by storage beetles (Coleoptera), mealybug (***Planococcus citri***) and scale insect (***Aspidiella hartii***)) during storage. In addition, physical damage acquired during harvest appeared to be ameliorated

by the insecticide, resulting in significantly fewer fungal lesions. The results suggest that insecticide treatment of yam tubers prior to storage could provide a relatively cheap and effective means of preservation.

Mukhopadhyay, A.K. & Ghose, S.K. 1999. Biology of the mealybug ***Planococcus lilacinus*** (Cockerell) (Pseudococcidae: Homoptera). Environment & Ecology 17(2): 464-466. [MukhopGh1999]

Navrozidis, E.I., Zartaloudis, Z.D., Papadopoulou, S.H. & Karayiannis, I. 1999. Biology and control of San Jose scale, ***Quadraspidiotus perniciosus*** (Comstock) (Hemiptera, Diaspididae) on apricot trees in northern Greece. Acta Horticulturae (No. 488): 695-698. [NavrozZaPa1999]

Notes: [Proceedings of the XIth International Symposium on Apricot Culture, Veria, Makedonia, Greece, 25-30 May, 1997, Volume 2.] The results indicated that ***Q. perniciosus [Diaspidiotus perniciosus]*** completed three generations per year and its parasitoid ***Encarsia perniciosi***, four generations per year. The two-year (1994-1995) field experiments also revealed that spring and summer applications of fenoxycarb, buprofezin and diofenolan gave successful control of the pest and reduced only slightly the parasitization by ***E. perniciosi***. The use of methidathion had a detrimental effect on the parasitoid.

New mealybug found in imperial county 1999. California Grower 23(8): 25. [NewMeFo1999]

Notes: ***Maconellicoccus hirsutus*** or pink hibiscus mealybug briefly discussed. Distribution, hosts and control.

Nguyen Thi, T.C., Paul, V.M. & Sastroutomo, S.S. 1999. Beneficial effects of black ants (***Dolichoderus thoracicus*** Smith) in sapodilla production in Vietnam. 29-33. In: Hong, L.W., Ed., Biological Control in the Tropics: Towards Efficient Biodiversity and Bioresource Management for Effective Biological Control. CABI Publishing, Wallingford, U.K.. [NguyenPaSa1999]

Notes: [Symposium on Biological Control in the Tropics held at MARDI Training Centre, Serdang, Malaysia from 18-19 March, 1999.] An extensive survey revealed that sapodilla farmers in the Mekong Delta of Vietnam explain the benefits of black ants, ***Dolichoderus thoracicus***, as three-fold. Firstly, the fruit borer, ***Alophia*** sp. is reduced due to predation. Secondly, some farmers mentioned the reduction of other ant species, which attend scale insects and mealybugs [Hemiptera], and thirdly, benefits were explained in terms of improved fruit quality. On the other hand, some farmers considered black ants as a pest, because they are believed to increase mealybug populations. Experiments were carried out from 1996 to 1997 to test some of these hypotheses. Fruit borer populations were significantly higher in ant-excluded trees, whereas no significant difference was found with regard to mealybugs.

Nohara, K., Nakao, S. & Nagatomi, A. 2000. A study of the relationship between pesticide treatment and the fauna in citrus groves on Nagashima Island, Kagoshima Prefecture. Applied Entomology and Zoology. Tokyo 35(2): 271-281. [NoharaNaNa2000]

Notes: This is our third report on the effect of agrochemical treatment to the insect and mite fauna at two native citrus groves of 'Kuroshima-mikan'. The groves are located in Kasedo and Kawatoko on the island of Nagashima, Kagoshima Prefecture. In Kasedo, spraying was practiced in 1974-85 but there was no (or no heavy) spraying from 1986-92. On the other hand in Kawatoko, which was left unsprayed until 1985, only petroleum oil was used once a year (in January) in 1986-87 and in 1990-92. In Kawatoko, ***Unaspis yanonensis*** (arrowhead scale) dropped in numbers from 1986 due to the use of petroleum oil. Kawatoko had a rich fauna of insects, especially the effective predators and parasitoids of insect and mite pests. The use of petroleum oil in winter (once a year) was effective against scales and eventually against mites and whiteflies whose natural enemies were uninhibited by the petroleum oil.

O'Connor, J.P. & Fox, H. 2000. The Horse Chestnut Scale ***Pulvinaria regalis*** Canard (Hemiptera: Coccidae) new to Ireland. Entomologist's Gazette 51(2): 145-146. [OConnoFo2000]

Notes: ***Pulvinaria regalis*** was discovered on the branches of large, mature trees of ***Aesculus hippocastanum*** in Dublin. This brief review speculates on the introduction of this species into Ireland and mentions additional hosts.

Omkar & Pervez, A. 1999. New record of coccinellids from Uttar Pradesh. I. Journal of Advanced Zoology 20(2): 106-112. [OmkarPe1999]

Notes: Ten coccinellid predators (***Micraspis allardi*** (Mulsant), ***Nephus regularis*** Sicard, ***Pharoscymnus flexibilis*** (Mulsant), ***Propylea japonica*** (Thunberg), ***Psyllobora bisoctonotata*** (Mulsant), ***Rodolia "brevirscula"*** Weise, ***Rodolia ruficollis*** Mulsant, ***Scymnus coccivora*** Ayyar, ***Pseudoscymnus*** sp. and ***Scymnus*** sp.) of aphids, scale insects and mealybugs were recorded from Lucknow region of Uttar Pradesh as a result of an extensive survey of local agricultural fields. A precise account of their diagnostic features, prey-range and distribution have also been given. The host species include ***Centrococcus insolitus, Ferrisia virgata, Hemiberlesia lataniae, Icerya seychellarum, Maconellicoccus hirsutus, Parlatoria blanchardii, Phoenicoccus (Phoenicococcus?) marlatti, Planococcus pacific, Pseudococcus*** sp., and ***Rastrococcus iceryoides***.

Omkar & Pervez, A. 2000. New record of coccinellids from Uttar Pradesh II. Journal of Advanced Zoology 21(1): 43-47. [OmkarPe2000]

Notes: Seven more coccinellid predators, viz., ***Catana parcesetosa*** (Sicard). ***Micraspis vincta*** (Gorham), ***Pharoscymnus horni*** (Wiese), ***Scymnus furscatus*** Boheman, ***Serangium? montazerii*** Fursch, ***Nephus*** sp. and ***Sehorus*** sp., of aphids, scale insects, mealybugs and whiteflies were recorded as a result of further intensive survey of local agricultural and horticultural fields. A precise account of their diagnostic features, prey range and distribution has also been given.

Ozaki, K., Takashima, S., Kitamura, S., Taniguchi, K. & Suko, O. 2000. Spraying seawater as an effective method to control ***Aulacaspis marina*** Takagi and Williams (Homoptera : Diaspididae), a mangrove infesting scale insect in Indonesia. Applied Entomology and Zoology. Tokyo 35(2) 287-292. [OzakiTaKi2000]

Notes: The scale insect, ***Aulacaspis marina*** Takagi and Williams, has killed a large number of mangroves, ***Rhizophora mucronata*** Lamk., planted in abandoned shrimp ponds on Ball Island, Indonesia. In this study, we developed a control method for ***A. marina*** using seawater. An examination of the relationship between tree height and leaf damage in an ***R. mucronata*** plantation indicated that ***A. marina*** did not damage ***R. mucronata*** when the saplings were lower than the highest sea level of the spring tide, resulting in the saplings being periodically submerged in seawater by changes in tidal level. To examine how seawater submergence prevents this damage, crawlers of ***A. marina*** were artificially transferred to ***R. mucronata*** seedlings on which seawater or fresh water were sprayed daily. The crawlers settled on more than 90% of the leaves in fresh-water-sprayed and unsprayed seedlings but only on 37% of the leaves in seawater-sprayed seedlings, indicating that seawater helped prevent crawler settlement. To develop a control method using this seawater effect, seawater was sprayed on damaged saplings in an ***R. mucronata*** plantation at weekly intervals using two types of sprayers. In these saplings, leaf damage was lower than that of control saplings after spraying for five or nine weeks for each type of sprayer, respectively. This indicates that periodic spraying of seawater is an effective control measure against ***A. marina***.

Ozaki, K., Takashima, S. & Suko, O. 2000. Ant predation suppresses populations of the scale insect ***Aulacaspis marina*** in natural mangrove forests. Biotropica 32(4): 764-768. [OzakiTaSu2000]

Padillo, M.R. 2000. [Bioecology of the pink mealybug and the risk of its entry into Honduras.] Bioecología de la cochinilla rosada y su riesgo de ingreso en Honduras. (In Spanish with summary in English). Manejo Integrado de Plagas 57: 10-22. [Padill2000]

Notes: Biological and ecological aspects, general characteristics, geographical distribution, hosts, natural enemies and management of the pink mealybug ***Maconellicoccus hirsutus***, an exotic, polyphagous pest, that was recently reported in Belize and threatens to enter Honduras, are presented. The risk factors of introduction of this insect, which has a host range of more than 70 families, 200 genera and 125 species of plants, among which are coffee, coffee crop shade trees, forest species, vegetables and ornamentals, are analysed. Pink mealybug reproduction is

sexual and asexual by parthenogenesis, its biological cycle is 23-30 days on average, depending on the climatic conditions. There is a relationship of mutual benefit with some species of ants. The damage that this pest can cause in the coffee ecosystem and the symptoms that the plants show on being attacked are analysed. Data on economic losses in other countries are presented and the impact it could have if it establishes in Honduras is analysed. The plant health tactics and strategies recommended to delay entry of the insect are analysed, high-lighting quarantine measures such as legal control. Agriculture, chemical and integrated management practices are also discussed. However, the best option of management of the pest is considered to be biological control with parasites and predators and a list of these is included, indicating their origin.

Pane, A., Garzia, G.T., Cacciola, S.O., Lio, G.M. di S., Grasso, S. & Perrotta, G. 1999. [Biological control of insect pests of agricultural crops with entomopathogenic fungi.] Impiego di funghi entomopatogeni nella lotta contro fitofagi di colture agrarie. (In Italian). Phytophaga. Palermo 9: Supplemento, 105-115. [PaneGaCa1999]

Notes: In this review the authors summarize the results of trials carried out in Sicily to test the efficacy of entomopathogenic fungi as bioinsecticides. Selected strains of ***Verticillium lecanii*** (Zimm.) Viegas were used against ***Bemisia tabaci*** (Gennadius) in commercial crops of both aubergine and pepper in the greenhouse. ***V. lecanii*** has been also used as biological control agent of ***Saissetia oleae*** (Oliver) on citrus. In ***S. oleae*** populations the maximum infection rate was higher than 80%, while in ***B. tabaci*** populations on aubergine it was about 50%. In contrast, on pepper the percentage of insects infected by ***V. lecanii*** was negligible. A strain of ***Beauveria bassiana*** (Bals.) Vuill., isolated from ***Galerucella*** sp., in laboratory tests proved to be effective against pupae and larvae of weevils. The effects of an epizootic of ***Neozygites parvispora*** (Mac Leod et Carl) Remaudiere et Keller in a population of ***Frankliniella occidentalis*** (Pergande) were studied in a pepper crop under glass.

Panis, A. 1999. [The Polyphagous Mealybug, ***Dysmicoccus multivorus*** (Kiritshenko) (Hemiptera: Pseudococcidae), a new species in France.] (In French). Annales de la Société Entomologique de France 35(Suppl. S): 37-40. [Panis1999]

Notes: A new Pseudococcidae to France has been found damaging lavandine crops (***Lavandula latifolia*** x ***Lavandula officinalis***) of the southeast. In addition to three morphological pecularities, other morphological and biological characters reveal the involvement of ***Dysmicoccus multivorus*** (Kiritshenko).

Panis, A. 1999a. [Predators of the Mediterranean black scale, ***Saissetia oleae*** (Olivier) (Hemiptera: Coccidae), from France.] (In French). Annales de la Société Entomologique de France 35(Suppl. S): 410-415. [Panis1999a]

Notes: Essential predators appear in late spring and are parasitised when they increase in numbers. Individually tracked, some unusual predators of Mediterranean countries were validated as were nine new ones. However, predators were not considered as a very significant death factor.

Park, S.C., Wi, A.J. & Kim, H.S. 2000. Flight of ***Matsucoccus thunbergianae*** males in response to synthetic pheromone placed at various heights above ground and the wind speed. (In Korean with summary in English). Journal of Korean Forestry Society 89(1): 135-140. [ParkWiKi2000]

Notes: ***Matsucoccus thunbergianae*** is a major insect pest of ***Pinus thunbergiana*** in southern Korean peninsula. To study the flight behavior of ***M. thunbergianae*** males responding to the synthetic pheromone, five sticky traps were placed on a bamboo pole at various heights, between 0.1m and 2.0m above ground. Bait impregnated with the synthetic pheromone was placed at 0.1m, 1.0m or 2.0m above ground and the number of male catches on each trap was counted. In an open area, numbers of males caught per trap were not different between heights when the bait was placed at 2m or 1m above ground; when the bait was placed at 0.1m height, male flight was aggregated near the ground. In a forest with low crown closure, trap catches on five traps on the same bamboo pole were not different from one another when the bait was placed at 2m height, but most males were flying near the bait when it was placed at 1m height. In a dense pine forest, most males were flying around the bait regardless of the bait position. In all three places, most males were caught on the trap near the ground when the bait was placed 0.1m above ground. Therefore, for monitoring the frontal zone of infestation of the scale, placing the pheromone trap

near the ground was considered the most efficient. When the males perceived pheromone, they tended to fly in the air with low wind speed.

Pasqualini, E. & Civolani, S. 2000. [Protection against the San Jose scale.] La difesa dalla cocciniglia di San Jose. (In Italian). Informatore Agrario 56(6) 93-95. [PasquaCi2000]

Notes: Infestations of ***Quadraspidiotus perniciosus [Diaspidiotus perniciosus]*** in plum and pear orchards in Italy are increasing. In a plum orchard near Faenza in 1999, application of white oil (Oliocin) at 3.5% when growth resumed in March proved more effective than traditional insecticides; imidacloprid + Oliocin at 2.5% performed well and also controlled aphids. In heavy infestations, treatment with chlorpyrifos at leaf fall reduces the overwintering population in preparation for the spring treatment. In pears in Ferrara province, chlorpyrifos proved most effective if preceded by an autumn application.

Patel, I.S. 1999. ***Perissopneumon*** sp., (Margarodidae: Homoptera) - a new pest of ber orchards in north Gujarat. Insect Environment 4(4): 135. [Patel1999]

Notes: This new mealybug was found on leaves and fruits of ber ({***Zizyphus [Ziziphus] mauritiana***)} in Gujarat. A survey revealed that infestation of fruits ranged from 12.0 to 31.47%.

Paternotte, E. 2000. [Damaging insects and mites on woody small fruits.] Schadelijke insecten en mijten op houtig kleinfruit. (In Dutch). Fruitteelt nieuws 13(9): 34-35. [Patern2000]

Notes: Damage to and chemical control of ***Cryptomyzus ribis*** and ***Tetranychus urticae*** (on black and red currants), ***Parthenolecanium corni*** (on red currants), ***Eriophyes ribis*** [***Cecidophyopsis ribis***] (on black currants), ***Phyllocoptes gracilis, Acalitus essigi*** and ***Byturus tomentosus*** (on blackberries and raspberries), and ***Anthonomus rubi*** (on raspberries) are described.

Patricia Larrain, S. 1999. [Effect of chemigation and painted applications of imidacloprid (Confidor R) upon ***Pseudococcus viburni*** (Signoret) (Homoptera: Pseudococcidae) populations in table grapes.] (In Spanish with summary in English). Agricultura Técnica Santiago 59(1): 13-25. [Patric1999]

Notes: [Original title: Efecto de la quimigación y el pintado con imidacloprid (Confidor R) sobre la población de ***Pseudococcus viburni*** (Signoret) (Homoptera: Pseudococcidae) en vides de mesa.] The effect of different rates and application methods of imidacloprid (Confidor R) upon the grape mealybug ***Pseudococcus viburni*** (Signoret) was evaluated in table grapes cv. Thompson Seedless and Ribier, in the III and IV Regions of Chile during the 1992-1997 seasons. Data suggests that one application of imidacloprid (Confidor R 350 SC) in spring through drop irrigation systems at rates of 0.75 g a.i. or higher per plant can provide an effective control of ***P. viburni*** during the entire season and even for two seasons providing population pressures remain low. Although trunk applications also controlled the pest, they were less effective and reliable, especially at medium and low rates. Chemigation is an environmentally suitable and more effective alternative to ***P. viburni*** control than foliar insecticide treatments, in particular regarding spray drift exposure, environmental contamination and effect upon beneficial and non-target insects.

Pedata, P.A. 1999. Description of a new species of ***Coccobius*** (Hymenoptera: Aphelinidae) parasitoid of ***Ephedraspis ephedrarum***, with complementary notes on ***Coccobius reticulatus*** (Compere et Annecke). (In English). Bollettino del Laboratorio di Entomologia Agraria 'Filippo Silvestri'. Portici 55: 45-51. [Pedata1999]

Notes: ***Coccobius sybariticus*** sp. nov. (Hymenoptera: Aphelinidae), a parasitoid of ***Ephedraspis ephedrarum*** (Lindinger) (Homoptera: Diaspididae) on ***Ephedra distachya*** in Italy is described. Some complementary notes are provided on the allied species ***C. reticulatus*** (Compere et Annecke).

Pellizzari-Scaltriti, G. & Kozár, F. 1999. Two new species of ***Greenisca*** Borchsenius, 1948 (Coccoidea Eriococcidae) from Italy and Greece. (In English with summary in Italian). Bollettino di Zoologia Agraria e Bachicoltura. Milano Ser. II, 31(1): 25-30. [PellizKo1999]

Notes: *Greenisca alpina*, new sp. and *G. hellenica*, new sp. described.

Pellizzari-Scaltriti, G. & Vettorazzo, M. 1999. [Interception of ***Lopholeucaspis japonica*** on bonsai imported from China.] Intercettazione di ***Lopholeucaspis japonica*** su bonsai importati dalla Cina. (In Italian with summary in English). Informatore Fitopatologia 49(10): 17-18. [PellizVe1999]

Notes: ***Lopholeucaspis japonica***, a quarantine pest for Europe, was intercepted in March 1999 on bonsai plants of *Acer* in Venice, Italy, on plants imported from China.

Petschen, I., Borsh, M.P. & Guerrero, A. 2000. Enzyme-catalyzed synthesis and absolute configuration of (1S,2R,5S)- and (1R,2S,5R)-2-(1-hydroxyethyl)-1- (methoxymethyloxyethyl)cyclobutane- 1-carbonitri le, key intermediates for the preparation of chiral cyclobutane-containiing pheromones. Tetrahedron: Assymetry 11(8): 1691-1695. [PetschBoGu2000]

Notes: Formal synthesis of chiral grandisol and the oleander scale pheromone (***Aspidiotus nerii***) and their antipodes can be achieved through a convenient lipase-catalyzed nantiodifferentiation process of the common cyclobutane intermediate (+/-)-2-(l-hydroxyethyl)-1-(methoxymethyl) cyclobutane-1-carbonitrile 3. The resolution afforded both enantiomers in almost enantiomerically pure form and their absolute configurations were assigned on the basis of the Delta delta values for their (R)- and (S)-MTPA esters.

Picart, J.L. & Matile-Ferrero, D. 2000. [Mealybugs in collection greenhouses.] Cochenilles en serres de collections.] (In French with summary in English). Phytoma 524: 44-46. [PicartMa2000]

Notes: 18 different species have currently been identified, on plants belonging to 15 different families. Three of these species are new to France, ***Trochiscococcus speciosus, Pseudococcus microcirculus*** and ***Pseudaulacaspis cockerelli.***

Pitan, O.O.R., Akinlosotu, T.A. & Odebiyi, J.A. 2000. Impact of ***Gyranusoidea tebygi*** Noyes (Hymenoptera : Encyrtidae) on the mango mealybug ***Rastrococcus invadens*** Williams (Homoptera: Pseudococcidae) in Nigeria. Biocontrol Science and Technology 10(3): 245-254. [PitanAkOd2000]

Notes: This study investigated the impact of released exotic mango mealybug parasitoid ***Gyranusoidea tebygi*** on mango mealybug ***Rastrococcus invadens*** in Nigeria. Observations were also made on the occurrence of the mealybug on other host plants in the surveyed areas. The monitoring exercise started in 1991 about 2 years after the first release in Ibadan. By 1997 and 1998, ***G. tebygi*** was found to have crossed all agro-ecological barriers to colonize the entire area of infestation nationwide on mango as well as other host plants. During this period, the populations of ***R. invadens*** had greatly decreased from between 11.0 and 98.0 mealybugs per leaf in 1991 to between 0.0 and 18.2 mealybugs per leaf in 1998. This fall was attributed to the activities of the released parasitoid. At many sampling sites in 1998, mealybugs were virtually absent on both mango and other host plants. Predators that were observed during the survey, were the coccinellids. ***Exochomus promptus*** Weise, ***Chilocorus nigritus*** (F) and *Nephus* spp. Larvae of chrysopid species, ***Ceratochrysa autica*** (Walker) and ***Plesiochrysa*** sp. The hyperparasitoids reared from mummies were ***Marietta leopardina*** Motsch (Aphelinidae), ***Chartocerus hyalipennis*** Hayat and ***Chartocerus subaeneus*** (For ste,) (Signiphoridea).

Polania, M.A., Calatayud, P.A. & Bellotti, A.C. 1999. [Feeding behaviour of the mealybug ***Phenacoccus herreni*** (Sternorrhyncha: Pseudococcidae) and influence of water deficiency in cassava plants on its development.] (In Spanish with summary in English). Revista Colombiana de Entomología 25(1/2): 1-9. [PolaniCaBe1999]

Notes: [Original title: Comportamiento alimenticio del piojo harinoso ***Phenacoccus herreni*** (Sternorrhyncha: Pseudococcidae) e influencia del deficit hídrico en plantas de yuca sobre su desarrollo.]

Polavarapu, S., Davidson, J.A. & Miller, D.R. 2000. Life history of the putnam scale, ***Diaspidiotus ancylus*** (putnam) (Hemiptera: Coccoidea: Diaspididae) on blueberries (***Vaccinium corymbosum***, Ericaceae) in New Jersey, with a world list of scale insects on blueberries. Proceedings of the Entomological Society of Washington 102(3): 549-560. [PolavaDaMi2000]

Notes: Life history of the Putnam scale was investigated during 1997 and 1998 on highbush blueberries in the pine barrens of southern New Jersey. Putnam scale has two generations each year. Crawler emergences in the first and second generations peaked during late May and early to mid-August, respectively. This species overwinters as second instar nymphs, primarily under the bark (cork cambium) of the host. Adult females that occur on or under the bark of blueberries differ morphologically from those on the leaves and fruit. Descriptions of both forms are provided. Nine species of parasitoids were reared from canes containing Putnam scale infestations and peak emergence times of the parasitoids coincided with the transition between the adult females and crawlers.

Pollard, G.V. 1999. ***Paracoccus marginatus***. CARAPHIN News (No. 18): 7. [Pollar1999]

Notes: ***P. marginatus***, a pest of cassava, was reported from Antigua in July 1998, although it is suspected that the pest may have been in the country since 1996. While this species appears new for the Eastern Caribbean there are earlier reports for other countries in the Sub-Region. Problems arise for Eastern Caribbean countries which are uninfested with the pink hibiscus mealybug, ***Maconellicoccus hirsutus***, as ***P. marginatus*** may show very similar symptoms to ***M. hirsutus*** on ornamentals, leading to confusion in differentiating between the 2 pests. It is predicted that, as an exotic pest introduction to the Eastern Caribbean, ***P. marginatus*** should easily lend itself to biological control.

Pollini, A. 2000. [Insecticidal activity in the control of codling moth.] Attivita di insetticidi nel contenimento della carpocapsa. (In Italian). Informatore Agrario 56(18): 91-94. [Pollin2000]

Notes: Field trials were conducted in apple and pear orchards in Bologna, Italy, to assess the efficacy of insecticide treatments for control of ***Cydia pomonella***, and to investigate the role of application timing. The second organophosphate treatment also targeted ***Quadraspidiotus perniciosus***.

Ponnamma, K.N. 1999. Coccoids associated with oil palm in India - a review. Planter 75(882): 445-451. [Ponnam1999]

Notes: Seventy-one species of insects are associated with oil palms in India, of which 20 species are coccoids. Scales and mealybugs are found as minor pests of oil palm, attacking spindle, leaves and fruit bunches. Mealybugs can be controlled by spraying with phosphamidon/dimethoate at 0.05% or methyl demeton [demeton-methyl] at 0.025%. Scale insects can be controlled by spraying with fenthion/malathion at 0.1%. Mealybugs are naturally controlled by many predators, of which coccinellid beetles are the most important.

Ponsonby, D.J. & Copland, M.J.W. 2000. Maximum feeding potential of larvae and adults of the scale insect predator, ***Chilocorus nigritus*** with a new method of estimating food intake. Biocontrol Dordecht 45(3): 295-310. [PonsonCo2000]

Notes: A method of estimating the weight of individual ***Abgrallaspis cyanophylli*** (Signoret) without the need for removal from the host plant is described. Using this method, which enables accurate estimations of scale insect weight by measuring length and relating it to a previously determined regression model, maximum feeding potential in male and female ***Chilocorus nigritus*** (F.) adults was examined at various constant temperatures over the range of 13 to 30 degrees C and at a cycling temperature of 12 h/12 h at 14/30 degrees C (r.h. in the range of 62 to 68%). Mean daily potential food intake varied from 0.097 mg/day at 13 degrees C to 1.432 mg/day at 30 degrees C. However, intake at the cycling temperature was significantly higher than that at constant temperatures (1.98 mg/day). At 15, 20 and 30 degrees C there were no significant differences between male and female potential food requirements while at temperatures in the mid range, there was a considerable increase in female potential voracity when compared to that of the males. Maximum potential larval food requirement for development at 26 degrees C and 62% r.h. in ***C. nigritus*** was also estimated using the above method. A mean of 16.24 mg of ***Abgrallaspis cyanophylli*** (Signoret) was required for larvae of both sexes to complete development. This study suggests that *C. nigritus* would be most efficient as a biological control agent if used in glasshouses with a mean daily temperature above 22 degrees C.

Ponsonby, D.J. & Copland, M.J.W. 2000a. Environmental effects on the development and survival of the scale insect *Abgrallaspis cyanophylli* (Signoret) (Homoptera: Diaspididae) with reference to its suitability for use as a host for rearing biological control agents. Biocontrol Science and Technology 10(5): 583-594. [PonsonCo2000a]

Notes: Developmental and survival rates of the locally important diaspidid pest, ***Abgrallaspis cyanophylli*** (Signoret) reared on ***Solanum tuberosum*** L. tubers were examined under light and dark conditions; humidities of 33, 53, 62 and 75% relative humidity (RH); varying population densities; constant temperatures in the range of 20 to 30 degrees C and at cycling temperatures of 12 h at 14 degrees C and 12 h at 30 degrees C. Developmental rate was slightly lower under constant light conditions but mortality was higher in the dark, particularly among the males. At 26 degrees C, there were no differences in developmental rate in relation to the various humidity levels. However; survival was significantly lower at 33% RN, with females suffering higher mortality than males. Population density was found to have no effect on developmental rate or size of the females. Overall mortality increased in line with population density although the result was poorly correlated. Within the range 20-28 degrees C developmental rate increased with rising temperature but decreased at 30 degrees C. Thermal summation and polynomial regression data show a theoretical lower thermal threshold for development of 12.47 degrees C. The thermal constant was 541.7 degree days. Survival was lowest at 20 degrees C and 30 degrees C and highest at temperatures in the median range and under cycling conditions. Male survival was significantly higher than that of the females at 30 degrees C and under the cycling regime of 14/30 degrees C. The results suggest that the optimum conditions for rearing ***A. cyanophylli*** on potatoes would be at temperatures in the range 24-26 degrees C and humidities of 55-65% RH.

Popay, A.J., Hume, D.E., Baltus, J.G., Latch, G.C.M., Tapper, B.A., Lyons, T.B., Cooper, B.M., Pennell, C.G., Eerens, J.P.J., Marshall, S.L. & Matthew 1999. Field performance of perennial ryegrass (***Lolium perenne***) infected with toxin-free fungal endophytes (***Neotyphodium*** spp.). Grassland Research and Practice Series No. 7: 22. [PopayHuBa1999]

Notes: [New Zealand Grassland Association symposium held in Napier, New Zealand, 8 October, 1999.] A series of six small plot trials in New Zealand were sown in 1996 and four in 1997 to evaluate the performance of six novel ***Neotyphodium*** endophytes in Grasslands Nui perennial ryegrass. Differences in yield at Lincoln, Canterbury, were attributed to pasture mealy bug (***Balanococcus poae***). It is concluded that endophytes are very important for maximizing ryegrass yield during summer and early autumn. The effect of endophytes on yield is at least partly due to the insect resistance they impart.

Portillo Martínez, L. & Vigueras Guzmán, A.L. 2000. [Natural enemies of the carmin cochineal.] Enemigos naturales de la cochinilla del carmín. (In Spanish). htt;://www.geocities.com/granacochinilla/enemigos.html [PortilVi2000]

Notes: [Work presented at the First International Congress on Cochineal and Natural Dyes from Oaxaca, Mexico in September of 1988.] Natural enemies of ***Dactylopius coccus*** include ***Laetilia coccidivora, Allograpta*** sp., and ***Sympherobius*** sp. Other sections of this illustrated website are history, classification and hosts.

Potaeva, A.G. 1999. [***Didesmococcus unifasciatus*** Arch. (Homoptera, Coccidae) - new species for the fauna of Turkmenistan.] (In Russian). Proceedings of the Applied Science Conference 77. [Potaev1999]

Notes: [Conference held at Bakharden, Kazakhstan, 4-5 May 1999.]

Pramanik, A. & Ghose, S.K. 1999. A new species of ***Phenacoccus*** Cockerell (Homoptera: Coccoidea: Pseudococcidae) from India. Proceedings of the Zoological Society (Calcutta) 52(1): 49-52. [PramanGh1999]

Notes: The adult female of ***Phenacoccus bengalensis***, sp.n., is described from India, Barasat, West Bengal on *Cestrum nocturnum* L. (Solanaceae).

Pszczolkowski, P., Echenique, A., Lyon, G. & Rios, J. 1999. [Behaviour of *Vitis* spp. rootstocks in soils infested with *Margarodes vitis* (Philippi).] Comportamiento de patrones *Vitis* spp. en suelos infestados con *Margarodes vitis* (Philippi). (In Spanish with summary in English). Revista Fruticola 20(3): 81-88. [PszczoEcLy1999]

Notes: *Margarodes vitis [Sphaeraspis vitis]* is one of the most economically important pests of the roots of many vines in the central valley of Chile. In 1997-1998 and 1998-1999 seasons, several grapevine rootstocks (*Vitis* spp.) were evaluated in two *S. vitis*-infested experimental plots that were established in 1970 and 1971 (Penalolen, Maipo valley, Chile). Under the experimental conditions of each assay, cvs *V. vinifera* Cabernet Sauvignon and Romano and the interspecific hybrids J 17-69 (*V. champini* X V. *rupestris*) and K 51-50 (*V. champini* X *V. riparia*) showed less susceptibility to the insect, measured as a percentage of survival. When the rootstock vigour was considered in terms of grape weight, the hybrid Teleki 5 A (*V. berlandieri* X *V. riparia*) and the varieties of *V. vinifera* showed the highest and lowest values for rootstock vigour, respectively. The results suggest that low susceptibility to the insect is not related to the vigour shown by the different rootstocks.

Qin, T.K. 2000. Some doubtful distributional records of *Ceroplastes destructor* Newstead (Coccidae: Ceroplastinae). The Scale 24: 12-13. [Qin2000]

Notes: Doubtful records were mentioned from India, Florida, Mexico, and Colombia.

Qin, T.K. & Gullan, P.J. 1999. A new synonym of *Ceroplastes destructor* Newsted (Hemiptera: Coccoidea: Coccidae: Ceroplastinae). African Entomology 7(2): 305-306. [QinGu1999]

Notes: *Ceroplastes postperlucidus* is examined from E.E. Green's material and is established as a synonym of *C. destructor*.

Rae, D.J., Watson, D.M., Huang, M.D., Cen, Y.J., Wang, B.Z., Beattie, G.A.C., Liang, W.G., Tan, B.L. & Liu, D.G. 2000. Efficacy and phytotoxicity of multiple petroleum oil sprays on sweet orange (*Citrus sinensis* (L.)) and pummelo (*C. grandis* (L.)) in Southern China. International Journal of Pest Management 46(2) 125-140. [RaeWaHu2000]

Notes: The efficacy of pest control of three different oil formulations in multiple low-concentration spray programmes on sweet orange and pummelo were compared with unsprayed and normal farmer-treatments over three years. Phytotoxicity of sprays was assessed in terms of fruit and leaf drop, fruit yield and external fruit quality. Trees sprayed with any type of oil had lower pest numbers than unsprayed trees. On sweet orange, the heaviest oil was better than the normal farm practice at controlling chaff scale on fruit and red mite and whitefly on leaves. On pummelo it provided the best control of red mite on leaves. All three oils were as effective as the normal farm practice in control of rust mite on sweet orange fruit and leaves and red mite, rust mite and red scale on pummelo fruit. On sweet orange trees there was no evidence of phytotoxicity, and the external quality of fruit generally improved over time. On pummelo trees, oil sprays were unable to improve the external fruit quality. The number of pummelo per tree was reduced in three of the oil spray schedules in 1995 and one in 1996, but the total weight of fruit harvested per tree was unaffected.

Ran, C., Lin, B.M. & Zhang, Q.B. 1999. [Study on functional reaction of *Cybocephalus nipponicus* Endrody-Younga predating *Pseudaulacaspis pentagona* Targioni-Tozzetti.] (In Chinese with summary in English). Plant Protection 25(5): 11-12. [RanLiZh1999]

Notes: *Cybocephalus nipponicus*, a dominant species of the natural enemies predating *Pseudaulacaspis* spp., is widely distributed in citrus gardens in China and predates many species of *Pseudaulacaspis*. The relationship between the amount of *P. pentagona* predated by *C. nipponicus* and the density of *P. pentagona* adults plus young nymphs could be described by a negative accelerative curve. The functional response equations for *P. pentagona* adults and 1st-instars are given. The level of predation increased with increasing prey density. The daily maximum amounts of *P. pentagona* predated by *C. nipponicus* were 12.15 adults and 256.67 young nymphs. These results

suggest that *C. nipponicus* should be released for control purposes during the peak period of *P. pentagona* nymph infestation.

Razafindrakoto, C., da Ponte, J.J., de Andrade, N.C., Silveira Filho, J. & Pimentel Gomes, F. 1999. [Manipueira and heat treatment for the treatment of cassava cuttings attacked by scale insects.] Manipueira e termoterapia no tratamento de estacas de mandioca atacadas por cochonilhas. (In Portuguese). Revista de Agricultura Piracicaba 74(2): 127-136. [RazafiDaDe1999]

Notes: Immersion of cassava cuttings in manipueira [a liquid extract from cassava roots] and immersion in hot water were tested against the scale insects *Mytilaspis dispar [Lepidosaphes dispar]* and *Phenacoccus manihoti*. The best results were obtained with one single immersion in manipueira for 60 minutes.

Reddy, K.B., Bhat, P.K. & Naidu, R. 1999. Suppression of mealybugs and green scale infesting coffee with natural enemies in Karnataka. Pest Management and Economic Zoology 5(2): 119-121. [ReddyBhNa1999]

Notes: Mealybugs, *Planococcus citri, P. lilacinus, P. minor* and green scale, *Coccus viridis*, are important sucking pests of coffee in India. Among the natural enemies, *Spalgis epius [Spalgis epeus]* occurred as a major predator of *Planococcus* while aphelinids, *Coccophagus cowperi* and *C. bogoriensis* resulted in parasitization of *C. viridis* of up to 87%. The fungal pathogen, *Verticillium lecanii*, caused more than 90% mortality of *C. viridis* during monsoon and the colder months of the year when RH was above 76%. The exotic parasitoid, *Leptomastix dactylopii*, released in 73 mealybug infested coffee estates in Karnataka between 1984-94, was found to have established as a parasitoid of *P. citri* in 31 estates out of 39 surveyed, causing 3.8 to 100% parasitization in different locations.

Rehman, S.U., Browning, H.W., Salyani, M. & Nigg, H.N. 1999. Effects of pesticide deposit pattern on rate of contact and mortality of *Aphytis holoxanthus* (Hymenoptera: Aphelinidae). (In English with summary in Spanish). Florida Entomologist 82(1): 28-33. [RehmanBrSa1999a]

Notes: *Chrysomphalus aonidum* is a host of this parasite.

Ridley, G.S., Bain, J., Bulman, L.S., Dick, M.A. & Kay, M.K. 2000. Threats to New Zealand's indigenous forests from exotic pathogens and pests. Science for Conservation No. 142: 67 pp. [RidleyBaBu2000]

Notes: The principal pathways by which forest pathogens and pests enter New Zealand are in debris inadvertently trapped in cargo (both sea and air) as well as in imported used vehicles. The regions which dominate trade and passenger travel are Australasia and the Northern Hemisphere, and they are also the major sources of contaminants arriving in New Zealand. Details are given of new records of pathogens and pests affecting trees and woody shrubs for the periods 1950-97 (insects) and 1956-97 (fungi). There are no records of invasion of temperate forest pathogens and pests between the Northern and Southern Hemispheres. This is due to the divergent floristic history and biogeography of the continents of the Northern and Southern Hemispheres. New Zealand is biogeographically linked with Australia, South America and Africa, and these are the most likely source of devastating pathogens. Similarly, pest threats will also come from these areas, although widely polyphagous insects from the Northern Hemisphere are also a potential problem. Impact scenarios are developed for various species, including *Eriococcus orariensis* (*manuka (Leptospermum)* blight) which failed to become a major pest due to a fungal parasite. The risk to New Zealand's forests was deemed to be medium to high from *E. orariensis*.

Rios, A.R. & Jimenez, M. 2000. Do armored scale insects influence visit rate and feeding activity of ants on *Echinopsis chilensis*? Revista Chilena de Entomología 26: 81-84. [RiosJi2000]

Notes: The feeding activity of the ant *Camponotus hellmichi* was evaluated on *Echinopsis chilensis* cacti. The mean number of ant visits was estimated on non-infested *E. chilensis*, on *E. chilensis* infested by the mistletoe *Tristerix aphyllus*, and on *E. chilensis* with *T. aphyllus* infested by the armored scale insect *Saissetia oleae*. Rate of ants' visits to *E chilensis* with *T. aphyllus* infested by the armored scale insect ($x = 15.3$) was twice as much as to other types of cacti ($x = 7.6$). Ants seem to forage for sugary secretions generated by armored scale insects,

however ants do not tend armored scale insects and spend more time feeding on branches of *T. aphyllus* than on armored scale insects, possibly because most sugar secretions are left over *T. aphyllus*. We hypothesize that there are no mutual benefits between ants and armored scale insects and therefore it is an opportunistic interaction within *E. chilensis*.

Ripka, G. 1999. [Arthropod pests of ornamental trees and shrubs: scale insects, aphids, mites.] Növénykárositó izeltlábuak a diszfákon és a diszcserjéken: pajzstetvek, levéltetvek, atkák. (In Hungarian with summary in English). Növényvédelem 35(12): 623-626. [Ripka1999]

Notes: The author gives an account of the three groups of arthropod pests currently causing the biggest problems on ornamental trees and shrubs: scale insects, aphids and mites. Among scale insects, the four major species are ***Pseudaulacaspis pentagona, Unaspis euonymi, Epidiaspis leperii*** and ***Chionaspis salicis***. In the group of aphids, occurrence of and damage caused by ***Periphyllus testudinaceus, Periphyllus obscurus, P. lyropictus, Eucallipterus tiliae, Chaitophorus leucomelas, Chaitophorus populialbae, Pemphigus spirothecae [P. spyrothecae], Aphis pomi, A. craccivora*** and ***A. fabae*** are important. Among phytophagous mites, ***Tetranychus urticae, Eotetranychus tiliarium, E. populi, Pentamerismus oregonensis, P. taxi, Eriophyes tiliae, Stenacis palomaris, Anthocoptes salicis, Aculus gemmarum, Aceria populi, A. fraxinivorus, Tetraspinus lentus*** and ***Epitrimerus trilobus*** are the ones frequently attacking ornamental trees and shrubs. ***Aphis catalpae***, new to the Hungarian fauna, caused severe infestation on common catalpa (***Catalpa bignonioides***) at various places in Budapest.

Ripka, G., Fain, A. & Bolland, H.R. 1999. New data to the knowledge on the corticolous mite fauna in Hungary (Acari: Prostigmata, Astigmata, Oribatida). Acta Phytopathologica et Entomologica Hungarica 34(4): 363-371. [RipkaFaBo1999]

Notes: Authors give a report on the results of the regular collections made between 1990 and 1998 on ornamental trees and shrubs, on streets, in parks, in green spaces of housing estates, in private gardens and in arboreta. A total of 19 corticolous mite species were found belonging to 14 families. ***Hemisarcoptes budensis, M. corticalis*** and ***Cheletogenes ornatus*** were the most frequent species in the acarofauna associated with scale insects.

Roque, A.L. & Causton, C. 1999. El Nino and introduced insects in the Galapagos Islands: Different dispersal strategies, similar effects. Noticias de Galapagos (60): 30-36. [RoqueCa1999]

Notes: ***Icerya purchasi*** is among the species mentioned.

Sabanadzovic, S., Abou Ghanem, N., La Notte, P., Savino, V., Scarito, G. & Martelli, G.P. 1999. Partial molecular characterization and RT-PCR detection of a putative closterovirus associated with olive leaf yellowing. (In English with summary in Italian). Journal of Plant Pathology 81(1): 37-45. [SabanaAbLa1999]

Notes: Electrophoretic analysis of extracts from cortical tissues of olive trees of cvs 'Biancolilla' and 'Nostrana' from Sicily (southern Italy) showing bright chrome yellow discolourations of the leaves, consistently revealed a number of double-stranded RNA (dsRNA) bands. RT-PCR assays detected OLYaV sequences in olive trees with leaf yellowing from some Italian regions (Calabria and Latium) and Jerusalem, as well as in individuals of an unidentified pseudococcid mealybug species and of the psyllid ***Euphyllura olivina*** that had fed on symptomatic cv. 'Biancolilla' trees.

Sadof, C.S. & Sclar, D.C. 2000. Effects of horticultural oil and foliar- or soil-applied systemic insecticides on euonymus scale in ***Pachysandra***. Journal of Arboriculture 26(2): 120-125. [SadofSc2000]

Notes: ***Unaspis euonymi*** is the target of pest control effort.

Sagarra, L.A. & Peterkin, D.D. 1999. Invasion of the Caribbean by the hibiscus mealybug, *Maconellicoccus hirsutus* Green [Homoptera: Pseudococcidae]. Phytoprotection 80(2): 103-113. [SagarrPe1999]

Notes: Since its accidental introduction into the island of Grenada in 1994, *Maconellicoccus hirsutus* [Homoptera: Pseudococcidae], commonly named the Hibiscus or Pink Mealybug (HMB), has been inexorably spreading through

the Caribbean islands where it has become a major pest on several crops in 24 Caribbean Islands. This pest was also reported in Guyana threatening South and Central America. ***M. hirsutus*** is a very prolific pest that injects a toxin at the point of feeding, causing severe distortion of leaves, new shoots and fruit. Initial use of physical and chemical control methods were ineffective. In addition, because of its wide host range and its rapid geographic expansion, not only to agricultural land but also to home gardens and forest areas, biological control appeared as the most suitable method to manage the HMB populations. Three natural enemies were selected for this biocontrol effort: the predatory beetles ***Cryptolaemus montrouzieri*** Mulsant and ***Scymnus coccivora*** Ramkrisna [Coleoptera: Coccinellidae] and the parasitoid ***Anagyrus kamali*** Moursi [Hymenoptera: Encyrtidae]. ***A. kamali*** and ***C. montrouzieri*** were highly effective in bringing HMB populations under control. In newly infested countries, early introduction of biological control agents resulted in effective management of the pest. This experience provided a model for future management of other alien invasive pest species in the region.

Sagarra, L.A., Peterkin, D.D., Vincent, C. & Stewart, R.K. 2000. Immune response of the hibiscus mealybug, ***Maconellicoccus hirsutus*** Green (Homoptera: Pseudococcidae), to oviposition of the parasitoid ***Anagyrus kamali*** Moursi (Hymenoptera: Encyrtidae). Journal of Insect Physiology 46(5): 647-653. [SagarrPeVi2000]

Notes: ***Anagyrus kamali*** Moursi has been recently introduced into the Caribbean as a biological agent against the hibiscus mealybug, ***Maconellicoccus hirsutus*** Green. This host has a cellular defense reaction that involves encapsulation and melanization of the endoparasitoid egg. The impact of this immune response on the parasitoid progeny was assessed, as well as the response of the parasitoid countermeasures to overcome it. Under laboratory conditions, significant differences in the immune response were found for different developmental stages of ***M. hirsutus***. The intensity of the immune response varied between second instar, third instar and adult mealybugs. After 30 h, the level of encapsulation was the highest for eggs oviposited in adults: 58% of eggs were encapsulated, followed by third (32%) and second (4%) instars. Three days after oviposition 23, 44 and 86% of the parasitoid eggs oviposited, respectively, in adult, third and second instars were not encapsulated. The unencapsulated parasitoid eggs could hatch and continue their development. Adult mealybugs required 30 h to encapsulate 50% of the eggs, whereas in second and third instars, 50% level encapsulation was never reached. Superparasitism had a saturating effect on the immune system; reduced levels of encapsulation occurred when more than 10 eggs were oviposited in a single mealybug. Wasp larvae were never encapsulated by ***M. hirsutus***.

Sagarra, L.A., Vincent, C. & Stewart, R.K. 2000. Mutual interference among female ***Anagyrus kamali*** Moursi (Hymenoptera: Encyrtidae) and its impact on fecundity, progeny production and sex ratio. Biocontrol Science and Technology 10(3): 239-244. [SagarrViSt2000]

Notes: The solitary endoparasitoid ***Anagyrus kamali*** Moursi was introduced to the Caribbean to control populations of Hibiscus Mealybug (HMB) ***Maconellicoccus hirsutus*** Green. As part of a biological control programme, mass rearing of ***A. kamali*** should produce a maximum of good quality female wasps, because only female parasitoids attack the mealybug. In laboratory experiments conducted at 27 +/- 2 degrees C, mutual interference between female parasitoids on the total oviposition, progeny production and sex ratio was assessed at five parasitoid densities: ie. 1, 2, 5, 10 and 20 female wasps per 50 mealybugs. Oviposition rates of females decreased with increasing female density, without significantly affecting the sex ratio (average across densities of 0.49 +/- 0.322) (male/female). Under mass-rearing conditions, an increase of the female density from 25 to 75 individuals per cage resulted in an increase of the progeny production from 266 +/- 70.1 to 877.5 +/- 393.3 parasitoids. From 75 to 100 females released per cages, the progeny production was not significantly different with 877.5 +/-393.3 and 965.3 +/- 608.3 parasitoids produced respectively. Regardless of the female density progeny sex ratio remained stable at an average of 0.45 +/- 0.095. As a result, the best efficiency of the mass-production system was obtained at a density of 75 females per cage. However, parasitoid production at this density was inferior to singly caged females by about 50%.

Sagarra, L.A., Vincent, C. & Stewart, R.K. 2000a. Fecundity and survival of *Anagyrus kamali* (Hymenoptera: Encyrtidae) under different feeding and storage temperature conditions. European Journal of Entomology 97(2): 177-181. [SagarrViSt2000a]

Notes: The parasitoid, *Anagyrus kamali* Moursi (Hymenoptera: Encyrtidae), has been recently introduced into the Caribbean as a biological control agent against the hibiscus mealybug (HMB), *Maconellicoccus hirsutus* Green (Homoptera: Pseudococcidae). Storage of *A. kamali* that is essential for its use in biological control did not affect the longevity of female and male parasitoids (40.3 +/- 14.07 and 31.7 +/- 9.57 days, respectively) when kept at 20 +/- 2 degrees C in absence of hosts and fed ad libitum with droplets of pure honey. At a storage temperature of 27 +/- 2 degrees C the longevity decreased by about 10 days. Fed females did not resorb eggs during the first two weeks of storage at 20 +/- 2 degrees. Parasitoid ovogenesis ceased when ovarioles/lateral oviducts were full. The lifetime fecundity was not significantly affected by a storage at 20 +/- 2 degrees C of up to 14 days. Foraging activities and oviposition were the main factors influencing the lifespan of female *A. kamali*.

Sagarra, L.A., Vincent, C., Peters, N.F. & Stewart, R.K. 2000. Effect of host density, temperature, and photoperiod on the fitness of *Anagyrus kamali* a parasitoid of the hibiscus mealybug *Maconellicoccus hirsutus.* Entomologia Experimentalis et Applicata 96(2): 141-147. [SagarrViPe2000]

Notes: The performance of the parasitoid *Anagyrus kamali* Moursi (Hymenoptera: Encyrtidae), as a function of host density, temperature, and photoperiod was investigated with the objective to optimize a mass-rearing system in the context of a biological control program. The number of hosts parasitized at densities varying from 2-100 hibiscus mealybug (HMB), *Maconellicoccus hirsutus* Green (Homoptera: Pseudococcidae), corresponded to a type II-III functional response in fixed-time conditions and a type III in variable-time conditions. Twenty-six percent of the oviposited eggs led to progeny emergence with a sex ratio of 0.49 +- 0.102 (M/F), regardless of host density. Fecundity and oviposition period under six abiotic combinations (i.e., two temperatures (26 +- 2 degree C and 32 +- 2 degree C) and three photoperiods (L0:D24, L12:D12, L24:D0)) were measured. Lifetime fecundity and reproductive life were significantly affected by temperature and photoperiod conditions. Optimum female parasitoid lifetime fecundity was attained at 26 +- 2 degree C, L0:D24 with an average of 116.1 +- 17.43 eggs. At 32 +- 2 degreeC, L24:D0 and L12:D12, an average of 79.4 +- 34.57 and 85.8 +- 35.81 eggs were laid, respectively. Reproductive longevity was maximal at 26 +- 2 degreeC, L0:D24 with 12 +- 4.85 days of oviposition. Because the parasite *A. kamali* can be reared optimally without light, this may save tremendous energy costs.

Saha, S.K. & Jaipuriar, S.K. 2 2000. Variability and inter relationship of biological parameters and resin characteristics in lac insect, *Kerria lacca* (Kerr.). Shashpa 7(1): 17-20. [SahaJa2000]

Notes: Eleven lac insect (*Kerria lacca*) stocks from different ecogeographical regions of India were studied for biological parameters including life period, fecundity, resin secretion and resin characteristics such as heat polymerization time, colour, wax content and melting point, with the aim of selecting lac insects for breeding studies.

Sahoo, A.K., Ghosh, A.B., Mandal, S.K. & Maiti, D.K. 1999. Study on the biology of the mealybug, *Planococcus minor* (Maskell) Pseudococcidae: Hemiptera. Journal of Interacademicia 3(1): 41-48. [SahooGhMa1999]

Notes: *P. minor* completes 10 generations in a year, 8 during Feb.-Nov. and 2 during Nov.-Jan. Details given for number of days for female and male nymphs to complete development during several temperature ranges, male and female ratio ranges, maximum oviposition period, minimum fecundity and maximum incubation periods and numbers of eggs, and length of life cycle in two seasons.

Salazar Torres, J. 1999. (In Spanish). In: [Pest control in Citrus.] Control de las plagas de los cítricos. Servicio Nacional de Sanidad Agraria, Jesus Maria, Peru. 101 pp. [Salaza1999]

Notes: The morphology, biology, natural enemies and damage caused by insect pests in Citrus in Peru are described, as well as suitable control methods. Insect pests include mites (3 species), Diaspididae and Coccidae (12 species), Aleyrodidae (5 species), aphids (6 species), and Lepidoptera (5 species).

Samways, M.J., Osborn, R., Hastings, H. & Hattingh, V. 1999. Global climate change and accuracy of prediction of species' geographical ranges: establishment success of introduced ladybirds (Coccinellidae, *Chilocorus* spp.) worldwide. Journal of Biogeography 26: 795-812. [SamwayOsHa1999]

Notes: ***Aonidiella aurantii*** is mentioned as a host for ***Chilorocus nigritus*** in Israel.

Schaub, L., Bloesch, B., Hippe, C., Keimer, C., Schmid, A. & Brunetti, R. 1999. [Validation of a phenology model for San Jose scale.] Validation d'un modele de la phenologie du pou de San Jose. (In French with summaries in English, German and Italian). Revue Suisse de Viticulture, d'Arboriculture et d'Horticulture 31(5): 253-257. [SchaubBlHi1999]

Notes: Simulations of San Jose scale (***Quadraspidiotus perniciosus) [Diaspidiotus perniciosus***] phenology are compared to field observations of larval emergence and trap catches of males in flight. In the region of Lake Geneva, Switzerland, heat unit accumulation starting at the beginning of male flight is an excellent tool to describe *Q. perniciosus* development. In other regions of Switzerland the model is less precise. For the start of heat unit accumulation, 2 simple alternatives to the beginning of male flight are the end of apple tree blooming and the beginning of the year.

Schiefer, T.L. 2000. Notes on scale insects described by Gladys Hoke Lobdell. The Scale 24: 7-12. [Schief2000]

Notes: A list is provided of the 24 additional specimens which have recently been added to the Mississippi Entomological Museum.

Seno, K.C.A. & Galli, J.C. 1999. Effect of aldicarbe and fosetyl-AL on ***Selenaspidus articulatus*** (Morgan) (Homoptera: Diaspididae) on citrus plants with and without variegated chlorosis symptoms. (In English with summary in Portuguese). Anais da Sociedade Entomologica do Brasil 28(4): 715-720. [SenoGa1999]

Notes: The objective of this work was to study the relationship between the presence of symptoms of citrus variegated chlorosis (CVC), a disease caused by ***Xilella fatidiosa***, (Wells) and the effect of aldicarbe and fosetyl-AL against rufous scale, ***Selenaspidus articulatus*** (Morgan) on citrus plants. The work was conducted in a five-year-old orchard of "Valencia" variety. Fosetyl-AL was sprayed four times, once every three months, and aldicarbe was applied to the soil only once. The occurrence of ***S. articulatus*** was evaluated every 15 days. The results indicated that: a) CVC symptoms did not interfere with the effect of soil aplication of aldicarbe on ***S. articulatus***; b) the dose of aldicarbe to control ***S. articulatus*** on plants with symptoms of CVC can be the same as that used on plants without symptoms; c) the residual capacity of aldicarbe was the same on plants with and without CVC symptoms; d) association of aldicarbe with fosetyl-AL did not interfere on the effect on the former on ***S. articulatus***.

Seraj, A.A. 1999. [Injection of insecticides into tree trunks: a new method for the control of citrus pests.] (In Persian with summary in English). Iranian Journal of Agricultural Sciences 30(1): 121-128. [Seraj1999]

Notes: An experiment was undertaken to determine the effect of injection of Metasystox [demeton-S-methyl] into lime tree stems, (***Citrus aurantifolia*** Christm.), in spring 1997. Mean percent of citrus leaf mined areas ***Phyllocnistis citrella*** Stainton (Lepidoptera: Gracillaridae) per leaf of 1-, 5-, and 20-year-old trees, respectively, were as follows (first week after injection): injected trees: 4, 3.5 and 6.2%. control trees: 45, 43 and 35%. Mean numbers of the citrus oriental mite ***Eutetranychus orientalis*** Klein (Acarina: Tetranychidae) per leaf of 5- and 20-year-old trees were as follows: injected trees: 0, 0. control trees: 3, 2. The mean numbers of the southern mealybug, *Nipaecoccus viridis* New. (Homoptera: Diaspididae [Pseudococcidae?]), were as follows: injected trees: 0, 0. control trees: 2.5, 1.1. The treatments showed little phytotoxicity. The injection of insecticide was more effective on young trees than old ones. The technique for injecting water-soluble insecticides into tree stems is described. Ordinary disposable plastic syringes, which can be used repeatedly, are used. The advantages of this type of

treatment compared with conventional spray techniques are: the application and absorption of the required dosage of insecticide takes only a few minutes per trees; as the entire plant system is poisoned all insects, including those in the most concealed hiding places, can be reached. In this way it should be possible to target particular pests and diseases. In some pests the chances of reinfestation after treatment should be reduced considerably, as survival of some individuals after normal spraying is usually the main cause of reinfestation. If reinfestation occurs subsequently from outside, natural enemies will be able to attack the pest unhindered as no insecticide residues will be present on the tree.

Shanker, C. & Solanki, K.R. 1999. Screening of some egg parasitoids against *Pseudohypatopa pulverea* (Meyr.) (Lepidoptera: Blastobasidae): A serious predator of lac insect, *Kerria lacca* (Kerr). Journal of Entomological Research. New Delhi 23(4): 365-368. [ShankeSo1999]

Notes: Five hymenopterous egg parasitoids, viz., ***Trichogramma brasiliensis, T. chilonis, T. pretiosum, Trichogrammatoidea bactrae*** (Trichogrammatidae) and ***Telenomus remus*** (Scelionidae) were screened against ***Pseudohypatopa pulverea***, a serious predator of lac insect (***Kerria lacca***), for assessing their parasitising efficiency. The maximum parasitisation was observed in the case of ***T. brasiliensis*** (56.73%) and lowest by ***T. remus*** (17.56%). The emergence of the adult parasitoids from the parasitised eggs was maximum in ***T. pretiosum*** (75.00%) followed by ***T. chilonis*** (72.85%), ***T. brasiliensis*** (66.04%), ***T. bactrae*** (34.70%) and lowest by ***T. remus*** (43.75%). All the five parasitoids appeared to be promising for the biological control of the predator.

Shanker, C. & Solanki, K.R. 2000. Agroforestry: An ecofriendly land-use system for insect management. Outlook on Agriculture 29(2): 91-96. [ShankeSo2000]

Notes: Agroforestry is an ecofriendly land-use system that is favourable for the management of insect pests and beneficial insects. The biodiversity found under agroforestry is a close mimic of the natural ecosystem and is amenable to integrated pest management principles, especially biopesticides and biological control. These techniques in turn provide an ecofriendly basis for economic ventures such as apiculture, sericulture and lac culture (***Kerria lacca***). The profitability of these practices under agroforestry is discussed in this paper.

Sharma, K.K. & Ramani, R. 1999. An update on synoptic catalogue of lac insects (Homoptera: Tachardiidae). Journal of the Bombay Natural History Society 96(3): 438-443. [SharmaRa1999]

Notes: Members of the family Tachardiidae (=Kerriidae) produce lac and certain species are exploited for their economically important products: resin, dye and wax. An updated checklist of world species is provided. It includes two subfamilies, nine genera and eighty-seven species. the systematic list provides name of species, author, year of description, synonym(s) if any and country (state/region) of occurrence. Taxa and species are listed in alphabetical order. The bibliography includes citations of each taxa for reference and taxonomic purposes.

Shaw, S.S., Veda, O.P., Badaya, A.K. & Parsai, S.K. 1999. An outbreak of mealybug, *Ceroplastodes cajani* (Maskell) in the Nimar region of Madhya Pradesh, India. International Chickpea and Pigeonpea Newsletter No. 6: 45-46. [ShawVeBa1999]

Notes: ***Ceroplastodes cajani*** was recorded on 2- to 3-year-old pigeon pea plants in Madhya Pradesh, India, during September-December 1992. This pest infested the main stem, laying an average of 29 eggs/3 cm. ***C. cajani*** infested 13.7% of the crop, with 6% of plants being killed. Two applications of 0.05% monocrotophos and 1 of 0.05% dimethoate did not control the pest.

Shi, L., Shi, B.C., Den, J., Gao, Y.Z. & Mao, Y.F. 1999. [Study on the host tree adjustment to the *Kerria lacca* insect.] (In Chinese with summary in English). Forest Research 12(2): 206-209. [ShiShDe1999]

Notes: The feeding behaviour of the lac insect ***Kerria lacca*** is described and statistically analysed in relation to its host trees and the regularity of the seasonal fluctuation of host chemical composition, based on studies in [Kunming, Yunnan] China. The chemical composition of the juice [sap] of 10 host tree species (***Schleichera oleosa, Litchi chinensis, Koelreuteria paniculata, Flemingia macrophylla, Cajanus cajan, Albizia bracteata, A. lucidior [A.***

lucida], Acacia montana [Paraserianthes lophantha], Zizyphus mauritiana [Ziziphus mauritiana] and *Ficus racemosa* was determined, inoculation trials made with the insects, and a quality analysis undertaken of the lac produced.

Silva, E.B. & Mexia, A. 1999. The pest complex ***Cryptoblabes gnidiella*** (Milliere) (Lepidoptera: Pyralidae) and ***Planococcus citri*** (Risso) (Homoptera: Pseudococcidae) on sweet orange groves (***Citrus sinensis*** (L.) Osbeck) in Portugal: interspecific association. (In English with summary in Portuguese). Boletín de Sanidad Vegetal, Plagas 25(1): 89-98. [SilvaMe1999]

Notes: The honeydew moth, ***Cryptoblabes gnidiella*** (Lepidoptera: Pyralidae), is a polyphagous pest of numerous crops and is recorded as a secondary pest in citrus groves, often associated with the attacks of other species such mealybugs and their honeydew. A study of ***C. gnidiella*** population dynamics on sweet orange groves (***Citrus sinensis***), the importance of damage caused by ***Cryptoblabes gnidiella***, and the interspecific association between ***C. gnidiella*** and the citrus mealybug, ***Planococcus citri*** (Homoptera: Pseudococcidae) were studied in four groves in Alagarve, Portugal. The percentage of the total ***C. gnidiella*** males captured in each grove showed a similar pattern and a greater percentage of males were trapped during the June-September period (except for the grove Fazenda Grande). It was possible to identify three or four distinct peaks. The results suggested a positive significant association (P_0.05) between ***C. gnidiella*** and ***P. citri***, supporting the hypothesis of several authors that a ***P. citri*** infestation is necessary for attack by ***C. gnidiella*** in the case of citrus. Even in the case of low ***C. gnidiella*** larval infestation it can cause serious damage by fruit drop and, consequently, a high reduction of sweet orange production, mainly in Navel cultivars.

Simmonds, M.S.J., Manlove, J.D., Blaney, W.M. & Khambay, B.P.S. 2000. Effect of botanical insecticides on the foraging and feeding behavior of the coccinellid predator ***Cryptolaemus montrouzieri***. Phytoparasitica 28(2): 99-107. [SimmonMaBl2000]

Notes: To investigate the effect of botanicals on the foraging behavior of the mealybug predator ***Cryptolaemus montrouzieri*** Mulsant, predator larvae and adults were exposed to leaves and the mealybug ***Planococcus citri*** (Risso) treated with one of the following: a crude neem seed extract; a formulation of azadirachtin (Azatin EC(R)); a pyrethrum extract; and one of two naphthoquinones isolated from ***Calceolaria andina*** Benth. (BTG 504 and BTG 505). All the botanicals influenced the foraging behavior of ***C. montrouzieri***, at one or more concentrations. Larval and adult foraging behavior was influenced most by BTG 504 and neem also affected larval behavior; the predators contacted fewer treated leaves and spent less time on treated than on untreated leaves. Larvae also consumed fewer mealybugs treated with BTG 504 and BTG 505 compared with untreated mealybugs.

Siscaro, G., Longo, S. & Lizzio, S. 1999. [Role of ***Aonidiella aurantii*** (Maskell) (Homoptera, Diaspididae) natural enemies in Sicilian citrus-groves.] Ruolo degli entomofagi di ***Aonidiella aurantii*** (Maskell) (Homoptera, Diaspididae) in agrumeti siciliani. (In Italian with summary in English). Phytophaga. Palermo 9(Suppl.): 41-52. [SiscarLoLi1999]

Notes: The results of observations carried out during 1994-95 in Eastern Sicily citrus-groves on the natural enemies of ***Aonidiella aurantii*** (Maskell) are reported. In the investigated areas the natural enemies complex included the Hymenoptera parasitoids: ***Aphytis melinus, A. proclia, Encarsia perniciosi*** and ***Comperiella bifasciata*** and the predators: ***Chilocorus bipustulatus, Rhyzobius lophantae, Cybocephalus rufifrons*** (Coleoptera); ***Lestodiplosis aonidiellae*** (Diptera: Cecidomyiidae) and ***Typhlodromus cryptus*** (Parasitiformes: Phytoseiidae). ***A. melinus*** was the main biotic mortality agent in all the biotopes. This aphelinid reached the higher presence during autumn till the winter end showing parasitization rate variable from 14.1% on twigs to 29.8% on fruits. In highly infested citrus-groves, ***C. bipustulatus*** was particularly efficacious. The other natural enemies assume a secondary practical role, however, the recoveries of ***E. perniciosi, L. aonidiellae*** and ***C. bifasciata*** are of particular interest.

Sittigul, C., Visitpanich, J., Changang, Y. & Zang, M. 2000. Preliminary observations on the association of ant species, ground mealybugs and bolete mushrooms with sudden death of longan. ANeT Newsletter (International Network for the Study of Asian Ants) (1): 21-24. [SittigViCh2000]

Notes: The involvement of unspecified ground mealybugs were observed in the damage done to the ***Dimocarpus longan*** fruit crop in northern Thailand.

Smith, K.M., Smith, D. & Lisle, A.T. 1999. Effect of field-weathered residues of pyriproxyfen on the predatory coccinellids ***Chilocorus circumdatus*** Gyllenhal and ***Cryptolaemus montrouzieri*** Mulsant. Australian Journal of Experimental Agriculture 39: 995-1000. [SmithSmLi1999]

Notes: These coccinellids are key predators of mealybugs and scales of citrus. Pyriproxyfen is strongly insecticidal to diaspid scale insects including red scale, ***Aonidiella aurantii*** and coccid scales such as Florida wax scale, ***Ceroplastes floridensis***.

Soares, G.L.G. 2000. [Gall forming coccids (Coccoidea, Brachyscelidae) attack leaves of ***Rollinia laurifolia*** Schdtl. (Annonaceae).] Alteraçoes químicas induzidas por coccídeos galhadores (Coccoidea Brachyscelidae) em folhas de ***Rollinia laurifolia*** Schdtl. (Annonaceae). (In Portuguese with summary in English). Revista Brasileira de Zoologia 2(1): 103-133. [Soares2000]

Notes: ***Pseudotectococcus anonae*** attack leaves of ***Rollinia laurifolia***. Chemical changes due to cecidogenesis are not well known. Plant species of Annonaceae produce several derivatives of chiquimic acid, nevertheless, references to the isolation of flavonoids in this plant family are rare. This study presents the analyses of the ethanolic extracts of leaves of ***R. laurifolia*** with and without galls by thin layer chromatography (TLC) and high performance liquid chromatographic (HPLC). The analysis by TLC detected flavonoid derivatives in both extracts. Therefore, the extract of leaves with galls exhibited a larger number of detectable substances. The chromatographic profile (HPLC) of the extracts revealed enormous differences in the chemical pattern of the analyzed samples. The extract of healthy leaves presented more polar substances, while the extracts of the leaves with galls exhibited a qualitative increase in less polar derivatives. The present results indicate that flavonoids are good biochemical markers for changes induced by gall forming coccids in ***R. laurifolia***.

Soares, A.O., Elias, R.B. & Schanderl, H. 1999. Population dynamics of ***Icerya purchasi*** Maskell (Hom; Margarodidae) and ***Rodolia cardinalis*** Mulsant (Col; Coccinellidae) in two citrus orchards of Sao Miguel island (Azores). (In English with summary in Spanish). Boletín de Sanidad Vegetal, Plagas 25(4): 459-467. [SoaresElSc1999]

Notes: Two citrus orchards in the North of São Miguel island (Rabo de Peixe) were selected in order to evaluate the population dynamics of ***Icerya purchasi*** and ***Rodolia cardinalis***. For that purpose sixteen trees were sampled from May to November 1997 and from April to October 1998. ***I. purchasi*** develops 2 annual generations, one at the end of spring and the other in autumn. Young females are the most abundant stage during the winter. The larval stages of the predator appear mainly at the beginning of summer and adults start to appear in July reaching the peak of abundance at the end of that season. This maximum probably contributes to the decrease of ***I. purchasi*** density during the summer reaching its minimum at the end of this season. During autumn the population level of ***Rodolia*** beetle decreases coinciding with the second generation of ***I. purchasi***. After November no individuals were found on trees probably indicating the beginning of the hibernation period. The majority of larvae and young females of the scale were found on the leaves and mature females were found on the branches, indicating a migration within plant parts.

Soria, S.J. & Braghini, L.C. 1999. [Artificial rearing of ***Eurhizococcus brasiliensis*** (Homoptera: Margarodidae) on Irish potato tubers ***Solanum tuberosum*** in the laboratory.] (In Portuguese with summary in English). 65-67 In: Miele, A., Tonietto, J., Rizzon, L.A. & Manfredini, S. (Eds.), VII Congresso Brasileiro de Viticultura e Enologia. Bento Gonçalves e Garibaldi, Brazil. 101 pp. [SoriaBr1999]

Notes: [Conference held 14 to 16 July, 1993. Original title: Criação de ***Eurhizococcus brasiliensis*** (Homoptera: Margarodidae) em tubérculos de batatinha ***Solanum tuberosum***.] 14 Irish potato tubers ***Solanum tuberosum*** in the germinating stage were individually infested with 100 first instar nymphs of ***Eurhizococcus brasiliensis*** (Homoptera: Margarodidae) in the laboratory. Results indicated that a total of 343 nymphs preferred to colonize the tuber surface, an amount 11 times more than the 31 that colonized the sprouts. This demonstrated that tuber surface was a preferential tissue as compared to the sprouts. The average period of permanence of the nymphs on the host was 40 days, within a range of variation of 33 days minimum and 50 days maximum. Eventually, the host started suffering a rotting process. The above mentioned time lapse of permanence feeding on the host was not enough to complete the nymphal stage and proceed to adulthood. It was therefore concluded that Irish potato tubers are not a suitable substrate to successfully mass rear successfully the insect in the laboratory.

Soria, S.J. & Braghini, L.C. 1999a. Chemical control of ***Eurhizococcus brasiliensis*** (Hempel in Wille, 1922) (Homoptera: Margarodidae) 2. [Evaluation of the bioefficiency of vamidothion in vineyards.] (In Portuguese with summary in English). Entomologia y Vectores 6(5): 555-561. [SoriaBr1999a]

Notes: [Original title: Controle quimico da perola-da-terra ***Eurhizococcus brasiliensis*** (Hempel in Wille, 1922) (Homoptera: Margarodidae) 2. Avaliaçao da bioeficacia de vamidotiom na cultura da videira.] A field experiment was carried out in order to assess the bioefficacy of vamidothion in the control of the Brazilian ground pearl ***Eurhizococcus brasiliensis*** (Hempel in Wille, 1922) (Homoptera: Margarodidae) in a vineyard, Rio Grande do Sul, Brazil. Significant population suppression was observed in treated plots compared with the control. No significant differences were found among treatments.

Soria, S.J., Camargo, U.A., Fão, V.M. & Braghini, L.C. 1999. [Field assessment of varietal resistance of American vine rootstocks to the Brazilian ground pearl, ***Eurhizococcus brasiliensis*** (Hempel in Wille, 1922) (Homoptera: Margarodidae) in southern Brazil. (In Portuguese with summary in English). 19-23 In: Miele, A., Tonietto, J., Rizzon, L.A. & Manfredini, S. (Eds.), VII Congresso Brasileiro de Viticultura e Enologia. Bento Gonçalves e Garibaldi, Brasil. 101 pp. [SoriaCaFa1999]

Notes: [Conference held 14 to 16 July, 1993. Original title: Avaliação no campo da resistência de videiras americanas à pérola-da-terra ***Eurhizococcus brasiliensis***, Brasil.] ***E. brasiliensis*** is a severe pest of the root system of vineyards in southern Brazil. The objective of this work was to determine the level of varietal resistance of some *Vitis* sp. rootstocks of American origin to the above-mentioned pest. The method of assessment was by screening several varieties for survivorship under field conditions. The rootstocks were planted in a heavily infested field after being kept for one year in the greenhouse. The level of resistance was determined by counting the number of plants that survived for two years. It was suggested that the mechanism of resistance was through tolerance of the pest.

Soria, S.J. & Conte, A.F.D. 2000. [Bioecology and control of insect pests of vineyards in Brazil.] Bioecologia e controle das pragas da videira no Brasil. (In Portuguese with summary in English). Entomologia y Vectores 7(1): 73-102. [SoriaCo2000]

Notes: The bioecology and control of the insect pests that cause the most damage to vineyards are briefly described in order of importance, as follows: ***Eurhizococcus brasiliensis, Dactulosphaira vitifoliae [Viteus vitifoliae], Parthenolecanium persicae*** and ***Duplaspidiotus fossor, Icerya schrotkyi [Icerya schrottkyi]*** and ***Acromyrmex*** spp. Also included are the names of some insects that damage the crop from time to time and may eventually become primary pests.

Souissi, R., Nenon, J.P. & Le Ru, B. 1999. [Influence of the plant species or variety on the olfactory preferences in *Epidinocarsis lopezi* (Hym.: Encyrtidae), parasitoid of the cassava mealybug, ***Phenacoccus manihoti*** (Hem.: Pseudococcidae).] (In French). Annales de la Société Entomologique de France 35(Suppl. S): 184-189. [SouissNeLe1999]

Notes: ***Epidinocarsis lopezi*** (Hym.: Encyrtidae) is the principal agent of biological control against the cassava mealybug ***Phenacoccus manihoti*** (Hem. : Pseudococcidae) in Africa. The influence of the plant species or variety

on the olfactory preferences in *Epidinocarsis lopezi* was studied in a Y-tube olfactometer. Dual-choice tests demonstrated that *E. lopezi* females distinguished between plant species and varieties at the uninfested and the infested state. They preferred the cassava variety MM79 to the hybrid Faux-caoutchouc or Talinum. The females of *E. lopezi* discriminated also between the three populations of *P. manihoti* reared distinctly on the three plants and preferred MM79 to Talinum.

Souissi, R. & Panis, A. 1999. [Estimation of the fecundity of two scales of fruit trees *Aspidiotus nerii* Bouche and *Pseudaulacaspis pentagona* (Targioni-Tozzetti) (Hemiptera: Diaspididae) using a micro-cage technique.] (In French). Annales de la Société Entomologique de France 35(Suppl. S): 87-92. [SouissPa1999]

Notes: *Aspidiotus nerii* Bouche bisexual and parthenogenetic forms, and *Pseudaulacaspis pentagona* (Targioni Tozzetti) (Hemiptera: Diaspididae) are polyphagous scales with important agronomic impact. Their fecundity was determined under controlled conditions on potato tubers variety "Monalisa" using a micro-cage technique. Irrespective of either the species or the biotype of the scale, the progeny of females were significantly more numerous on the upper side of the tuber than on the lower one. In addition, fecundity of the females was largely dependent on their longevity. There was no significant difference between fecundities of the bisexual and the parthenogenetic forms of *A. nerii*. The interest of the micro-cage technique in both the laboratory and the field is discussed.

Sousa, L.O.V. de, Santa Cecilia, L.V.C., Souza, B. & Goncalves Gervasio, R. de C.R. 1999. [Occurrence of white mealybug *Pseudaulacaspis pentagona* (Targioni-Tozzetti) in relation to peach tree phenology in Caldas, Minas Gerais.] Revista Ceres 46(267): 565-569. [SousaSaSo1999]

Notes: [Original title: Ocorrência da cochonilha-branca *Pseudaulacaspis pentagona* em relação a fenologia do pessegueiro em Calda, Minas Gerais.] Studies were was conducted to investigate the occurrence of different development phases of *Pseudaulacaspis pentagona* (Targioni-Tozzetti) (Homoptera: Diaspididae) in relation to peach tree phenology in Caldas, MG. Observations on the insect biological cycle were made in 10 plants of peach cv. Biuti by sampling three branches/tree every fifteen days from September 1996 to August 1997. The results showed female occurrence during all the evaluation period, with great intensity from September to December, coinciding with the vegetative and fruit yield phases. In winter, when peach trees are dormant, the adult female population was constant. Mobile nymphs occurred all year long, except during July and October, with greater infestation in December. Male nymphs occurred throughout the entire evaluation period except for July and August.
Stathas, G.J. 2000. *Rhyzobius lophanthae* prey consumption and fecundity. Phytoparasitica 28(3): 203-211. [Statha2000]

Notes: The daily and total prey consumption and the fecundity of the predator *Rhyzobius lophanthae* Blaisdell (Coleoptera: Coccinellidae) fed on the scale *Aspidiotus nerii* Bouche (Homoptera: Diaspididae) were studied under controlled laboratory conditions. The prey consumption of *R. lophanthae* was studied on larvae and on virgin adults, and the fecundity on mated females. For the development of the 1st instar larvae of *R. lophanthae* at 25 degrees C, 1.2 adult female *A. nerii* were consumed; for the development of the 2nd, 3rd and 4th instar larvae, prey consumption was 2.7, 7.5 and 24.6 adult females, respectively. The duration of the larval development of the 1st, 2nd, 3rd and 4th instars was 3, 2.2, 2.7 and 6.7 days, respectively. *R. lophanthae* male and female adults consumed in their lifetime 390.6 and 672.3 adult female *A. nerii* respectively. Thus, the male's daily prey consumption came to 7 and the female's to 12 adult female *A. nerii*. The average fecundity of *R. lophanthae* was calculated to be 633.7 eggs per female and the daily fecundity to be 18-25 eggs. The average longevity was 63.4 days for mated adult females and 119.4 days for unmated.

Stathas, G.J. 2000a. The effect of temperature on the development of the predator *Rhyzobius lophanthae* and its phenology in Greece. Biocontrol Dordecht 45(4): 439-451. [Statha2000a]

Notes: The effect of temperature on the development of ***Rhyzobius lophanthae*** Blaisdell (Coleoptera: Coccinellidae) fed on *Aspidiotus nerii* Bouche (Homoptera: Diaspididae) was studied under controlled laboratory conditions. The duration of each developmental stage and adult longevity were measured at 15, 20, 25, and 30 degrees C. The life cycle of ***R. lophanthae*** (from egg to oviposition) lasted 78.7, 43.6, 32.1, and 23.9 days, whereas the average adult longevity was 257.6, 171.4, 121.3, and 88.5 days at each temperature, respectively. Low temperature thresholds of ***R. lophanthae*** immature life stages ranged from 7.6 to 9.3 degrees C, while the thermal constant for the development of ***R. lophanthae*** from egg to adult was 443.5 degree-days. The average fecundity at 25 degrees C was 633.7 eggs per female. ***Rhyzobius lophanthae*** reared in cages outdoors during 1993-1995 at Kifissia, Athens developed 5 complete overlapping generations per year from May to October and a 6th partial overlapping generation during February and March. Adults of the 4th and 5th generation survived winter conditions giving rise to the following year's 1st generation. Females were reproductively active throughout the year, indicating that ***R. lophanthae*** does not diapause.

Steven, D. & Retamales, J. 1999. Integrated and organic production of kiwifruit. Acta Horticulturae (No. 498): 345-354. [StevenRe1999]

Notes: The current situation and prospects for integrated pest management (IPM) and organic techniques for pest control on kiwifruit in New Zealand, China, Chile, Japan, USA and Europe is examined with regard to the pest spectra present. In particular, armoured scales [Diaspididae], including ***Hemiberlesia rapax, H. lataniae*** and *Aspidiotus nerii*, and leafrollers [Tortricidae] are reviewed. Constraints and opportunities for both approaches are discussed. For both systems in New Zealand there is a critical need for a wider range of acceptable controls, in order to better assure consistent production that meets quarantine requirements, even in situations which favour pest outbreaks. Secondary pests also require better controls. Organic production in New Zealand is small but rapidly increasing. A healthy premium is currently being achieved, although some question the sustainability of this in the longer term. An IPM system called KiwiGreen has become the norm for production of kiwifruit in New Zealand. Planned and possible further developments are considered.

Stimmel, J.F. 1999. Maskell scale, ***Lepidosaphes pallida*** (Maskell) Homoptera: Diaspididae. Regulatory Horticulture (PA Dept. of Agric.) No. 25(1): 23-24. [Stimme1999]

Notes: Notes on hosts, distribution, field description, life history, damage and control.

Stumpf, C.F. & Lambdin, P.L. 2000. Distribution and known host records for ***Planchonia stentae*** (Hemiptera: Coccoidea: Asterolecaniidae). Florida Entomologist 83(3): 368-369. [StumpfLa2000]

Notes: ***P. stentae*** (Brain 1920) is reported from 49 ornamental plant species in Colombia and the United States for the first time. Based on its wide host range, this species is a potential threat to several ornamental plants within subtropical regions.

Subbarayudu, B. & Dayal, R. 1999. Natural incidence of Indian lac insect, ***Kerria lacca*** (Kerr.) at Rajendranagar, Hyderabad, India. Insect Environment 4(4): 133. [SubbarDa1999]

Notes: The lac insect was found on ***Peltophorum pierocarpa*** [? ***Peltophorum pterocarpum***], in the absence of its natural enemies.

Sudheendrakumar, V.V. & Varma, R.V. 1999. Record of a lac insect, ***Kerria*** sp. (Homoptera: Kerridae) in Kerala. Entomon 24(4): 393-395. [SudheeVa1999]

Notes: The occurrence of a lac insect, ***Kerria*** sp. (Homoptera: Kerridae) on ***Amherstia nobilis*** is reported. ***Kerria*** sp. is a new record from Kerala and ***A. nobilis*** is recorded for the first time as a food plant.

Sugonyaev, E.S. 1999. [Chalcid wasps (Hymenoptera, Chalcidoidea) parasites on soft scales (Homotera, Coccidae) in Vietnam. VII. A new peculiar species of the genus ***Encyrtus*** Latr. (Encyrtidae) inhabiting ants' nests (Hymenoptera, Formicidae)] (In Russian). Entomologicheskoe Obozrenye 78(2): 453-456. [Sugony1999]

Notes: *Megalocryptes bambusicola* is host of *Encyrtus ludmiliae*.

Sugonyaev, E.S. 1999a. A new species of chalcid wasps of the genus *Microterys* Thomson from the Hypoarctic of Russia (Hymenoptera: Encyrtidae). Zoosystematica Rossica 8(1): 151-152. [Sugony1999a]

Notes: *Microterys obventionis* sp. nov., a parasitoid of soft scale insects (Coccidae), *Eulecanium douglasi* and *Pulvinaria betulae*, in Russia, is described.

Sullivan, R.F., Bills, G.F., Hywel-Jones, N.L. & White, J.F. 2000. Hyperdermium: a new clavicipitalean genus for some tropical epibionts of dicotyledonous plants. Mycology 92(5): 908-918. [SullivBiHy2000]

Notes: The morphological characteristics of two tropical clavicipitalean fungi on species of the plant family Asteraceae were examined. These species were found to be superficial on the stems of living plants but early stages of infection involve necrotrophy of scale insects.

Suris, M. 1999. [Spatial distribution of *Selenaspidus articulatus* Morg. (Coccoidea: Diaspididae) in Valencia oranges (Citrus sinensis L.).] Disposición espacial de *Selenaspidus articulatus* Morg. (Coccoidea: Diaspididae) en naranjo Valencia (*Citrus sinensis* L.). (In Spanish with summary in English). Revista de Protección Vegetal 14(1): 17-22. [Suris1999]

Notes: For three years, ten Valencia orange trees were sampled every 15 days, in the field in Cuba. A leaf pertaining to the inferior, medial and superior area of every cardinal point was taken from these trees. The density of larvae and adult females of *Selenaspidus articulatus* was evaluated on the leaves. Variance/mean relation, K parameter of DBN and Taylor's power law were applied. Results showed an aggregate distribution which, with random arrangements, alternates throughout the year in height levels as well as in cardinal points for the larva and adult female. The collected information allowed improvement to the existent sampling method by reducing its duration.

Sushil, S.N., Mishra, Y.D., Bhattacharya, A. & Kumar, P. 1999. Screening of some egg parasitoids against *Pseudohypatopa pulverea* (Meyr.) (Lepidoptera: Blastobasidae): A serious predator of lac insect, *Kerria lacca* (Kerr). Journal of Entomological Research. New Delhi 23(4): 365-368. [SushilMiBh1999]

Notes: Five hymenopterous egg parasitoids, viz., *Trichogramma brasiliensis, T. chilonis, T. pretiosum, Trichogrammatoidea bactrae* (Trichogrammatidae) and *Telenomus remus* (Scelionidae) were screened against *Pseudohypatopa pulverea*, a serious predator of lac insect, for assessing their parasitising efficiency. The maximum parasitisation was observed in the case of *T. brasiliensis* (56.73%) and lowest by *T. remus* (17.56%). The emergence of the adult parasitoids from the parasitised eggs was maximum in *T. pretiosum* (75.00%) followed by *T. chilonis* (72.85%), *T. brasiliensis* (66.04%), *T. bactrae* (34.70%) and lowest by *T. remus* (43.75%). All the five parasitoids appeared to be promising for the biological control of the predator.

Suvak, M. 1999 (1998). [Distribution of beech scale (*Cryptococcus fagi* Barensp.) in beech forest stands.] Rozsirenie cervca bukoveho (*Cryptococcus fagi* Barensp.) v bukovych porastoch. Acta Facultatis Forestalis Zvolen 40: 73-83. [Suvak1999]

Notes: Information is presented on beech scale (*Cryptococcus fagi* [*C. fagisuga*]) and its occurrence in beech [*Fagus sylvatica*] stands in Slovakia, including factors influencing the population density and distribution of the insect pest. The most important primary factor seems to be the chemical composition of beech bark tissue. This factor is reflected in visible growth characteristics of tree. Examples are given of the variability and distribution of beech scale in 2 beech stands (in the Stagiar and Bien valleys near Zvolen) where these characteristics were observed in association with the distribution of diameter at breast height (dbh). Two methods of evaluation of degree of infestation of beech trees and whole stands were used. The first method was direct counting of colonies of beech scale and enumerations of degree of infestation as density of beech scale colonies over an area of 1 dm2. The second method was visual assessment of degree of infestation classified into one of 5 categories. High variability of infestation was found in trees of both stands. A relationship between beech scale density and dbh was

found only where there was a close relationships between the chemical composition of bark tissues and tree diameter.

Takagi, S. 1999. Notes on the scale insect subtribe ***Kuwanaspidina*** (Homoptera: Coccoidea: Diaspididae). Insecta Matsumurana (56): 95-150. [Takagi1999a]

Notes: The kuwanaspidine pattern of marginal appendages is defined. Five genera are recognized and referred to the subtribe Kuwanaspidina, tribe Diaspidini. Seven new species are described from Malaysia, Japan, the Philippines, and India: ***Kuwanaspis pectinata, Nikkoaspis berincangensis, N. sikokiana, Xiphuraspis ctenopyga, Medangaspis payunga*** (gen. et sp. nov.), ***Coronaspis malesiana***, and ***C. malabarica***. Some species referred to the subtribe do not conform exactly to the kuwanaspidine pattern; a few of them are interpreted to have undergone atavistic modifications, and the others to have changed towards the advanced state of the Diaspidini. They are kept in the subtribe according to the view that an atavistic organism does not mean the revival of an ancestral taxon and that an incompletely derivative state alone is not sufficient for taxonomic change. ***Kuwanaspis*** and ***Nikkoaspis*** are closely related to each other, but the other genera appear to be isolated due to a fairly wide variety of characters observed in the first instar larvae and also in the second instar males. It follows that the known forms are fragments from a once diversified large group, unless unrelated forms are included. Preliminary considerations are given to the question of why marginal appendages change from taxon to taxon. A list of the ***Kuwanaspidina*** is provided. ***Chuaspis*** Tao and Wong is synonymized with ***Kuwanaspis***, and ***C. shuichuensis*** Tao and Wong with ***K. bambusicola***.

Takagi, S. 2000. Four extraordinary diaspidids (Homoptera: Coccoidea). Insecta Matsumurana 57: 39-87. [Takagi2000]

Notes: This paper reviews and illustrates ***Sinistraspis unilateralis, Crockeraspis fungosa, Mempelaspis serpentina*** and ***Icaraspidiotus chaetopterus***.

Tatara, A. 1999. [Occurrence of pest insects and their natural enemies under spraying program using mainly BT and IGR agents in tea field.] (In Japanese). Annual Report of the Kanto Tosan Plant Protection Society No. 46: 119-122. [Tatara1999a]

Notes: Spraying programmes for tea fields using 7 applications between 25 May and 1 September with either ***Bacillus thuringiensis*** or insect growth regulators were compared in Japan. More insects were present when ***B. thuringiensis*** was used. Under the ***B. thuringiensis*** regime ***Ceroplastes ceriferus, Scirtothrips dorsalis*** and ***C. rubens*** were the most abundant species. Under the insect growth regulator regime ***Caloptilia theivora*** and ***C. ceriferus*** were the most abundant. Few natural enemies were observed under any insecticide spraying regime.

Tchuanyo, M., Huis, A. van & Lenteren, van J.C. 2000. Distribution, incidence and abundance of the cassava brown root scale insect, ***Stictococcus vayssierei***, in Cameroon. Tropical Science 40: 20-24. [TchuanHuLe2000]

Notes: A new scale insect, ***Stictococcus vayssiere***, has been found attacking all the underground parts of cassava. From surveys in all the cassava-growing areas of Cameroon, the insect seems to be limited to the southern part of the country, where it is a major pest of cassava. This is the semi-humid zone with a bimodal rainfall pattern. Field populations of the pest vary within fields and regions. More than 200 insects were observed on a single plant in many fields. Seasons seem to influence field populations.

Temecula Grapes Devastated by Disease. 1999. California Grower 23(9): 9. [TemecuGrDe1999]

Notes: Unspecified pseudococcid mentioned as pest.

Tertuliano, M., Calatayud, P.A. & Le Ru, B.P. 1999. Seasonal changes of secondary compounds in the phloem sap of cassava in relation to fertilization and to infestation by the cassava mealybug. (In English with summary in French). Insect Science and its Application 19: 1, 91-98. [TertulCaLe1999]

Notes: The aim of the present study was to determine, by a field experiment, whether the seasonal variations in the levels of cyanide and rutin in the phloem, secondary compounds potentially implicated in cassava resistance to the cassava mealybug (***Phenacoccus manihoti***), could be influenced by different kinds of soil fertilization (manure, NPK, KCl, lime, mulch).

Thakur, M.L. 1999. Insect pest status of poplars in India. (In English with summary in Hindi). Indian Forester 9: 866-872. [Thakur1999]

Notes: Poplars (***Populus*** spp.), especially the exotics, are susceptible to indigenous forest pests in India. The 120 or so pest species concerned comprise chiefly cockchafers (7 species), defoliators (58 species) stem and shoot borers (23 species), sap-suckers (27 species), termites (4 species) and mites (1 species). Sap-sucking insects affecting poplars include chiefly aphids and scale insects such as (***Quadraspidiotus perniciosus [Diaspidiotus perniciosus***]).

Thakur, J.R. & Gupta, P.R. 1999 (1997). Population trend of olive white scale, ***Metaceronema japonica*** Maskell and its predation by ***Chilocorus bijugus*** Mulsant in Himachal Pradesh. Pest Management and Economic Zoology 5(2): 151-154. [ThakurGu1999]

Notes: Populations of ***Metaceronema japonica*** existed on olive trees throughout the year in one or the other stage and it completed one generation from August to January. The coccinellid, ***Chilocorus bijugus***, was recorded as its effective predator for the first time at Solan, Himachal Pradesh, India. Feeding rate of an adult beetle was 19.2, 20.1, 7.3 and 1.3 scale insects per day of I and II instar nymphs, young females and mature females with ovisacs, respectively. Average longevity of adult beetle on this insect was 110.2 days.

Thippaiah, M. & Kumar, N.G. 1999. ***Dysmicoccus*** sp. (Pseudococcidae: Homoptera): a pest of soybean in Karnataka. Insect Environment 5(2): 70. [ThippaKu1999]

Notes: ***Dysmicoccus*** sp. was observed to suck sap from the root and rhizobium nodules of soybean grown in red sandy soil during the kharif and summer seasons in Karnataka, India. Infestation ranged from 6 to 25%. Severely affected plants showed stunted growth. Ants were actively associated with the mealybugs during the summer.

Tooker, J.F. & Hanks, L.M. 1999. Dwarf Millipedes (Diplopoda: Polyxenidae) on pines in an ornamental landscape. Proceedings of the Entomological Society of Washington 101(3) 696-697. [TookerHa1999]

Notes: Beat samples were taken from pine trees (***Pinus mugo, P. sylvestris*** and ***P. nigra***) and shrubs from 19 June to 27 August, 1997, standing within the city limits of Urbana-Champaign, Illinois, as part of a study to identify predators of the scale, ***Chionaspis pinifoliae***. Sixty-three millipedes (***Polyxenus lagurus***) were collected only from trees supporting populations of ***C. pinifoliae***. However, it was concluded unlikely that there was any direct ecological relationship between the millipede and scale insect.

Tooker, J.F. & Hanks, L.M. 2000. Influence of plant community structure on natural enemies of pine needle scale (Homoptera: Diaspididae) in urban landscapes. Experimental Entomology 29(4): 1305-1311. [TookerHa2000]

Notes: Pine needle scale, ***Chionaspis pinifoliae*** (Fitch), is a pest of many species of conifers in urban habitats and Christmas tree farms. We found