

## **Historic, archived document**

Do not assume content reflects current scientific knowledge, policies, or practices.



a QL523  
C706

5

# The Scale



Editor:  
Douglass R. Miller  
Systematic Entomology Lab.,  
Agric. Research Service  
Plant Sci. Inst., USDA  
Bldg. 046, BARC-W  
Beltsville, MD 20705  
Fax 01 301-504-6482  
dmiller@sel.barc.usda.gov

---

Vol. XXIII

March 1999

---

## SCALE INSECT FORUM

Many of you are aware that two of our colleagues Francesco Porcelli and Yair Ben-Dov have combined to establish a new forum for communication among coccidologists. It is a web site where items of interest can be presented and discussed in the rapid communication mode available through the Internet. Some information about this exciting new home page is given below. Please support this endeavor because it has taken a lot of energy and effort to get it started and should prove an interesting way of discussing issues of interest. The following are the "Opening words from the Editors", as given in Issue No. 1 (December 1998) of Scale Insect Forum. "At the business meeting of the VIII International Symposium on Scale Insect Studies (ISSIS - 31 August - September 6, 1998, Wye, England) colleagues suggested establishing a web site on the Internet to improve and enhance communication among scale insect students. This site would facilitate communication of information, in a faster and more frequent format than 'The Scale' newsletter, which currently is issued only once a year.. In response to this request we have agreed to collaborate and establish a new web site. We are pleased that within a short period of time the goal was achieved and the first issue of Scale Insect Forum is available on the Web. We anticipate that this new web site will become a useful tool and will enhance communication about scale insect workers. Because Scale Insect Forum is new, feedback from colleagues and other users will be extremely valuable. We would appreciate receiving your comments, corrections and suggestions, because they will contribute to improved presentation and function of this site." If you want more information or have suggestions you can contact Francesco at [scaleinfo@iea8.uniba.it](mailto:scaleinfo@iea8.uniba.it). Please go to the site at <http://193.204.185.103/scaleinfo/scale.htm> and see what it has to offer.

## NEWS FROM AROUND THE WORLD

Editors Note: With the advent of Scale Info (<http://193.204.185.103/scaleinfo/scale.htm>) it seems more appropriate for this kind of information to be located there rather in "The Scale" so that it will be more timely. I am sure that Francesco Porcelli or Yair Ben-Dov will be happy to

include any information that you think would be of interest to the coccidology community.

**Yair Ben-Dov, Department of Entomology, Institute of Plant Protection, The Volcani Center, Bet Dagan, Israel:** Since July 1995 the major project (a joint project with Dug Miller, USDA, Beltsville, Maryland) in our laboratory is the development of "ScaleNet," a computerized database of the scale insects of the world. The work at Bet Dagan is carried out by Yair Ben-Dov and is assisted by Ms. Viktoria German and by Ms. Yulia Bir. A detailed report on the project was published by Dug Miller and by us in "The Scale" vol. 22 (March 1998). In September 1998, during ISSIS-VIII, a detailed presentation and demonstration of "ScaleNet" was given to the participants of the Symposium. Since July 1998 I have been studying at the Laboratoire d'Entomologie, Museum National d'Histoire Naturelle, Paris, France, where I am working on a study with Daniele Matile-Ferrero on a revision of the Mediterranean Mealybugs. The scale insect fauna of this region includes some 'old' taxa from the 18th and 19th centuries. In the Coccoidea Collection in MNHN, Paris are deposited specimens of some of these 'old' species. These specimens have proven to be of great significance to the study. Francesco Porcelli and I have joined efforts to establish a new website, called the "Scale Insect Forum." Information on this website is given at the beginning of this issue of "The Scale."

**Evelyna Danzig, Zoological Institute, St. Petersburg, Russia:** I am continuing the revision of mealybugs of the former USSR. I am nearly finished with the part on *Peliococcus* Borchs., *Peliococcopsis* Borchs., and *Spinococcus* Kir., which includes 20 species. It will be published in *Zoosystematica Rossica* in English. In March in *Entomol. Obozr.* N1 my revision of the genus *Puto* Sign. (including *Ceroputo* Sulc and *Macrocerococcus* Leon. as synonyms) will be published. I just received a message from Valentina Yasnosh that Zoja Konstantinovna Hadzhibeyli passed away on February 2 after a prolonged illness at the age of 88. Her daughter gave the collection to the Institute of the Plant Protection, Tbilisy, Georgia. Last autumn 2 coccidologists visited our Institute. Just after the ISSIS Symposium, Jan Giliomee spent 2 days in St. Petersburg. Unfortunately, I was still in England. During the last 2 weeks of September Francesco Porcelli spent many interesting hours in my laboratory. He was working with the scale literature and borrowed a lot of slides of Diaspididae for his project (now our joint project) on the antennae of this family. He worked very hard, but his visit was especially pleasant and usefully for me and my assistant Margarita. He left us some dissections of valuable material and taught Margarita how to improve her preparations of slides.

**John Davidson, Department of Entomology, University of Maryland, USA:** Since my retirement in 1994 I have kept my hand in at the University of Maryland Dept of Entomology by teaching an Ornamentals Pest course and by running a short course for the green industry. My scale work revolves around projects with Dug Miller. We recently discovered and described *Hemiberlesia neodiffinis*, an armored scale previously confused with *H. diffinis*. We just completed a year long observation on the life history of Putnam scale, *Diaspidiotus ancylus*, on blueberry in southern N.J. with Dr. S. Paravalapu of Rutgers University, this to be published shortly. The remainder of my time is spent working on our 20 year project covering the armored

scales of economic importance in the U.S.

**Imre Foldi, Muséum National d'Histoire Naturelle, Entomology, Paris:** I continue the generic revision of this family Margarodidae which is well progressed now. The most time consuming so the hardest part of this work e.g. the illustrations (females and some males) are now made for sixty on 77 genera. A cladistic analysis is undertaken also on this family and related groups for serving a basis for its classification. This work is difficult because there is no too much usable characters and in numerous cases their homology could not well establish. To assure a better understanding of the margarodids, a morpho-anatomic study is also associated at this revision and finally completing with the preparation a systematic catalogue. In 1997, I published a work on the defense strategies in scale insects and proposed a hypothesis of phylogeny of the scale insects, based on a cladistic analysis. This phylogeny was used as a reference to provide hypotheses for a evolutionary scenario concerning habitat (feeding site) and the type of protective structure for all the scale insects. This is really a fascinating research area. The same method will be applied for the basal groups e.g. margarodids and related groups trying establish a evolutionary scenario on the origin of the scale insects. About systematic studies, I am finishing this year a work on the diversity and evolution of populations of the scale insects of the French Mediterranean Islands in the natural and man modified environments. I worked really in the very nice area from sea level to high mountain during several years in different periods of the year. The field work in these beautiful environmental conditions I am wishing to my all colleagues coccidologists. The results will be compare with data from 65 years to see how the fauna is modified.

**Jan Giliomee, Department of Entomology & Nematology, University of Stellenbosch, South Africa:** Waktola Wakgari, a PhD student, is making good progress with his studies on the biology of *Ceroplastes destructor*. A paper has been published in African Entomology in which the developmental stages are described. (6:303-316). Jan Giliomee and Ferenc Kozár have nearly completed a paper on the Asterolecaniidae of South Africa. Jan has also relocated the only known indigenous eriococcid, *Calycicoccus merwei*, not seen since its description by Brain in 1919, but still present in its type locality. It forms a beautiful little gall on the leaves of its host. Specimens have been sent to Penny Gullan in Australia for molecular phylogenetic studies.

**Ray Gill, California Department of Food and Agriculture:** About the only thing that is going on here at CDFA is my next "Scale Insects of California" book. It will be the fourth in the series and the last on the scale insects. It is on the mealybugs of California and was actually written some years ago. Over the last year I have been trying to bring it up to date and to get it ready for printing. I do not know at this point if I can fund it this year if I am able to get it done. The main hurdle here is time and a number of illustrations that will have to be completed.

**Avas B. Hamon, Florida State Collection of Arthropods, Gainesville, Florida USA:** I have a 3 year (unfunded) project with Nereida Mestre of the Instituto de Ecología y Sistemática, Ministerio de Ciencia Tecnología y Medio Ambiente, in Havana, Cuba to collect, identify, and describe Coccidae of Cuba. She is presently doing extensive collecting and slide mounting, and

will visit the FSCA for the second time later this summer (1999). I plan to visit there and collect in the year 2000. Afterwards, we plan to produce a joint publication on the Coccidae of Cuba.

**From Rosa Henderson, Landcare Research, Auckland, New Zealand:** It was great having Chris Hodgson visit here last (southern) summer, January-February 1998, and I think he got a feeling for the native scale insect fauna by collecting in the forests whilst travelling around with his family. However, by coming at that time of year he missed the major difference between our forests and those deciduous forests of Europe, say -it was some time later that the point about NZ forests being evergreen finally came up, with regard to the many scale species which overwinter here on the leaves of trees. We have made good progress on our joint revision of the NZ soft scales, the manuscript on the adult females has been submitted for peer review, and is due to be published in the Fauna of New Zealand series before the end of 1999. We propose 8 new genera and 27 new species along with Maskell's previously described 16 species and the 14 established exotic species. Colour photos and some scanning electron micrographs will be included. An earlier paper on one of the new genera, *Pounamococcus* came out in December 1998. Chris intends the next part of this revision to be the adult males for which he has the basis done already, followed by a volume on all the known immature stages of the indigenous species. I much enjoyed meeting fellow coccidologists at Wye College for ISSIS VIII last year.

**Chris Hodgson, Wye College, Wye, England, UK:** I have been working with Rosa Henderson on a revision of the New Zealand soft scales. Details of this are covered in her letter and so I will not repeat them here. However, two other items might be of interest. 1. I am now about half-way through editing the Proceedings of ISSIS VIII. It is my aim to have finished this by the end of March, although I think that may be a bit optimistic. I shall then be sending the manuscripts off to reviewers to see if there are any points that I have missed. Hopefully, the reviewing and final corrections should be in by the end of June and so I am optimistically hoping that the manuscript should go to *Entomologica* sometime mid- to late summer. I am not sure what their time scale is but it may be on course for publication in 1999. That will, however, depend very much on the second point, which will come as a bit of a surprise to many people! 2. I am leaving Wye, probably at the end of the summer term and should be contactable through the Entomology Department, National Museum of Wales, Cardiff, Wales, from about 1st August onwards. I shall be sending out e-mails with contact addresses and e-mail addresses as soon as I have them to anyone whose e-mail address I have through ISSIS, etc. Otherwise I shall rely on "The Scale" to advertise my whereabouts for those who are interested. This move could be complex from my point of view and so could hold up the publication of the Proceedings if I have not managed to move it along as I would wish! I have now been at Wye for 32 years. Nonetheless, the College does not see fit to offer me promotion and I have therefore decided to leave and work on scales full-time! I shall finish the revision of the soft scales of New Zealand (the males and immature stages are partially complete) and then I am hoping that Penny Gullan and I can concentrate on Australia. However, any other interesting projects that people can suggest, I would be delighted to consider!

**Michael Kosztarab, Department of Entomology, Virginia Polytechnic Institute and State**

**University, Blacksburg, USA:** 1998 was both a good and a bad year for me. It was good since I was able to complete the manuscript with the survey results on the human resources in coccidology and to give a talk on this topic at the 8th International Symposium on Scale Insect Studies at Wye College, University of London last September. Two manuscripts are in print: one with Mary Rhoades as co-author on "Disjunct Distribution and Endemism in the Appalachian scale insect fauna", and also "Revision of the Tribe Serrolecaniini", with senior author H.J. Hendricks. The latter was scheduled for release last January (1999) in Berlin. On the down side, I moved my office last December to my home, but still receive mail to both the office and my home address. My email (mkoszt@vt.edu) comes home, but fax messages (540-231-9131) still go to the Department. Please do not send e-mail with attachments that require downloading. The scale bulletin and books from our former laboratory are on sale by the Virginia Museum of Natural History, 1001 Douglas Ave., Martinsville, VA 24112, USA (Tel: 01-540-666-8629). I just packed my leftover library on scale insects to go to Paris Lambdin, who is coordinating the writing of a manual for the identification of scale insects of southeastern North America, and who has two graduate students studying scale insects.

**Jan Koteja, Institute of Applied Zoology, Krakow, Poland:** I presented my current studies on fossil scale insects at the ISSIS VIII (poster). In the meantime the number of fossils available for examination has significantly grown, reaching 876 specimens. Also my "private" collection of fossil coccids reached 310 specimens. By the end of March, I hope to get another portion of amber inclusions, at the International Amber Fair (Amberif '99) held at Gdansk. What is more important, the collection includes more and more Cretaceous material. Among them there is a sample of Lebanese amber definitely different from recent forms (in cooperation with Mr. Dany Azar, owner of a large collection of Lebanese inclusions). Dr Dmitry Shchervakov from the Moscow Paleontological Laboratory informed me of a discovery of an Upper Jurassic coccid impressions (I have not seen it yet), thus the scale insect fossil record successfully crossed the Jurassic/Cretaceous boundary (earlier Mesozoic records apparently refer to some other taxa, and not to coccids). Also, with the accumulation of fossil material, some special cases appear; several have been described in a paper ("Sudden death in amber?"). Currently my main task is completing the drawings for the study of the New Jersey amber scale insects which include about 8 families and perhaps 12 species. The New Jersey coccids really are an unusual sample in many ways. As far as I know, Dr. Bozena Lagowska and her student are working on the Polish scale insect fauna, Dr. Anna Dziejicka on introduced and greenhouse species, and Dr. Teresa Szklarzewicz on coccid ovarioles. All my best wishes to you and "The Scale" readers.

**Ferenc Kozár, Plant Protection Institute, Budapest, Hungary:** I have become very interested in the scale insects collected in Berlese samples and have found several groups to be very common, particularly ortheziids. In collaboration with Dug Miller, we have nearly finished with the work on *Ortheziola* of the World. The genus now includes 23 species, most of which are found in Africa but two are present in Europe and one is found in Asia. It is interesting that there are no species in North and South America, Australia, or the Pacific. My current research is on the genus *Newsteadia* of the World. Several new species are being described from Africa and

...en new species from Australia and the Pacific. Some other species are waiting for  
...ent from the Oriental Region. Based on the samples available, there are few undescribed  
...ies in Central and South America. Several new species of the strange Carayonemidae scale  
family were also found in Berlese samples from Central and South America. This family looks as  
if it can survive in aquatic habitats. Perhaps hydrobiologists are aware of them. Please see if you  
can find them.

**Dug Miller, Systematic Entomology Laboratory, USDA, Beltsville, Maryland:** Many things  
have been going on at Beltsville including visits from Ferenc Kozár ( to work on Ortheziidae)  
and Doug Williams (to work on *Furcaspis*). The grant that Yair Ben-Dov and I obtained from  
the Binational Agricultural Research and Development Fund will be running out in July of this  
year (although there will be a one-year extension without funds) and we are vigorously looking  
for additional monies that will allow us to finish the retrospective part of the project on ScaleNet.  
The biggest hurdle is to input data on the Diaspididae which Maren Gimpel (on the US side) has  
been working on for nearly a year. A manuscript catalog on the eriococcids is complete and will  
be submitted to a publisher soon. One of the exciting things for the year was a National Science  
funded trip to Davis, California to help them improve their scale collection. Chris Hodgson  
called it a mini-ISSIS since those present were: Jack Beardsley, Ray Gill, Penny Gullan, Doug  
Williams and myself. We spent 2 weeks trying to identify and organize the extensive dry  
collection that is deposited there. It was great fun looking at material and drawing from the  
expertise of all present to make a determination. Although we worked long hours and looked at  
way too many little boxes, a good time was had by all. There is some very valuable material  
there; so when you are doing work on a group we highly recommend that you contact Steve  
Heydon, Bohart Museum, University of California, Davis, California 95616 to see what is  
available. We did not have time to work in the slide collection, but it also is quite exhaustive.  
We are grateful to Lynn Kimsey for finding the funds to allow us to go there.

**Francesco Porcelli, Istituto di Entomologia Agraria, Università di Bari, Italy:** While analysis  
of the morphology of Diaspididae (mainly functional morphology of sense organs) is my primary  
research effort, in order to enhance the control of diaspidid pests I am also building a multimedia  
database on Diaspididae and related organism. This project is being funded by a grant from my  
University. My student Agnese Ingegno has just completed her PhD Thesis on *Nidularia*  
*pulvinata* Plachon reporting data on morphology of all stages, biology, predators/parasitoids,  
damage, and control. A study on *Septobasidium*/Diaspididae interactions is starting thanks to the  
help from many Colleagues who responded through Scale Insect Forum. The first paper giving a  
list of the available collection material will hopefully be ready soon. Recently I have become  
fascinated by the "Zonobiome" concept and its possible use in searching for natural enemies of  
Diaspididae. I may try to input data into a GIS (Geographical Information System) program to  
search for biocontrol agents. Francesco also wrote: While studying the antennae of female  
Diaspididae I wondered if it would be possible to borrow specimens of 80% of the species.  
Evelyna Danzig has started the process by lending me about 300 slides. I would be delighted to  
have a loan of other material from other readers of "The Scale." Please let me know if this is  
possible. My address is "Istituto di Entomologia Agraria, Università di Bari, Via Amendola,

165/a, 70125 Bari, Italy." I can be reached by e-mail as follows: porcelli@agr.uniba.it

**Karen Veilleux, Blacksburg, Virginia:** I continue compiling annotated bibliographies of scale and aphid literature and I am responsible for the ever increasing reference file in ScaleNet [<http://www.sel.barc.usda.gov/scalenet/scalenet.htm>]. I am most anxious to have recent reprints and will include them in ScaleNet soon after I receive them. Please send them to 710 Cedarview Dr., Blacksburg, VA 24060, USA or fax them to 815-371-2472. My e-mail address is veilleux@vt.edu.

**Xie Yingping, Department of Biology, Nankai University, Tianjin, P. R. China** Happy New Year! I want to draw attention to a book that I wrote which was published in February, 1998. It is "The Scale Insects of the Forests and Fruit Trees in Shanxi of China". This research is the result of work that I did as a M.S. student working with Prof. Tang Fang-de. Since then I have continued my research in coccidology and worked in the Department of Forestry in Shanxi Agricultural University, Taigu, China. Last April I was promoted to Professor of Forest Entomology. My main research focus is on scale insects on forests and fruit trees and on environmental pollution and scale insects. Now, I am working on a Ph.D. thesis in the Department of Biology of Nankai University, in Taijin, China.

#### NECROLOGY

A sad note from Valentina Yasnosh, Georgian Plant Protection Institute.

On February 2, 1999 Zoja K. Hadzhibeyli passed away after a prolonged illness at the age of 88. She was a very famous specialist of scale insects and a good friend of N. Borchsenius. Her many papers and her monograph "Coccids of the subtropical zone of the Georgian SSR" (in Russian), 1983 provided important new knowledge on the Coccoidea of all of the Caucasus.

#### NOTES OF INTEREST

##### A NOTE ON THE GENITALIA OF SOME PACIFIC *PSEUDOCOCCUS* SPECIES (HOMOPTERA: PSEUDOCOCCIDAE) AND THEIR POTENTIAL UTILIZATION IN SYSTEMATICS

John W. Beardsley

Ferris (in Zimmerman 1948), in describing *Pseudococcus floriger* from the Hawaiian islands, stated that the vulva in that species exhibited "a peculiar, slightly sclerotized

internal folding which has suggested the specific name." He noted further that "this disappears or becomes obscured in old females after the eggs have been deposited" (sic!). The same sort of vulvar sclerotization is seen in a few other Hawaiian *Pseudococcus* species (e.g.: *P. nudus* Ferris, *P. swezeyi* Ehrhorn). Similar vulvar sclerotization also is present in some extra-Hawaiian Pacific species of *Pseudococcus*, such as *P. orchidicola* Takahashi and *P. trukensis* Beardsley. In the former the vulva has an unusual and characteristic shape and exhibits what appear to be internal lateral pockets (fig. 1).

All of the *Pseudococcus* species that possess such sclerotized or saccate vulvae that I have seen apparently are ovoviviparous forms. These species have a relatively small number of multilocular disc pores which are restricted to the ventral segments immediately around the vulvar opening.

*Pseudococcus* Westwood is a large and taxonomically difficult genus. As presently constituted, it is probably not monophyletic. As is the case in all mealybug genera, classification in *Pseudococcus* is based almost exclusively on the external morphology of the the neotenic adult females, and the information available on other stages is very incomplete.

In a paper on adult males of Hawaiian mealybugs (Beardsley 1960) those of *P. longispinus* (Targioni-Tozzetti)

(as *P. adonidum* (L.)) and several other *Pseudococcus* spp. were characterized. Emphasis was placed on the form of the penial sheath, and on various non-genitalic characters useful in distinguishing between species. The intromittent organ (aedeagus) was described and figured for *P. adonidum*, but was not compared with the aedeagi of other species. This was due in part to the difficulty in obtaining slide preparations that clearly showed the form of the often partly or entirely membranous aedeagus.

More recently, while attempting to clarify the identity some Pacific *Pseudococcus*, I examined the adult males of several species, and noticed the presence of lateral aedeagal lobes in a few of these. These structures, which appear to arise near the base of the aedeagus and take different forms in different species, apparently have not been reported previously in males of other mealybugs. Their function is as yet undemonstrated. However, they appear to occur only in those species in which the female vulva is modified in some way, as described above. They are absent in *P. longispinus* and in other species in which the vulva is unmodified. The form of the aedeagus in *P. orchidicola*, in which the lateral lobes of the aedeagus are very strongly

developed, is illustrated in fig. 2. In this species the penial sheath (fig. 3) is exceptionally broad, presumably to accomodate the large aedeagus. Perhaps the lateral aedeagal lobes, which appear to be at least somewhat flexible, and the lateral pockets associated with the vulva in the females of this species, have the sort of lock and key type of relationship that is characteristic of the genitalia in many other insects. If these structures are species specific, as I believe them to be, they may provide morphological characters that can be utilized to help distinguish between species in this taxonomically difficult group of *Pseudococcus*.

#### REFERENCES CITED

- Beardsley, J. W. 1960. A preliminary study fo the males of some Hawaiian mealybugs (Homoptera: Pseudococcidae). Proc. Hawaii. Entomol. Soc. 17:199-243.
- Zimmerman, E. C. 1948. Insects of Hawaii. Vol.5, Homoptera: Sternorhyncha. vi + 464p. University of Hawaii Press, Honolulu.

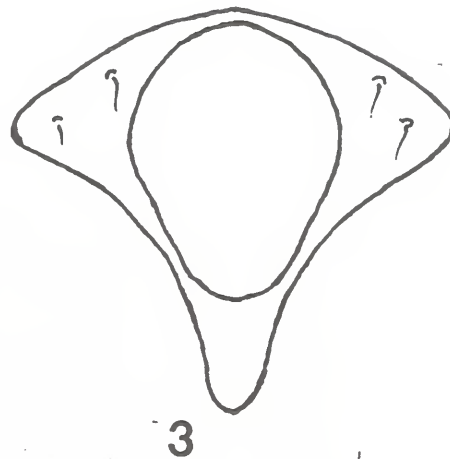
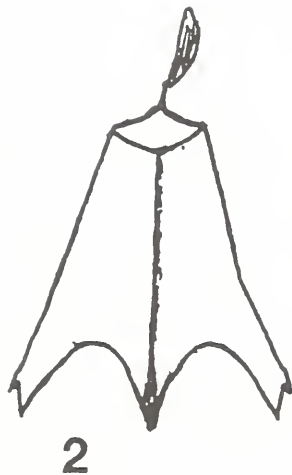
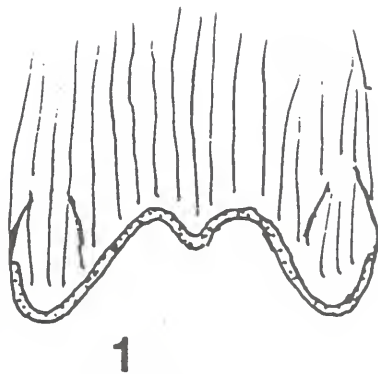


Fig. 1. *Pseudococcus orchidicola* Takahashi, vulva.

Specimen from Suva, Fiji.

Fig. 2. *Pseudococcus orchidicola* Takahashi, aedeagus.

Specimen from Ebeye Islet, Kwajalein Atoll, Marshall  
Is.

Fig. 3. *Pseudococcus orchidicola* Takahashi, penial sheath.

Same specimen as fig. 2.

## Recent Literature

Compiled By Karen Veilleux

Abd-Rabou, S. 1998. An annotated list of hymenopterous parasitoids of armoured scale insects (Hemiptera: Coccoidea: Diaspididae) in Egypt. Page 9 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Eighteen species of hymenopterous parasitoids of armoured scale insects (Diaspididae) were recorded from various host plants in Egypt in a survey between 1994-1997. Ten of these parasitoids were new records from Egypt: Aphelinidae - *Ablerus atomon*, *Aphytis lignanensis*, *A. phoenicis*, *Aphytis* sp., *Coccophagoides* sp., *Encarsia aurantii*, *Marietta leopardina* and *Marietta* sp.; host range and distribution.

Abd-Rabou, S., Hanafi, A. & Hussein, N. 1998. Notes on the parasitoids of the soft brown scale, *Coccus hesperidum* L. (Hemiptera: Coccoidea: Coccidae) in Egypt. Page 9 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Parasitoid species found in association with *Coccus hesperidum* on host plants in different localities in Egypt are *Coccophagus bivittatus*, *C. ishii*, *C. scutellaris*, *Marietta picta*, *Diversinervus elegans*, *Metaphycus flavus*, *M. helvolus*, *Microterys flavus*, *Prochiloneris aegyptiacus*, *Alaptus pallidicornis* and *Scutellista cyanea*.

Abdrashitova, N. 1998. Dendrophilous coccoids (Hemiptera: Coccoidea) of the walnut-fruit forest area of Kyrgyzstan. Page 10 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. 45 coccoid species were discovered belonging to 27 genera and 6 families: Diaspididae, Coccidae, Pseudococcidae, Margarodidae, Eriococcidae and Ortheziidae. *Sphaerolecanium prunastri* was found to be the most numerous and economically important species, causing extensive damage *Prunus sogdiana*. Biological control recommended utilizing such encyrtid parasitoids as *Discodes coccophagus* and *Microterys hortulanus*.

Abeeluck, D. & Walter, G.H. 1997. Mating behaviour of an undescribed species of *Coccophagus*, near *C. gurneyi* (Hymenoptera: Aphelinidae). *Journal of Hymenoptera Research* 6: 92-98.

Notes: Parasite of *Phenacoccus parvus*.

Abou-Elkhair, S. 1998. Surveys of coccoid insects (Hemiptera: Coccoidea) and their parasitoids on some ornamental plants and trees in Alexandria, Egypt. Pages 9-10 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Surveys of the Coccoidea attacking some ornamental plants and trees in Alexandria, Egypt. Their associated hymenopterous parasitoids were also recorded. Surveys revealed the presence of 37 scale insect species belonging to eight families: Asterolecaniidae, Coccidae, Diaspididae, Eriococcidae, Margarodidae, Ortheziidae, Phoenicococcidae and Pseudococcidae.

Acero, S., Tabar, A.I., Alvarez, M.J., Garciak, B.E., Olaguibel, J.M. & Moneo, I. 1998. Occupational asthma and food allergy due to carmine. *Allergy* 53: 897-901.

Notes: Carmine (E120), a natural red dye extracted from the dried females of the insect *Dactylopius coccus* var. *Costa* (cochineal), has been reported to cause hypersensitivity reactions.

Ackonor, J.B. 1997. Preliminary studies on breeding and predation of *Scymnus* (*Pullus*) sp. and *Hyperaspis egregia* Mader on *Planococcoides njalensis* Laing. *Proceedings First International Cocoa Pests and Diseases Seminar* 238-241.

Notes: [Conference held in Accra, Ghana, 6-10 November, 1995.] Predation

and breeding studies were carried out on *Scymnus* sp. and *Hyperaspis egregia* reared from *Planococcoides njalensis* colonies which were sampled from Bieni in Eastern Ghana and kept in petri dishes. Newly emerged adults of the predators were kept singly in glass vials and given 40 2nd- and 3rd-instar nymphs (crawlers) of *P. njalensis* daily for 20-33 days. Missing crawlers were assumed eaten by the predators. Breeding in *H. egregia* was studied by pairing four females with males of comparable age in petri dishes. In the case of *Scymnus* sp., the sexes were undetermined. Therefore four to five adults were kept together in single petri dishes, assuming both sexes were included. *Scymnus* sp. consumed more ( $33.8 \pm 0.7$ ) crawlers per day than both the female ( $29.8 \pm 1$ ) or male ( $25.8 \pm 0.5$ ) *H. egregia*. Apart from preying on live crawlers, the two predators appeared to have eaten dead or moribund crawlers as well. Both beetles mated frequently in captivity but failed to oviposit. Pupation of field-collected larvae lasted  $15.8 \pm 3.8$  days in the female *H. egregia* and  $16.3 \pm 2.5$  days in the male. Adult longevity was  $48.3 \pm 7.9$  days and  $50.0 \pm 8.9$  days in *H. egregia* female and male, respectively. For *Scymnus* sp. pupation lasted  $13.6 \pm 4.5$  days while the adult survived for  $28.4 \pm 11.3$  days in captivity.

Al-Whaibi, M.H. 1997. Some metabolic changes of chlorotic and green leaflets of date palm tree. (In English with summary in Arabic.) Journal of King Saud University, Science 9: 1-9.

Notes: Yellow leaflet samples of 2 date palm trees showing either infection by green scale insects (*Asterolecanium phoenix* (*Palmaspis phoenicis*) or unknown pathogen(s) were compared with healthy green leaflets.

Alford, J., Cronin, M. & Ponsonby, D. 1998. Effect of host plant and selected environmental factors on the abundance of *Pulvinaria regalis* Canard. Page 10 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *Pulvinaria regalis* investigated on its hosts *Tilia*, *Acer* and *Aesculus* in rural and urban areas of Kent and South London related to environmental factors such as stress due to poor growing conditions, traffic volume and nitrogen dioxide levels. Regression analysis showed a significant positive relationship between mean scale insect infestation levels and maximum monthly NO<sub>2</sub> levels.

Allsopp, P.G. & Manners, J.M. 1997. Novel approaches for managing pests and diseases in sugarcane. Pages 173-188. in: Keating, B. & Wilson, J. (Eds.), Intensive sugarcane production: meeting the challenge beyond 2000. Proceedings. CAB International, Wallingford; UK.

Notes: [Conference held in Brisbane, Australia, 20-23 August 1996.] Pest and disease control on sugarcane in Australia is discussed. Novel approaches to minimising impacts of pests and diseases are considered. The major pests of Australian sugarcane are Scarabaeidae and rodents, with *Rhabdoscelus obscurus*, *Inopus rubriceps*, Elateridae and *Eumargarodes laingi* being less important. Management is moving from reliance on synthetic pesticides to pest management systems integrating cultural, biological and insecticidal control. The ability to transform sugarcane plants has opened new opportunities for control of many diseases. The application of strategies for control of viral diseases using novel resistance genes encoding viral coat proteins, replicases and movement proteins are discussed.

Allsopp, P.G. & McGill, N.G. 1997. Variation in resistance to *Eumargarodes laingi* (Hemiptera: Margarodidae) in Australian sugarcane. Journal of Economic Entomology 90: 1702-1709.

Notes: The responses of 24 commercial cultivars and one experimental clone of sugarcane to the margarodid *Eumargarodes laingi* Jakubski were evaluated in a field trial in southern Queensland. Although there were significant quantitative differences between clones in yields over the four crops, the rankings for yield components and for cyst numbers did not differ significantly between crops. Hence, clones could be selected for resistance

, *E. laingi* on the basis of data from one or two years. However, clones that showed good antibiosis/antixenosis resistance to *E. laingi* showed poor resistance to the root pathogen *Pachymetra chaunorhiza*, which may provide a conflict in the breeding program. Combining cultivars should minimize the detrimental impact of *E. laingi* on sugar production.

Alstad, D. 1998. Population structure and the conundrum of local adaptation. Pages 3-21. in: Mopper, S. & Strauss, S.Y., Eds., Genetic Structure and Local Adaptation in Natural Insect Populations: Effects of Ecology, Life History, and Behavior. Chapman & Hall, New York. xix + 449 pp.

Notes: *Nuculaspis californica* is a parasite of *Pinus ponderosa* and 11 other species; review and discussion of theory that these scale populations apparently become adapted to specific host individuals, and population densities can become high only with genetic fitness of the population to the host species and individual; viability of neutral drift hypothesis.

Alvarez, J.M. & Van Driesche, R. 1998. Biology of *Cybocephalus* sp. nr. *nipponicus* (Coleoptera: Cybocephalidae), a natural enemy of euonymus scale (Homoptera: Diaspididae). Environmental Entomology 27: 130-136.

Notes: *Cybocephalus* sp. nr. *nipponicus* Endrody-Younga was introduced into the U.S. as part of a biological control project against euonymus scale, *Unaspis euonymi* (Comstock). Biology discussed. Adult beetles consumed 4.5 times more euonymus scales than San Jose scales, *Quadraspidiotus perniciosus* (Comstock), with high consumption rates of 2-stage male euonymus scales.

Alvarez, J.M. & Van Driesche, R. 1998a. Effect of prey sex, density, and age on oviposition of *Cybocephalus* sp. nr. *Nipponicus* (Coleoptera: Cybocephalidae), a natural enemy of *Euonymus* scale (Homoptera: Diaspididae). (In English with summary in Spanish.) Florida Entomologist 81(3): 429-436.

Notes: *Unaspis euonymi* is the ovipositional prey for this predator; discussion of qualities of individual scales or patches of scale insects as factors that can potentially be used by beetles to select oviposition sites.

Amin, A.H., Madiha, A.R. & Sakr, H.E.A. 1998. Factors responsible for the extinction of *Chrysomphalus ficus* Ashmed from citrus orchards in Egypt. Page 11 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Ecological studies demonstrate that the black armoured scale, *Chrysomphalus ficus* has four overlapping annual generations on naval orange trees in Qalyubia Governorate, Egypt. Five species of natural enemies were recorded on *C. ficus*. The ectoparasitoid, *Aphytis holoxanthus*, was recorded for the first time from Egypt. The endoparasitoids were *Aspidiotiphagus citrinus*, *A. lounsburyi* and *Habrolepis pascuorum* and an entomogenous fungus was *Cladosporium cladosporides*. Timing and effectiveness of chemical control also discussed.

Appelbaum, S. & Gerson, U. 1997. David Rosen: 1936-1997. Phytoparasitica 25(2): 171-174.

Notes: Obituary.

Arai, T. 1997. [The ecology and control of mealybugs on citrus.] (In Japanese.) Shokubutsu Boeki 51: 263-266.

Notes: Species mentioned include *Pseudococcus citriculus*, *P. comstocki*, *P. longispinus*, *Planococcus kraunhiae* and *P. citri*.

Arai, T. 1998. [Discrimination of nymphal stages of *Pseudococcus cryptus* Hempel (Homoptera; Pseudococcidae).] (In Japanese.) Japanese Journal of Applied Entomology and Zoology 42: 24-27.

Notes: Several morphological characteristics of each nymphal stage of *Pseudococcus cryptus* were compared. Antennae of slide-mounted individuals of each stage were observed under a differential interference microscope. The number of antenna segments of the first, second, and third instar, and adult females were 6, 6, 7 and 8, respectively. The length of the second and third antenna segments differentiated the first instar from the second

- instar nymph. Each instar stage was precisely discriminated by the number and length of antenna segments. To discriminate nymphal stages by external appearance, the body length, dorsal wax covering, and 17 paired marginal wax appendages were compared under a stereoscopic microscope. Nymphal stages could not be identified by body length alone. The first instar had only one pair of wax appendages, and the second instar could be distinguished from other stages by the appearance of 17 paired marginal wax appendages. The third instar could be differentiated from adult females by the combination of body length and dorsal waxy covering. The accuracies of the first, second, third instar nymph, and adult female, discriminated by combined observation of body length, dorsal wax covering and 17 paired marginal wax appendages, were 92.0%, 91.4%, 93.4% and 81.8%, respectively.
- Awasthi, V.B.** 1997. Introduction to General and Applied Entomology. Scientific Publishers, Jodhpur, India. vi + 394 pp.
- Notes: This textbook aims to fill a gap between too exhaustive or too brief and research-oriented textbooks, and those which deal with only one part of entomology. Accounts are presented of the morphology, anatomy, physiology and developmental biology of various insect organs and systems. Control and preventive measures against crop and veterinary pests are covered. Various aspects of the lac insect (*Laccifer lacca* (*Kerria lacca*)) are among those species discussed. The book is based upon lectures given by the author.
- Bae, W.I., Shin, S.C. & Kim, Z.S.** 1997. Difference in occurrence of pine needle gall midge and sucking insects in pure-pine and mixed-pine stands. *Journal of Forest Science* (Seoul) 56: 37-43.
- Notes: Results of this study indicate that sucking insects, including unspecified scale insects, have increased population density. Planting mixed pine stands is recommended as a strategy to prevent these insect pests.
- Balu, A., Rajarishi, R., Deeparaj, B. & Durairaj, S.** 1997. Curling and crinkling of teak leaves. *Indian Forester* 123: 775-777.
- Notes: A few unnamed species of mealybugs are among those insects implicated in this disease.
- Baroffio, C.** 1997. [Some aspects of the biology of *Encarsia perniciosi* (Tower) in its host, *Quadraspidotus perniciosus* (Comstock), and application of the results in a biological control program in central Switzerland (Canton Zug).] (In French with summary in English.) *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 70: 323-333.
- Notes: [Original title: Quelques aspects de la biologie de *Encarsia perniciosi* (Tower) dans son hôte, *Quadraspidotus perniciosus* (Comstock). Applications de ces données dans un programme de lutte biologique en Suisse centrale (Canton de Zoug).] The biology of *Encarsia perniciosi* in its host, *Quadraspidotus perniciosus* (SJS), was studied. The aim of the study was to develop a technique for a controlled release of the parasitoid in the field in pumpkins (*Cucurbita maxima*). As a support, pumpkins infested with SJS were used. It was best to have 3 days of contact between the parasitoids and SJS when they were between 6 and 9 days old. The pumpkins with parasitized SJS were transferred to the field 1 month later. After 3 years, the parasitoids were well established. The parasitism rate calculated on branches in the third spring was 75%. A strategy to avoid reinfestation with SJS which escaped parasitism is discussed.
- Bayaa, B., Kumari, S.G., Akkaya, A., Erskine, W. & Makkouk, K.M.** 1998. Survey of major biotic stresses of lentil in South-East Anatolia, Turkey. *Phytopathologia Mediterranea* 37: 88-95.
- Notes: In May, 1996, 47 randomly-selected lentil fields in the main lentil production regions of South-East Anatolia, Turkey, were surveyed for the incidence and severity of diseases (fungal and viral), parasitic weeds and insect pests. Among insect pests, ground pearl (*Porphyrophora polonica*) was among the most damaging.
- Beardsley, J.W.** 1998. *Nipaecoccus nipae* (Maskell), a widespread mealybug that is one member of a species complex. Page 11 in: VIIIth International Symposium

Insect Studies. 41 pp.

: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The most widely distributed form of the mealybug *N. nipae* apparently is a single species that occurs in South America, California, Hawaii, Europe and Asia. A single adult male recovered from Maskell's unmounted type material appears to be the same as the males from California and Hawaii and female morphology and colour of external wax support this conclusion. The species almost certainly originated in the Neotropical region. Morphological and biological evidence for the existence of sibling species of this mealybug is presented, and two of these are named: *N. floridensis* from Florida and *N. neonipae* from Hawaii and Mexico. Further collecting and research on tropical America *Nipaecoccus* is needed to elucidate possible additional siblings in this complex.

Beckh, G. & Lullmann, C. 1998. [Phenol as a natural component in New Zealand honeydew honeys.] Phenol - ein natürlicher Bestandteil neuseelandischen Waldhonigs? (In German with summary in English.) Deutsche Lebensmittel-Rundschau 94: 149-152.

Notes: Many different phenolic substances are known as characteristic components of honey responsible for the honey-specific or source-specific flavour and taste. Phenol itself is generally considered a residue of bee repellents. Maximum limits for phenol in honey are discussed between experts and the trade. In New Zealand honeydew honeys produced by the beech scale insect, *Ultracoelostoma assimile* on *Nothofagus* sp., phenol can be found at concentrations up to 0.2 ppm. Phenol in small amounts (<0.2 ppm) should be considered as a natural component of this type of honey. Discussion of the origin of phenols in honey.

Ben-Dov, Y. & Lit, I.L. 1998. Stabilizing Kerridae as the family-group name of the lac insects (Hem., Coccoidea). Bulletin de la Société Entomologique de France 103(5): 455-456.

Notes: This brief communication confirms Kerriidae's replacement of Tachardiinae and Lacciferidae and establishes it as the family name that will be used on the Scalenet website.

Ben-Yehuda, S., Hada, D., Wysoky, M., Izhar, Y. & Swirski, E. 1998. The importance of oils in the integrated management of the pyriform scale in avocado orchards in Israel. Pages 11-12 in: VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London; Aug. 31st - Sept. 6th, 1998.] Abstract only. History of *Protopulvinaria pyriformis* on avocado in Israel; damage; impact of *Metaphycus stanleyi*, an introduced encyrtid; discussion of chemical control.

Bermuda, Department of Agriculture and Fisheries. 1997. Unwelcome visitors to the island at Christmas. Monthly Bulletin (Department of Agriculture, Fisheries & Parks, Bermuda) 68: 8 pp.

Notes: Species mentioned include *Chionaspis pinifoliae*.

Bernal, J.S., Luck, R.F. & Morse, J.G. 1998. Sex ratios in field populations of two parasitoids (Hymenoptera: Chalcidoidea) of *Coccus hesperidum* L. (Homoptera: Coccidae). Oecologia 116: 510-518.

Notes: Several assumptions and predictions of host-quality-dependent sex allocation theory were studied with data obtained for the parasitoid *Metaphycus stanleyi* on its host, brown soft scale (*Coccus hesperidum*) in a California citrus grove and in the laboratory. Scales ceased growing after parasitization by *M. stanleyi*. Thus, parasitoid fitness gains with host size and adult size were similar in males compared to females. Females consistently emerged from larger hosts than males. Mean host sizes of females versus males, and of solitary versus gregarious parasitoids, varied with the available host size distribution. Only females emerged from hosts in the upper size range, and a variable ratio of males and females emerged from hosts in the lower size range. It was concluded that the sex ratio of field populations of *M. stanleyi* is driven largely by the available size distribution of *C. hesperidum*. In addition, predictions resulting from

theoretical analyses of sex allocation in autoparasitoids were tested with data obtained on *Coccophagus semicircularis* parasitizing brown soft scale in the field. The sex ratio of *C. semicircularis* was consistently and strongly female biased (ca. 90% females). Based on available theoretical analyses, it is suggested that this sex ratio pattern may have resulted from a very low encounter rate of secondary hosts coupled with a strong time limitation in *C. semicircularis* females. This explanation was the most plausible, given constraints stemming from the detection of secondary hosts, their variable location within primary hosts, and their handling times. Finally, the size of hosts which yielded single versus multiple parasitoids, and the sizes of these parasitoids, were compared. These comparisons suggested that: (1) *M. stanleyi* females gauge host sizes precisely, and in terms of female offspring; thus a fitness penalty is not incurred by females which share a host, while males benefit from sharing a host, and; 2) instances where multiple *C. semicircularis* emerged from a single host were probably the result of parasitism by different females, or during different encounters by a single female.

**Bhattacharya, A., Jaiswal, A.K., Sharma, K.K. & Mishra, Y.D.** 1997. Evaluation of diflubenzuron on *Eublemma amabilis* Moore (Lepidoptera: Noctuidae) - a predator of lac insect, *Kerria lacca* (Kerr). Journal of Entomological Research. New Delhi 21: 365-369.

Notes: The toxicity of diflubenzuron (as Dimilin 25 WP) was evaluated against larvae of *Eublemma amabilis*, a highly destructive lepidopterous predator of lac insects, *Kerria lacca*.

**Bhattacharya, A., Naqvi, A.H., Sen, A.K. & Mishra, Y.D.** 1998. Artificial rearing of *Pseudohypatopa pulverea* Meyr. - a predator of lac insect, *Kerria lacca* (Kerr). Journal of Entomological Research. New Delhi 22: 83-87.

Notes: Nutrition; biological characteristics i.e., duration of each instar, and morphological parameters such as length of larvae, width of head capsule and dimension of adult reared in artificial diets were at par with those reared under natural condition. The adult moths which laid eggs only on lac encrusted twigs in nature were made to lay eggs on artificial substrates, (sand and emery paper).

**Bhattacharya, A., Sushil, S.N., Mishra, Y.D., Jaiswal, A.K. & Sharma, K.K.** 1998. Effect of UV light on eggs of *Eublemma amabilis* Moore (Lepidoptera: Noctuidae). Insect Environment 4: 15-16.

Notes: One- to 3-day-old eggs of *Eublemma amabilis*, a serious predator of lac insects (*Kerria lacca*), were exposed to ultraviolet radiation in a closed chamber at 55 cm from a 30-watt light source for 5, 10, 20 or 25 min. Percentage mortality ranged from 24.07 to 90.99 after 5 and 25 min exposure, respectively, as compared to 6.78 in the control. These findings may be used for the rearing of egg parasitoids in the laboratory.

**Bhuiya, B.A.** 1998. Two new species of Encyrtidae (Hymenoptera: Chalcidoidea) from Bangladesh attacking *Pulvinaria psidii* Maskell (Homoptera: Coccidae) on guava. Oriental Insects. New Delhi 32: 267-277.

Notes: Two new species of Encyrtidae (Hymenoptera: Chalcidoidea), namely *Aschitus zakeri*, sp. nov. and *Paraphaenodiscus momawari*, sp. nov. are described from Bangladesh parasitizing early stages of *Pulvinaria psidii* Maskell (Coccidae).

**Blackmer, J.L. & Hanson, P.** 1997. Abundance and life history of two gall-inducing homopterans on *Nectandra salicina* (Lauraceae) in Monteverde, Costa Rica. Revista de Biología Tropical 45: 1131-1137.

Notes: This paper presents information on the abundance and life-history characteristics of two gall-inducing homopterans and a parasitic wasp that occur on *Nectandra salicina* (Lauraceae). The more common gall replaced the fruit and contained *Trioza* sp. (magnoliae group). The stem gall contained a Coccoidea sp. (Homoptera), *N. salicina* were heavily infested with the psyllid gall, the mean ratio of galled to normal fruit was 6.2:1. Galls had one to three chambers, with 2.0 plus or minus 0.1 individuals per chamber and 3.0 plus or minus 0.2 psyllids per gall. *Trioza* sp. had four instars

and at the time of collection 71% of the psyllids were 3rd or 4th instar. The galls increased in size as the number and size of the psyllids, and the number of chambers increased. Eighteen percent of the 3rd and 4th instar psyllids were parasitized by *Metaphycus electra*. Thirty-three percent of galls containing 3rd or 4th instar psyllids had one or more parasitoid, and within these attacked galls 69% of the psyllids were parasitized. The likelihood of a gall being attacked by *M. electra* had less to do with the size of the gall than with the frequency distribution of the various gall sizes. Similar to the *Trioza* sp. galls, the size of the Coccoidea galls increased as the mother matured and the number of offspring increased.

Blair, B.W. 1998. Insect pests of lawns in Rhodesia. Rhodesia Agricultural Journal 2446: 37-39.

Notes: *Antonina graminis* and *A. natalensis* are among the pests discussed; brief descriptions; chemical control recommendations.

Blank, R.H., Gill, G.S.C. & Dow, B.W. 1997. Determining armoured scale distribution within kiwifruit blocks. Pages 293-297 in: Proceedings of the Fiftieth New Zealand Plant Protection Conference. New Zealand Plant Protection Society, Rotorua, New Zealand.

Notes: [Conference held at Lincoln University, Canterbury, New Zealand, 18-21 August, 1997.] *Hemiberlesia rapax*, *H. lataniae* and *Aspidiotus nerii* are most common species found on *Actinidia deliciosa*.

Blank, R.H., Olson, M.H., Gill, G.S.C. & Dow, B.W. 1997. Timing of insecticide applications for control of soft wax scale (Homoptera: Coccidae) on citrus. New Zealand Journal of Crop and Horticultural Science 25: 311-317.

Notes: The efficacy of four insecticide treatments-buprofezin, chlorpyrifos, 1 and 2% mineral oil, applied at four single, and a double application time, was evaluated against soft wax scale, *Ceroplastes destructor* Newstead, on 'Seminole' tangelo (*Citrus paradisi* (Macfadyen) times *C. reticulata* (Blanco)) in Kerikeri, New Zealand. The 1% mineral oil treatment was the preferred choice in an integrated pest management programme.

Blumberg, D., Ben Dov, Y. & Mendel, Z. 1998. The citriculus mealybug, *Pseudococcus cryptus* Hempel, in Israel: History and present situation. Page 12 in International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Occurrence and abundance of this mealybug population on citrus in Israel; impact of *Clausenia purpurea*, imported from Japan; impact of chemical control techniques; list of other biological control agents.

Boecklen, W.J. & Mopper, S. 1998. Local adaptation in specialist herbivores: theory and evidence. Pages 64-88. in: Mopper, S. & Strauss, S.Y., Eds., Genetic Structure and Local Adaptation in Natural Insect Populations: Effects of Ecology, Life History, and Behavior. Chapman & Hall, New York. xix + 449 pp.

Notes: Examples mentioned include *Nuculaspis californica* on *Pinus ponderosa*, *Pseudaulacaspis pentagona*, *Cinara cupressi* on *Cupressus lusitanica*, *Cryptococcus fagisuga* on *Fagus sylvatica*, *Matsucoccus acalyptus* on *Pinus edulis* and *P. monophylla*.

Bogo, A., Watson, G.W. & Mantle, P.G. 1998. The sugar composition of honeydew excreted by *Stigmacoccus asperhempel* (Coccoidea: Margarodidae: Xylococcinae) feeding on leguminous trees in Brazil. Page 13 in: VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Flying insects were recently observed attending mature leguminous trees (*Schizolobium excelsum*) in Brazil; their trunks were black with sooty mould and bore numerous, protruding hyaline wax filaments, each with a droplet of honeydew at its tip. The insects producing the honeydew have been identified as *Stigmacoccus asper* (Coccoidea: Margarodidae: Xylococcinae). Preliminary analysis of the honeydew sugars has revealed a complex composition. The principal sugar was

sucrose, but there were significant proportions of fructose, glucose and three oligosaccharides. One of the latter has been tentatively characterized as melezitose, a trisaccharide. Although the sugar composition of the tree sap has yet to be determined, the findings imply significant metabolic transformations of sugars, consistent with passage through an insect with a discontinuous gut.

**Bohidar, K.** 1998. The taxonomic relationship of some Coccoidea (Hemiptera) based on male characteristics. Pages 12-13. in: VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Male characters of species from five different families were studied and the taxonomic status of the families are described. A key of characters provided for adult males. The quantitative evaluation method was applied to assess the relationship between the families. All the characters included were regarded as being of equal importance and those shared by any one family exhibited some differences, justifying the recognition of the taxon as a distinct family. It was found that the Margarodidae were the most primitive group followed by Pseudococcidae. The Diaspididae showed the maximum number of specialised characters, while the Coccidae and Dactylopiidae fell between the Diaspididae and the Pseudococcidae. The Coccidae and Dactylopiidae share an equal number of characters with the Pseudococcidae and are considered to be close to each other.

**Bokonon-Ganta, A.H.; Alphen, J.J.M. van & Neuenschwander, P.** 1997. Competition between two parasitoids of the mango mealybug. International Institute of Tropical Agriculture, Research No. 14-15: 14-18.

Notes: The competition between the encyrtids *Gyranusoidea tebygi* and *Anagyrus mangicola*, exotic parasitoids of *Rastrococcus invadens*, was studied in the laboratory.

**Booth, R.G.** 1998. A review of the species resembling *Chilocorus nigrita* (Coleoptera: Coccinellidae): Potential agents for biological control. Bulletin of Entomological Research 88(4) 361-367.

Notes: *Chilocorus nigrita* (Fabricius) is a well-known predator of scale insects. It has been widely used for biological control and has spread naturally beyond its previous native range over the last three decades or so. Three other Oriental species closely resembling *C. nigrita* can now be separated.

**Borowka, R. & Hummel, H.E.** 1997. Olfactometric response of one introduced exotic and two indigenous coccinellid beetle predators of the cassava mealybug in Malawi. Mitteilungen der Deutschen Gesellschaft für Allgemeine und Angewandte Entomologie. Bremen 11: 529-532.

Notes: [Proceedings of the German Society for General and Applied Entomology, Bayreuth, Germany, 18-22 March 1997.] Olfactometry was used to measure the reactions of 3 coccinellid predators of the cassava pests *Phenacoccus manihoti* and *P. madeirensis*; these were *Diomus hennesseyi*, *Exochomus troberti* and *Hyperaspis aestimabilis*. Females of *D. hennesseyi* reacted clearly to the odour of the pest on cassava leaves. Females of *H. aestimabilis* gave a similar reaction, while no reaction was observed in males of either species. On cassava leaves infested with *P. madeirensis*, only female *H. aestimabilis* reacted significantly. *E. troberti* showed no significant reaction to either pest.

**Borowka, R., Neuenschwander, P. & Hummel, H.E.** 1997. Reaction of two cassava cultivars to cassava mealybug attack under conditions favoring high pest infestation in Malawi. Mededelingen Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent 62: 289-299.

Notes: Each of the two local cassava cultivars Gomani and Koroweka confirmed good adaptation to the difficult growth conditions of a marginal location on the shore of lake Malawi. They reacted to the beginning of the dry season with a reduction of the above soil biomass and the approaching end of the dry season led to a reduced leaf area. During the dry season the

plants were living from the reallocated energy resources of their roots. A chemical exclusion of the predominant and well-established exotic parasitoid *Apoanagyrus (Epidinocarsis) lopezi* De Santis (Hym., Encyrtidae) and other beneficials indicated reductions in root yield in both cultivars and changes in other assessed plant parameters. As this experiment reconfirmed the impact of efficient biological control of the cassava mealybug, *Phenacoccus manihoti* Matile-Ferrero (Hom., Pseudococcidae), it also indicated agronomic strategies for the improvement of cassava production under marginal conditions.

Borroto, E.G., Cintra, M., Gonzalez, J., Borroto, C. & Oramas, P. 1998. First report of a closterovirus-like particle associated with pineapple plants (*Ananas comosus* cv. Smooth Cayenne) affected with pineapple mealybug wilt in Cuba. *Plant Disease* 82: 263.

Notes: [Abstract only] Leaves from wilt-affected pineapple plants, collected from the Experimental Station "Tomas Roig" at Ciego de Avila, Cuba, and asymptomatic plants derived from meristem tissue and cultivated under greenhouse conditions were analysed by several virus purification procedures. Partially purified samples from symptomatic and asymptomatic plants were negatively stained and examined by transmission electron microscopy. Long, flexuous, rod-shaped, virus particles were observed in symptomatic leaves. These particles were similar to those of the pineapple wilt-associated closterovirus found in Hawaii and Australia. This is the first report of closterovirus-like particles associated with pineapple plants affected with pineapple mealybug wilt in Cuba. Individual mealybug species not mentioned.

Boursiquot, J.M. 1997. [The development of viticulture in Chile.] L'évolution de la viticulture au Chili. (In French.) *Progrès Agricole et Viticole* 114: 8, 177-181.

Notes: During the period 1994-97, viticulture and wine production in Chile expanded considerably, taking advantage of markets in America, northern Europe and Asia. The main cultivars are Cabernet Sauvignon, Pais, Muscat d'Alexandrie, Chardonnay, Sauvignon, Semillon, Merlot and Torontel, with another 14 grown in 1996. Grafting onto a range of rootstocks has recently been introduced, with mixed results, and a number of different training systems are used. The main pest is the soil insect *Margarodes vitium* [*M. vitis*], which feeds on the roots and can kill the vines.

Brown, M.W. & Puterka, G.J. 1997. Orchard management effects on the arthropod community on peach with comparison to apple. *Journal of Entomological Science* 32: 165-182.

Notes: *Quadraspidiotus perniciosus* among the 162 species recorded in this survey.

CAB International. 1997b. *Parasaissetia nigra*. Distribution Maps of Pests, Series A, Agricultural Map no. 573: 2 pp.

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.

CAB International 1998. *Lopholeucaspis japonica*. Distribution Maps of Pests, Series A, Agricultural Map no. 582: 2 pp.

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.

CAB International 1998a. *Rastrococcus invadens*. Distribution Maps of Pests, Series A, Agricultural Map no. 585: 2 pp.

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.

Cabaleiro, C. & Segura, A. 1997. Field transmission of grapevine leafroll associated Virus 3 (GLRa V-3) by the mealybug *Planococcus citri*. *Plant Disease* 81: 283-287.

Notes: Analysis of spatial distributions of grapevine leafroll in nine

vineyards in the Galician wine-growing regions of northwestern Spain; in five, significant aggregations of diseased plants and/or disease gradients toward one of the borders of the plots constituted indirect evidence of vector transmission by a nonflying vector; *P. citri* associated with the infected plants; other mealybugs mentioned as vectors are *Pseudococcus longispinus*, *P. affinis* and *Planococcus ficus*; *Pulvinaria vitis* also mentioned as possible vector.

Cabaleiro, C. & Segura, A. 1997a. Some characteristics of the transmission of grapevine leafroll associated virus 3 by *Planococcus citri* Risso. *European Journal of Plant Pathology* 103(4): 373-378.

Notes: Some characteristics of the acquisition and transmission of GLRaV-3 by *Planococcus citri* were determined by ELISA testing and transmission experiments. Groups of five insects were used, i.e. the advisable minimum group size suggested by the results of ELISA of insect groups of various sizes. The virus was transmitted to only 1/10 test plants each of which had been exposed to a group of insects fed on GLRaV-3 infected plants for at least three days, even though more than 80% of the insect groups were expected to contain viruliferous individuals under these conditions. Viruliferous mealybugs transferred to potato plants could retain the virus for up to 24 h, but lost the capacity for effective transmission to vines within 1 h after transfer. In newly infected vines, the virus remained latent or undetectable by ELISA for at least 13 months.

Cadée, N. & Van Alphen, J.J.M. 1997. Host selection and sex allocation in *Leptomastidea abnormis*, a parasitoid of the citrus mealybug *Planococcus citri*. *Entomologia Experimentalis et Applicata* 83(3): 277-284.

Notes: *Leptomastidea abnormis* (Girault) and *Leptomastix dactylopii* (Howard) (Hymenoptera: Encyrtidae) are the two parasitoid species frequently used for biological control of the citrus mealybug *Planococcus citri* (Risso) (Homoptera: Pseudococcidae). As part of a programme to determine the best control practice, host size selection and sex allocation were studied in *L. abnormis*, and compared with those of *L. dactylopii*. *L. abnormis* showed a preference for the second size class, but also attacked third and fourth size class and adult mealybugs, while in previous studies *L. dactylopii* was found to prefer the third and fourth size class and adults, and never attacked second size class mealybugs. Female *L. abnormis* reared from parasitized mealybugs had a higher mean body mass than males, as is predicted by Charnov's theory on sex allocation. However, sex ratios of emerging *L. abnormis* did not differ between mealybug size classes. These results imply possible coexistence of the two parasitoids. As field evidence suggests a more complex interaction between the two species, studying direct competition would be a useful next step.

Calatayud, P.A., Delobel, B., Guilaud, J. & Rahbé, Y. 1998. Rearing the cassava mealybug, *Phenacoccus manihoti*, on a defined diet. *Entomologia Experimentalis et Applicata* 86: 325-329.

Notes: Brief review of biology and attempts to control this major pest of *Manihot esculenta*; this research designed to provide knowledge of nutritional requirements of phloem-feeding insects; similar data previously supplied for *Planococcus citri* and *Acyrtosiphon pisum*.

Calatayud, P.A. & Le Ru, B. 1997. [Control of the cassava mealybug in Africa.] *La lutte contre la cochenille du manioc en Afrique*. (In French with summary in English.) *Cahiers de la Recherche Développement* No. 43: 59-66.

Notes: Since the first detection of the pest in Africa in the Congo and Zaire in 1973, cassava crops have been damaged by the cassava mealybug, *Phenacoccus manihoti*. This oligophagous pest reproduces by thelytokous parthenogenesis and feeds on the sap of cassava. Biological control (particularly using the parasitoid *Epidinocarsis lopezi* (*Apoanagyrus lopezi*)) and the use of resistant varieties to control the pest are briefly described.

Calatayud, P.A., Rouland, C. & Le Ru, B. 1997. [Influence of linamarin in the cassava-mealybug system.] *Influence de la linamarine dans la relation manioc-*

cochenille. (In French with summary in English.) Acta Botanica Gallica 144: 427-432.

Notes: Cassava *Manihot esculenta* Crantz (Euphorbiaceae) is distinguished by the presence of cyanid compounds in leaves, stems and tubers. In plant's tissues, -CN group is linked with D-glucose to form cyanogenic glucosides: mainly linamarin. In Congo, the cassava mealybug *Phenacoccus manihoti* Matile-Ferrero (Homoptera: Pseudococcidae) is the major pest of cassava. This insect is living mainly on genus *Manihot*. This oligophagy of *P. manihoti* towards cassava suggests that the mealybug is adapted to secondary compounds of its host plant, and more particularly to linamarin. This specialization supposes the presence of an enzymatical fittings adjusted. In fact, our results show that this insect has a linamarase (participating in hydolysis of linamarin), an endogenous and an inductive enzyme in cassava mealybug. As other insects, *P. manihoti* has an enzymatical fittings hydolysing linamarin. In this insect, the use of hydolysis products is discussed.

Ceballo, F.A., Papacek, D. & Walter, G.H. 1998. Survey of mealybugs and their parasitoids in south-east Queensland citrus. Australian Journal of Entomology 37(3): 275-280.

Notes: Mealybugs in Queensland citrus receive regular control measures, but have never been surveyed for species composition or for their associated parasitoids. We collected infested fruits regularly between February 1994 and May 1995 at Mundubbera, Nambour, and Brisbane in south-east Queensland. More than 650 fruits and twigs were sampled from citrus trees and nearby plants. The citrus mealybug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae), accounted for virtually all mealybugs collected. Ten species of hymenopteran parasitoids were recovered. The pteromalid *Ophelosia* sp. and four Encyrtidae (*Anagyrus* sp., *Coccidoxenoides peregrinus*, *Leptomastix abnormis* and *Leptomastix dactylopii*) were the most common species and are primary parasitoids of mealybugs. A hyperparasitic signiphorid, *Chartocerus* sp., was also present, as were males of an unidentified encyrtid species with indeterminate host relationships. The three remaining species were Aphelinidae (*Myiocnema comperei*, *Euryishia* sp., *Coccophagus* sp.) and were uncommon in samples. Parasitism was never higher than 3%.

Cech, T. & Perny, B. 1998. [Pine decline in the Tyrol.] Kiefernsterben in Tirol. (In German with summary in English.) Forstschutz-Aktuell. No. 22: 12-15.

Notes: Scots pine (*Pinus sylvestris*) trees along the Upper Inn Valley, Tyrol, Austria are affected by a decline, which began in 1989. Specific site conditions and site stresses as main causes as well as the role of mistletoes, scale insects and sapwood nematodes are discussed.

Cermeli, M. & Geraud-Pouey, F. 1997. *Capulina* sp. near *jaboticabae* von Ihering (Homoptera: Coccoidea, Eriococcidae) new pest of guava in Venezuela. *Capulina* sp. cercana a *jaboticabae* von Ihering nueva plaga del Guayabo en Venezuela. (In Spanish with summary in English.) Agronomía Tropical 47: 115-123.

Notes: First record of this Eriococcid on *Psidium guajava*; description of damage; natural enemies; distribution.

Chai, X.M. 1997. Research on population variation of natural predators of *Matsucoccus matsumurae*. (In Chinese with summary in English.) Journal of Nanjing Forestry University 21: 36-39.

Notes: When there was simultaneous occurrence of the pine blast scale *M. matsumurae* and the pine aphid *Cinara pinitabulae*, the population of the predators increased considerably, and they were more inclined to prey on the latter. *Sticholotis punctus*, *Exochomus monol* and *Sospita chinensis* preyed on the scales, while *Ballia obscurosignata* preyed mainly on the aphids.

Chai, X.M. 1998. [A study of the natural predators of the pine bast scale.] (In Chinese with summary in English.) Scientia Silvae Sinicae 34: 58-62.

Notes: A study was carried out to examine the number of predators and predation capabilities along with mortalities of the pine bast scale, *Matsucoccus liaoningensis* (*Matsucoccus matsumurae*), inside a sampling plot, and by applying the K-value graphic analysis method. The stage primarily preyed upon was the female imago, rarely the egg sac. The main species of predator were *Harmonia axyridis*, *Sticholotis punctata*, *Exochomus mongol*, *Iridomyrmex anceps* and *Polyrhachis dives*.

Chandrababu, A., Gautam, R.D. & Garg, A.K. 1997. Feeding potential and associated behaviour of predatory beetle, *Brumoides suturalis* (Fabricius). *Annals of Plant Protection Sciences* 5: 1, 53-60.

Notes: Feeding and associated behaviour of *Brumoides suturalis* was studied on 3 species of mealybugs, *Ferrisia virgata*, *Planococcus pacificus* [*P. minor*] and *Maconellicoccus hirsutus*, and one species of aphid (*Aphis craccivora*) at a temperature of  $25 \pm 2^\circ\text{C}$  and  $65 \pm 5\%$  RH. The feeding efficiency of the predator increased progressively with the development of the larval stages of the predator. Discussion of the average number of 2nd-instar nymphs of *P. pacificus*, *M. hirsutus*, *F. virgata* and *A. craccivora* consumed by 1st- to 4th-instar larvae. Females consumed food faster than males. The speed of movement of larvae also increased with the development of different larval instars. Larval mortality due to cannibalism was about 15.6% in group rearings.

Charlet, L. 1997. Pink Hibiscus mealybug. *IOBC Newsletter* 66: 6-7.

Notes: Distribution of *Maconellicoccus hirsutus* in the Caribbean; brief description of damage to hosts; mentions introduction of *Gyranoidea indica* for control.

Charlet, L. 1997a. Pink Hibiscus mealybug. *Newsletter* (International Organization for Biological Control) 19: 4.

Notes: Report of invasion of *Maconellicoccus hirsutus* into U.S. Virgin Islands, Puerto Rico, St. Kitts, Trinidad, Tobago, Grenada and other Caribbean islands; hosts include coffee, cotton, soybeans and citrus.

Charles, J.G., Froud, K.J. & Henderson, R.C. 1998. Morphological variation in the mealybugs *Pseudococcus calceolariae* and *P. similans* (Hemiptera: Coccoidea: Pseudococcidae). Pages 13-14 in: VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Examination of slide-mounted laboratory-reared daughters from isolines of *Pseudococcus calceolariae* and *P. similans* mothers collected from two widely separated locations in the North Island of New Zealand has thrown doubt on the validity of the defining characters of the species. For *P. similans*, the number and position of oral rim tubular ducts varied widely and sometimes fell outside the defined species limits. In addition, the characteristic 'stout abdominal setae' were lost in the F1 generation. The combinations of leg-length and number of oral rim tubular ducts which separate *P. calceolariae* (Maskell) from *P. similans* co-existed in cohorts of F1 sisters and both character-sets could be manipulated by changing the temperature at which the mealybugs developed. Mating studies are proposed to investigate whether the two species are valid, or whether they merely represent the phenotypic extremes of one widely polymorphic species.

Charmillot, P.J., Baillod, M., Bloesch, B., Linder, C. & Pasquier, D. 1997. [Management strategies for insect pests in deciduous fruit orchards.] *Strategies de lutte contre les principaux ravageurs des arbres fruitiers*. (In French.) *Revue Suisse de Viticulture, d'Arboriculture et d'Horticulture* 29: 39-44.

Notes: Integrated pest management strategies for the major arthropod pests in apple and pear orchards in western Switzerland are discussed. The major pests include *Quadraspidiotus perniciosus*. The strategies presented include biological control, mating disruption, insect growth regulators and chemical control.

Cheah, L.H. & Irving, D.E. 1997. Kiwifruit. Pages 209-227. in: Mitra, S.K.,

Ed., Postharvest Physiology and Storage of Tropical and Subtropical Fruits. CAB International, Wallingford, England, UK. 423 pp.

Notes: Important quarantine pests include *Hemiberlesia rapax*, *H. lataniae*, *Aspidiotus nerii* and *Quadraspidiotus perniciosus*; chemical control recommendations.

Chen, X.M.; Chen, Y., Wang, S.Y., Mao, Y.F., Feng, Y. & Ye, S. 1998. [The radiation experiment for lac insects.] (In Chinese with summary in English.) Forest Research 11: 382-387.

Notes: Different stages of the lac insects (*Kerria chinensis* and *K. lacca*) were radiated by several dosages of Co 60. Results showed complete mortality of second stage lac insects after radiation of 500-2000 rad, females of *K. chinensis* with eggs radiated by 1000 rad can still produce new generation. *K. lacca* females with eggs radiated by 11000 rad can occasionally produce new generation. The egg amount and amount of secreting lac are similar to those of the normal, effective production and sex ratio are higher than those of the normal, group density on branch is lower than the normal in the generation of *K. lacca* after radiation. The sex ratio of the female, group density on branch are higher than those of the normal, egg amount and amount of secreting lac are normal in the generation of *K. chinensis* after radiation.

Chen, X.M., Chen, Y., Ye, S., Mao, Y.F., Wang, Z. & Wang, S. 1997. Studies on hatching behavior of Chinese white wax scale (*Erikerus pela*). (In Chinese with summary in English.) Forest Research 10: 149-153.

Notes: *Erikerus pela*; hatching success; effects of temperature.

Chen, X.M., Chen, Y., Zhou, C.H., Wang, Z.L. Ye, S.D. & Wang, S.Y. 1998. Studies on wax secretion of Chinese white wax scale (*Erikerus pela* Chavannes). I: The comparison of wax secretion of different geographic varieties. (In Chinese with summary in English.) Forest Research 11: 34-38. Notes: Wax secretion from *E. pela* from 3 different regions in China was compared. The differences in secretion levels between the 3 groups were related to the activities of esterase and peroxidase levels.

Chen, Y.G. & Hu, D.X. 1998. [Interspecific interaction between *Hemiberlesia pitysophila* Takagi (Homoptera: Diaspididae) and its parasite *Coccobius azumai* Tachikawa (Hymenoptera: Aphelinidae).] (In Chinese with summary in English.) Natural Enemies of Insects 20: 136-142.

Notes: A set of differential equations was established to describe the interaction between *Hemiberlesia pitysophila* and *Coccobius azumai* based on population data from the field in Huidong and Gaoming, Guangdong, China, during 1993-95. The pest and parasitoid were found to coexist, under low population densities, characterized by a long parasitoid-releasing period.

Chen, C.C., Ko, W.H. & Liao, C.T. 1997. A survey on the wild host plants and life cycle of *Brevennia rehi* (Lindinger) in Taiwan. (In Chinese.) Bulletin of Taichung District Agricultural Improvement Station No. 57: 49-54.

Notes: The occurrence of *B. rehi* on *Oryza sativa*, *Panicum maximum*, *Echinochloa crusgalli* var. *oryzicola*, *Eleusine indica*, *Paspalum distichum* and *Leptochloa chinensis* is noted, and symptoms of damage described. The developmental stages of the pest are described.

Chen, S.L., Wu, H. & Ye, J.X. 1997. Bionomics and control methods of *Kermococcus roboris* (Four). (In Chinese with summary in English.) Wuyi Science Journal 13: 176-181.

Notes: In field studies conducted in Fujian, China, the kermesid *Kermococcus roboris* had one generation each year and overwintered as second-instar nymphs. The most effective level of control was obtained using 50% mevinphos, 40% dimethoate and 80% DDVP (dichlorvos).

Chen, X.M., Ye, S., Chen, Y., Mao, Y.F., Wang, Z.L. & Wang, S.Y. 1997. Studies on distribution characteristics of Chinese white wax scale. Forest Research 10: 415-419.

Notes: The distribution of *Erikerus pela* (a coccid used for wax production in forest plantations in China) on host trees of *Ligustrum lucidum* and *Fraxinus chinensis* relates to the direction and position of the branches,

- and varies with sex and developmental stages of the insect.
- Cheng, Z.S. 1997. Test on effect of some preparations to control *Unaspis yanonensis* Kuwana. (In Chinese with summary in English.) Journal of Zhejiang Forestry Science and Technology 17: 38-40.
- Chi, D.F., Miao, J.C., Qu, H., Xiang, W.J., Li, C.Y., Lu, C.J. & Yi, L.S. 1997. Control of *Quadraspidiotus gigas* and *Lepidosaphes salicina* using insect growth regulator, RH-5849. (In Chinese with summary in English.) Journal of Northeast Forestry University 25: 10-14.
- Notes: 1,2-dibenzoyl-1-tert-butylhydrazine (the insecticide RH-5849) was tested in Heilongjiang province, northeast China, in the middle of May 1994 to coincide with the emergence of the target pests after overwintering. Between 86 and 98% of 2nd-instar larvae of *Quadraspidiotus gigas* (*Diaspidiotus gigas*) were killed by spraying RH-5849 in oil, diluted to 0.5-3%, on *Populus xiaohei*. Using RH-5849 in July against 1st-instar larvae which had emerged that year was equally effective. Mortality of *Lepidosaphes salicina* eggs and larvae varied between 93% and 100% with 1-3% RH-5849. When formulated as a 25% wettable powder and sprayed in June, 91-95% of 1st-instar larvae were killed. Natural enemies were unaffected by RH-5849 when tested in the laboratory and in the field.
- Chi, D.F., Shao, J.W., Sun, F., Wang, C.Y., Mu, Y.J. & Zhou, Z.Y. 1997. Effects of phytoecdysones from *Ajuga* plants on the nymphs of pests with piercing-sucking mouthparts and their natural enemies. (In Chinese with summary in English.) Journal of Northeast Forestry University 25: 91-96.
- Notes: Nymphs of *Aphrophora intermandia*, *Parthenolecanium corni* and *Myzus persicae* kept on plants cultivated in a phytoecdysone solution extracted from *Ajuga multiflora*, *A. multiflora* var. *brevispicata*, *A. multiflora* var. *serotina* and *A. linearifolia* were significantly affected by these extracts. More than 90% mortality of *Aphrophora intermandia* was recorded. Natural enemies were not affected.
- Chi, D.F., Zhang, F.B., Hu, Y.Y. & Sun, Y. 1997. The influence of the kairomone of *Quadraspidiotus gigas* and oviposition deterring pheromone in parasitoids on the control ability of these parasitoids. (In Chinese with summary in English.) Journal of Northeast Forestry University 5: 15-21.
- Notes: A kairomone occurring mainly in the scale of *Quadraspidiotus gigas* (*Diaspidiotus gigax*) helps *Pteroptrix longiclava* and *Encarsia gigas* find their host for oviposition so as to keep the host population at a low level. Experiments showed that after oviposition by *P. longiclava* and *E. gigas* on their hosts, some chemical compounds with an oviposition-detering effect were left on the parasitized hosts. The existence of these compounds can significantly reduce the occurrence of superparasitism or multiparasitism, assure that the parasitoids in the bodies of *Q. gigas* have sufficient nutrition, and allow the parasitoids maximum use of the limited number of eggs.
- Choi, K.S., Lee, S.G. & Shin, S.C. 1997. [Selection of a low toxic insecticide for aerial control of the black pine bast scale, *Matsucoccus thunbergianae*.] (In Korean with summary in English.) Journal of Forest Science (Seoul) 56: 82-86.
- Notes: Stem injection of a systemic insecticide such as Phosphamidon 50% Lq and thinning are commonly applied to control the black pine (*Pinus thunbergii*) bast scale, *Matsucoccus thunbergianae* in the Korea Republic. However, both these methods have high labour costs, so aerial spraying with a low toxicity insecticide was tested as an alternative. Buprofezin 40% SC was selected as a low toxicity pesticide, and was applied as 100 litres/ha in 50-80x dilution. Both dilutions, used at different locations, gave about 80% mortality of the intermediate nymph stage under all conditions. The effective application period for this aerial control method was in early March.
- Cipolla, C., Lugo, G., Sassi, C., Belisario, A., Nucci, M.C., Palermo, A., Pescarelli, M.A., Nobile, M. & Raffi, G.B. 1997. [Hypersensitivity and allergic diseases in a group of workers employed in breeding insects for

- cal pest control.] Sensibilizzazioni e patologia allergica in un gruppo di lavoratori addetti all'allevamento di insetti utili per la lotta biologica. (Italian with summary in English.) *Medicina del Lavoro* 88: 3, 220-225.
- Notes: On the basis of the results of a previous study and immuno-allergological tests, a group of 21 workers employed in breeding insects for biological pest control in Italy were studied to ascertain whether any new sensitizations to arthropods had occurred and whether any new allergic diseases were observed. The results confirmed a high sensitization to *Ephestia kuehniella* and to *Orius* sp. Sensitization to *Tetranychus urticae* and to *Planococcus citri* were observed, although to a lesser degree. It is concluded that the insects used in biological pest control are highly allergenic and that the protective devices used in this case were ineffective. The authors recommend the use of closed or semi-closed rearing chambers along with local ventilation equipment.
- Cobb, N.S. & Whitham, T.G. 1998. Prevention of deme formation by the pinyon needle scale: problems of specializing in a dynamic system. Pages 37-63. in: Mopper, S. & Strauss, S.Y., Eds., Genetic structure and local adaptation in Natural insect populations: effects of ecology, life history, and behavior. Chapman & Hall, New York. xix + 449 pp.
- Notes: No evidence found to support deme formation (DF) hypothesis, whereby insect herbivores became genetically adapted to individual host trees; mechanisms that could prevent deme formation by *M. acalyptus* on individual trees examined.
- Coll, M. & Abd-Rabou, S. 1998. Effect of oil emulsion sprays on parasitoids of the black parlatoria, *Parlatoria ziziphi*, in grapefruit. *Biocontrol* 43: 1, 29-37.
- Notes: The black parlatoria, *Parlatoria ziziphi*, a common pest of citrus in the tropics and subtropics, has become the most important citrus pest in Upper Egypt. Spray oils may be a relatively safe alternative to harmful synthetic insecticides. However, the effect of spray oils on black parlatoria and associated parasitoids is unknown. Field studies were conducted in Giza, Egypt to assess the effect of two experimental spray oils on *P. ziziphi* and three associated parasitoid species on grapefruit (*Citrus paradisi*). Triona oil was more effective than Shecrona oil and reduced scale populations by up to 99% 75 days after application. The parasitoid *Encarsia citrina* was not affected significantly by either spray oil. Triona oil was slightly harmful to the other primary parasitoid *Habrolepis aspidioti* and reduced parasitism rate by *Marietta leopardina*. However, because the latter species is a hyperparasitoid, the reduction in its number by Triona was beneficial. Triona application is therefore highly effective in controlling the black parlatoria and it reduced the rate of hyperparasitism by *M. leopardina*. The oils had only a minor negative impact and only on the less important primary parasitoid in the system.
- Cook, L. 1998. Are the enlarged ducts of *Eriococcus* plesiomorphic? Page 14 in: VIIIth International Symposium on Scale Insect Studies. 41 pp.
- Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Borchsenius (1948) separated the genus *Eriococcus* Targioni-Tozzetti (Eriococcidae) on the basis of the occurrence of enlarged ducts in the type-species, *E. buxi*. Enlarged ducts are found also in another Palaerctic species and several Australian species of *Eriococcus*. the enlarged ducts of *Eriococcus* are similar in appearance and distribution to the large oral rim ducts of *Ferrisia* (Pseudococcidae) and the dorsal tubercle ducts of *Ceronema* (Coccidae). It is argued that the enlarged ducts in taxa from each of these three families are homologous and therefore may be plesiomorphic for the Eriococcidae. As such, the possession of enlarged ducts alone is not sufficient to justify the separation of *Eriococcus* as defined by Borchsenius.
- Cook, L., Gullan, P. & Trueman, H. 1998. A putative molecular phylogeny of nine scale insect "families" and its implications. Pages 14-15. in: VIIIth

International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. An incomplete and only partially tested molecular phylogeny of the scale insects based on 18S rDNA using sample taxa from the Margarodidae, Ortheziidae, Pseudococcidae, Coccidae, Kerriidae, Eriococcidae, Diaspididae, Dactylopiidae and Asterolecaniidae is presented. Aphids and psyllids have been included as outgroup taxa. The general topology is discussed in relation to the evolution of the scale insects. Several well-supported clades have major implications for the classification and taxonomy of the Eriococcidae. A phylogeny of the Eriococcids based on sequence data from the mitochondrial gene cytochrome oxidase subunit II is in general agreement with the nuclear gene-based tree.

Coombs, M. & Khan, S.A. 1998. Population levels and natural enemies of *Plautia affinis* Dallas (Hemiptera: Pentatomidae) on raspberry, *Rubus idaeus* L., in south-eastern Queensland. Australian Journal of Entomology 37: 2, 125-129.

Notes: Population densities of *Plautia affinis* on canes of raspberry, *Rubus idaeus*, were examined at Caboolture, southeastern Queensland, Australia, in 1994-95. The presence of natural enemies of *P. affinis* was also monitored. When feeding directly on developing and mature fruit, both adult and nymphal *P. affinis* cause damage. *Pseudococcus-viburni* is among the species mentioned.

Couturier, G., Quinones, R.L., Gonzalez, R.L., Riva, R.R. & Young, R.F. 1997(1996). [The insect pests of the fruit trees of the family Myrtaceae in Pucallpa, Peruvian Amazonia.] Los insectos plaga de las Myrtaceae frutales en Pucallpa, Amazonia peruana. (In Spanish with summary in English.) Revista Peruana de Entomologia 39: 125-130.

Notes: *Pseudoparlatoria turgida* is one of the pests.

Cranshaw, W., Gerace, D. & Demirel, N. 1998. Control of hawthorn mealybug, 1997. Pages 359-360. In Saxena, K.N., Arthropod Management Tests, Vol. 23. Entomological Society of America, Lanham, MD.

Notes: Chemical control substances evaluated against *Phenacoccus dearnessi*.

Daneel, M.S. & Dreyer, S. 1997. Further studies on the establishment of *Aphytis* sp. and *Cybocephalus binotatus* in mango orchards for the control of mango scale. (In English with summary in Afrikaans.) Yearbook (South African Mango Growers' Association) 17: 144-146.

Notes: The mango scale, *Aulacaspis tubercularis*, is a serious pest on mango and causes damage especially with late cultivars. The scale causes lesions on the fruit which are unacceptable for export purposes. In most of the mango producing countries the mango scale is limited due to effective biological control. Several *Aphytis* spp. were imported and one of these species was bred successfully and released. A predatory beetle, *Cybocephalus binotatus*, was also imported together with the *Aphytis* sp. and was bred in the insectarium. *Aphytis* sp. was successfully recovered in every locality in which it was released.

Danzig, E.M. 1998. [Revision of mealybugs (Homoptera, Pseudococcidae) with oral rim tubular ducts of the fauna of Russia and neighbouring countries.] (In Russian with summary in English.) Entomologicheskoe Obozrenye 77: 106-133.

Notes: Species reviewed include *Atrococcus altaicus*, *A. fuscus*, *A. achilleae*, *A. saxatilis*, *A. parvulus*, *A. arakeliana*, *A. paludinus*, *A. indigenus*, *A. bejbiekoi*, *A. pauperculus*, new sp., *Spilococcus artemisiphilus*, *S. mongolicus*, *S. furcatispinus*, *S. flavus*, *S. expressus*, *S. erianthi*, *S. halli*, *S. nanae*, *S. jailensis* and *S. vashlovanicus*, new sp. ; illustrations; keys provided to 13 species of *Atrococcus* and 11 species of *Spilococcus*.

Danzig, E.M. 1998a. *Kiritshenkella* and related genera of mealybugs from Russia and neighbouring countries (Homoptera: Coccinea: Pseudococcidae). Zoosystematica Rossica 7: 153-161.

Notes: The taxonomy of the genera *Kiritshenkella*, *Balanococcus*,

- Neotrionymus*, *Miscanthicoccus* and *Adelosoma* is discussed and key proposed; annotated list of 12 species of these genera and keys to species of *Balanococcus* and *Neotrionymus* are presented; new synonymies established.
- Danzig, E.M. 1998b. Designation of lectotypes of some scale insects from the collection of the Zoological Institute, St. Petersburg (Homoptera: Coccinea). *Zoosystematica Rossica* 7(2): 306.
- Notes: Lectotypes established of *Cerococcus longipilosus* on *Lactuca viminea*, *C. perowskiae* on *Perowskia scrophularifolia*, and *Kermes variegatus* var. *corticalis* on *Quercus*.
- Danzig, E.M. 1998c. Some aspects of the taxonomy of palaeartic mealybugs (Hemiptera: Coccinea: Pseudococcidae). Page 15 in: VIIIth International Symposium on Scale Insect Studies. 41 pp.
- Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. In the group of mealybugs possessing oral rim ducts, the morphology of the genera *Atrococcus*, *Chorizococcus* and *Paracoccus* are discussed. Species of *Paracoccus* recorded in the former USSR on grasses are *Spilococcus furcatispinus*, *S. flavus*, *S. expressus*, *S. erianthi*, *S. herbaceus* and *S. halli*.
- Danzig, E.M. & Pellizzari, G. 1998. Diaspididae. Pages 172-370 in: Kozár, F., Ed., Catalogue of Palaearctic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.
- Notes: Reviews species from 118 genera. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.
- De Souza, A.L.B., Delabie, J.H.C. & Fowler, H.G. 1998. *Wasmannia* spp. (Hym., Formicidae) and insect damage to cocoa in Brazilian farms. *Journal of Applied Entomology* 122(6): 339-341.
- Notes: Diagnostic insect damage to cocoa tree leaves and fruits were compared in situations with and without the presence of the little fire ants, *Wasmannia auropunctata* and the closely related and sympatric *W. cf rochai*. No significant differences in thrips, lepidopteran, or chrysomelid beetle damage to fruit, or to young and old leaves, were associated with these ants. However, significant increases of pseudococcids *Planococcus citrii*, associated with areas dominated by *W. auropunctata*, and to a lesser degree with *W. cf rochai*, were present. *W. auropunctata* has been reported to be a canopy mosaic dominant in cocoa farms, but the lack of reduced herbivore incidents and its lack of spatial permanence do not support favoring its populations for the management of phytophagous insect control.
- Dentener, P.R., Bennett, K.V., Hoy, L.E., Lewthwaite, S.E., Lester, P.J., Maindonald, J.H. & Connolly, P.G. 1997. Postharvest disinfestation of lightbrown apple moth and longtailed mealybug on persimmons using heat and cold. *Postharvest Biology and Technology* 12: 255-264.
- Notes: The effect of temperature on the mortality responses of fifth instar lightbrown apple moth (*Epiphyas postvittana*) and longtailed mealybug (*Pseudococcus longispinus*) on Fuyu persimmons was examined at temperatures between 44 and 50 deg C (hot air), and 0 and 7 deg C (cold storage). *P. longispinus* was more tolerant than *E. postvittana* to heat treatments but tolerance was opposite in cold storage. For both species, cold storage following heat treatment allowed a reduction in the time of heat treatment required for a predicted 99% mortality level. This effect was most apparent at 0 deg C and less with higher cold storage temperatures. *E. postvittana* was more tolerant than *P. longispinus* to the combination treatment. An estimated treatment time of 3.3 h (including a 2-h warming-up period) at 44 deg C, followed by 40 days' cold storage at 0 deg C was needed to achieve 99% mortality of *E. postvittana*. Time required to give 99% mortality decreased with increasing high temperature to about 2.6 h (including a 2-h warm-up period) at 50 deg C, followed by similar cold storage conditions. Treatment for 5 h at 47 deg C followed by cold storage at 0 deg C is thought to delay chilling injury in persimmons while

- causing only minor levels of heat injury to the fruit. A combined heat/cold storage treatment may therefore be effective for disinfestation of *E. postvittana* and *P. longispinus* on persimmons.
- Dixon, A.F.G. 1997. Patch quality and fitness in predatory ladybirds. *Ecological Studies* 130: 205-223.
- Notes: *Icerya purchasi* and *Aspidiotus destructor* mentioned as hosts.
- Dohino, T., Masaki, S., Takano, T. & Hayashi, T. 1997. Effects of electron beam irradiation on sterility of Comstock mealybug, *Pseudococcus comstocki* (Kuwana) (Homoptera: Pseudococcidae). *Research Bulletin of the Plant Protection Service Japan* 33: 31-34.
- Notes: Twelve-day-old eggs and third-instar nymphs (including 77.5% preovipositional adult females) of *Pseudococcus comstocki* were irradiated with electron beams to determine their radiosensitivities. Survivors from 12-day-old eggs irradiated at 400 Gy or higher died as 1st-instar nymphs. However, at 200 Gy, survivors developed into adult females slowly. Cross testing indicated that these females were sterilized. Third-instar larvae were sterilized at 200 Gy or higher, and yielded unviable eggs.
- Dominiak, B.C., McGill, N.G. & Allsopp, P.G. 1998. Tolerance to soil type of pink ground pearl *Eumargarodes laingi* Jakubski (Hemiptera: Margarodidae) on sugarcane. *Plant Protection Quarterly* 13: 143-144.
- Notes: A glasshouse pot trial evaluated the ability of the margarodid *Eumargarodes laingi* to colonize sugarcane roots in six Bundaberg soil types. Soils from a sand to a clay supported *E. laingi*, but cyst numbers were significantly higher in silty clay loams.
- Dubbert, M., Tschardtke, T. & Vidal, S. 1998. Stem-boring insects of fragmented *Calamagrostis* habitats: herbivore-parasitoid community structure and the unpredictability of grass shoot abundance. *Ecological Entomology* 23: 271-280.
- Notes: *Eriopeltis* sp. is among those species mentioned; attacks basal internodes of *Calamagrostis* shoots.
- Dunkelblum, E., Mori, K. & Mendel, Z. 1998. Semiochemical activity of pheromones and analogues of *Matsucoccus* (Hemiptera: Coccoidea: Matsucoccidae). Pages 15-16 in: VIIIth International Symposium on Scale Insect Studies. 41 pp.
- Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The sex pheromone of the Israeli pine blast scale, *Matsucoccus josephi* (Matsucoccidae) was identified as a ketone (2E, 5R, 6E, 8E)-5,7-dimethyl-2,6,8-decatrien-4-one). The chiral diene chain is common also to the sex pheromones of *M. matsumurae* and *M. feytaudi*. The species specificity of the three pheromones is due to differences in the second side chain of these ketones. Field and GC-EAD studies indicated that the *M. josephi* pheromone is a potent kairomone of the predator *Elatophilus hebraicus* (Hemiptera: Anthocoridae). The predator responds very strongly also to the sex pheromones of the other *Matsucoccus* species, despite the fact that it does not occur in the distribution area of these congeneric species. These results prompted a series of analogues with variations in the two side chains in order to probe the structure-activity relationship of the pheromonal/kairomonal attractancy of *M. josephi* and *M. hebraicus*. Field results indicated that alterations in the common diene moiety affected the kairomonal activity, while structural changes in the second side chain markedly reduced the pheromonal activity.
- Ehler, L.E. 1997. Obscure scale declines after parasitic wasp introduced. *California Agriculture* 6: 29-32.
- Notes: Control of *Melanaspis obscura* on *Quercus* species is reported in Capitol Park in Sacramento, California, by the release and establishment of *Encarsia aurantii*. Yellow card traps were positioned on release trees (*Q. rubra*, *Q. palustris*, *Q. agrifolia* and *Q. wislizenii*); the results of surveys of the pests and parasitoids are presented for 1992-96, showing that cumulative trap capture of parasitoids increased 5-fold by 1995, compared with a reduction in trapped immature *M. obscura* of about 16-fold

by the end of 1996. Pest density on samples of twigs was reduced from 4.2 *M. obscura* per *Q. wislizenii* twig in 1994 to 0.18 *M. obscura* per twig in 1997. The numbers of twigs infested was reduced from 82% in 1994 to 10.6% in 1997. The amount of parasitism increased from 38.1% in 1994 to 83.3% in 1997.

Einhorn, J., Guerrero, A., Ducrot, P.H., Boyer, F.D. & Gieselmann, M. 1998. Sex pheromone of the oleander scale, *Aspidiotus nerii*: structural characterization and absolute configuration of an unusual functionalized cyclobutane. Proceedings of the National Academy of Science. USA 95: 9867-9872.

Notes: This pheromone has been isolated and characterised using advanced MS and NMR spectroscopic methods, as well as a variety of microderivatization sequences. The structure has been confirmed by stereo- and enantioselective synthesis of the four possible stereoisomers. The absolute configuration has been determined by comparison of the activity of the *cis* (1S,2R) and (1R,2S) enantiomers with that exhibited by the natural material in greenhouse bioassays and field tests. The structure of this sesquiterpenoid pheromone is new in the coccids and in the pheromone field in general.

Elder, R.J., Middleton, C.H. & Bell, K.L. 1998. *Heteropsylla cubana* Crawford (Psyllidae) and *Coccus longulus* (Douglas) (Coccidae) infestations on *Leucaena* species and hybrids in coastal central Queensland. Australian Journal of Entomology 37: 52-56.

Notes: *Leucaena* psyllid, *Heteropsylla cubana*, and long soft scale, *Coccus longulus*, populations were examined in 1993 and 1996 on nine *Leucaena* accessions grown at Raglan in coastal central Queensland. Accessions included five of *Leucaena leucocephala*, two of *Leucaena diversifolia* (a diploid and a tetraploid), and two hybrids (*L. leucocephala* times *Leucaena pallida* and *L. leucocephala* times *L. diversifolia*). The five *L. leucocephala* accessions had higher nymphal psyllid infestations than the two *L. diversifolia* accessions or the two hybrids. Scale numbers were highest on *L. leucocephala* (cultivar Tarramba), the tetraploid *L. diversifolia* and the two hybrids. Lowest scale counts were recorded on the diploid *L. diversifolia* and three lines of *L. leucocephala* (CPI 61222, Q25221 and cultivar Cunningham). Plant breeders should consider both insects when selecting parent lines.

Elder, R.J., Smith, D. & Bell, K.L. 1998. Successful parasitoid control of *Aonidiella orientalis* (Newstead) (Hemiptera: Diaspididae) on *Carica papaya* L. Australian Journal of Entomology 37: 74-79.

Notes: The role of three parasitoids in controlling *Aonidiella orientalis* in papaya (pawpaws) in coastal areas of central and northern Queensland, Australia, was assessed during 1989-95. *Comperiella lemniscata* was introduced from Hainan Island in China and from the Torres Strait in northern Queensland, and reared and released in 1991 at the rate of 2000 per property. Within 12 months, parasitisation mainly of the third-instar scales rose to as high as 80% and rejection of fruit for the market dropped from 20-30% to 1-2%. *Aphytis melinus* was augmentatively released in pawpaw plantations in central and northern Queensland at a rate of 25 000/ha. Parasitisation mainly of the third-instar scales was boosted by these releases from 0% to between 10 and 30%, but these levels persisted for only a few months and the parasitoid had to be continually re-released. *Encarsia citrina* occurred naturally at parasitisation levels of up to 80% in mainly the second-instar scales and was important in the biological control of *A. orientalis*.

Eliason, E.A. & McCullough, D.G. 1997. Survival and fecundity of three insects reared on four varieties of Scotch pine Christmas trees. Journal of Economic Entomology 90: 1598-1608.

Notes: *Dioryctria zimmermanni*, *Neodiprion sertifer* and *Chionaspis pinifoliae* were reared on 4 varieties of Scotch pines (*Pinus sylvestris*). Survival and fecundity of each species were evaluated in 1994 and 1995 in

Michigan. The varieties tested were Riga, Belgium, Land O'Pine, and Pike Lake Improved. Abundance and fecundity of *C. pinifoliae* reared on Belgium and Land O'Pine were significantly lower than those reared on varieties Riga and Pike Lake Improved.

**Ericson, L. & Wennström, A.** 1997. The effect of herbivory on the interaction between the clonal plant *Trientalis europaea* and its smut fungus *Urocystis trientalis*. *Oikos* 80: 107-111.

Notes: *Arctorthezia cataphracta* is a polyphagous insect feeding on a large number of plants including on stalks of *T. europaea*, just below the ground level. This species was found to prefer smut infected shoots to healthy shoots.

**Erkiliç, L.B. & Uygun, N.** 1998. Observations on the population development of *Pseudaulacaspis pentagona* (Hemiptera: Coccoidea: Diaspididae) under semi-field conditions in the east Mediterranean region of Turkey. Page 16 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Populations of *Pseudaulacaspis pentagona* (Targioni Tozzetti) were observed on naturally infested young peach trees field conditions. *P. pentagona* had four generations a year and the first crawlers appeared from overwintered females at the beginning of April. The duration of each generation was found to vary significantly in relation to temperature, with the first generation taking the longest (71.6 days) and (cv. 'June Gold'), kept in 2x2x2m cages covered in cheese cloth under semi-the second generation the shortest (61.2 days). The number of crawlers produced by each generations was also found to vary significantly. The greatest number of crawlers (99.4 crawlers per female) were produced by the overwintering females and the lowest number of crawlers (17.9 crawlers per female) by the fourth generation.

**Etienne, J., Matile-Ferrero, D., Leblanc, F. & Marival, D.** 1998. [First record of the mealybug *Maconellicoccus hirsutus* (Green) in Guadeloupe; present state of this pest of crops in the French Caribbean (Hem., Pseudococcidae).] (In French with summary in English.) *Bulletin de la Société Entomologique de France* 103: 173-174.

Notes: [Original title: Premier signalement de la cochenille *Maconellicoccus hirsutus* (Green) en Guadeloupe; situation actuelle de ce ravageur des cultures dans les Antilles françaises (Hem., Pseudococcidae).] This mealybug was accidentally introduced in the Caribbean recently; notes on biology, damage and control; *Cryptolaemus montrouzieri* and *Anagyrus kamali* introduced for control.

**Faber, T. & Sengonca, C.** 1997. [Laboratory studies on the longevity and the fecundity of *Coccophagus scutellaris* (Dalm.) (Hym., Aphelinidae) as a parasitoid of the horse chestnut scale insect *Pulvinaria regalis* Canard (Hom., Coccidae).] (In German with summary in English.) *Gesunde Pflanzen* 49: 3, 84-88.

Notes: [Original title: Laboruntersuchungen zur Lebensdauer und Fruchtbarkeit von *Coccophagus scutellaris* (Dalm.) (Hym., Aphelinidae) als Parasitoid der Wolligen Nappfschildlaus *Pulvinaria regalis* Canard (Hom., Coccidae).] The longevity and fecundity of *Coccophagus scutellaris*, a parasitoid of *Pulvinaria regalis* were examined under laboratory conditions. The influence of temperature, nutrition and sex on longevity was evaluated. The longevity of both sexes was reduced by raising the temperature. Compared to water, honeydew and water led to a greater longevity at all temperatures.

**Fabres, G. & Nenon, J.P.** 1997. [Biodiversity and biological control: The case of the cassava mealybug in Africa.] (In French with summary in English.) *Journal of African Zoology* 111: 7-15.

Notes: In the early 1970's, the whole African cassava belt was invaded by two arthropod pests introduced from South America. One of them, the cassava mealybug (*Phenacoccus manihoti* Matile-Ferrero, Homoptera, Pseudococcidae), induced intensive research and a pan African biological

control programme was initiated. Twenty years later, the assumption is that the problem has been completely solved through the introduction of a single exotic parasitoid species in spite of the considerable ecological diversity within the African cassava growing area. However, in several countries, this parasitoid is not as efficient as expected. This paper discusses the influence of biodiversity in the control of phytophagous insects.

Fain, A. & Ripka, G. 1998. A new species of *Hemisarcoptes* Lignieres, 1893 (Acari: Hemisarcoptidae) from ornamental trees in Hungary. *International Journal of Acarology* 24(1): 33-39.

Notes: *Hemisarcoptes budensis* sp.n. (Acari: Hemisarcoptidae) is described from adults and immatures, including deutonymphs, from Budapest, Hungary. The adult mites were collected from trees and shrubs infested with six armored scale species. The deutonymphs were found beneath the elytra of ladybirds (Coleoptera: Coccinellidae), especially *Chilocorus renipustulatus*, more rarely *C. bipustulatus*, visiting the infested trees.

Fernandez de Cordova, J., Gallego, F.J. & De-Cordova, J.F. 1997. [Control of the oak scale (*Asterolecanium ilicicola*, Targioni, 1892) by injection of insecticide into the tree trunk.] Control de la cochinilla de la encina (*Asterolecanium ilicicola*) mediante la inyección de insecticidas al tronco del árbol. (In Spanish with summary in English.) *Boletín de Sanidad Vegetal, Plagas* 23: 4, 607-612.

Notes: A major infestation of oak scale, *Asterolecanium ilicicola*, aggravated by the drought in the past few years, has been the reason for the mortality of many oaks (*Quercus ilex*) in Southern Spain. The need for protecting the environment in the 'dehesas' and in national parks led to a reduction in the use of insecticides, and the result is that any authorised product for treatment of the oak wood is not effective against this insect. Oaks infested with this pest were injected with prepared injection capsules of 225 ml acephate or imidacloprid solution. These insecticides were effective in the control of the pest: more than 79% control of the insect was obtained when acephate was injected at 7.5 g a.i. per tree or imidacloprid at 0.8 ml per tree.

Ferraro, M., Epifani, C., Bongiorno, S., Nardone, A.M., Parodi, D.S. & Prantera, G. 1998. Cytogenetic characterization of the genome of mealybug *Planococcus citri* (Homoptera, Coccoidea). *Caryologia* 51(1): 37-49.

Notes: In the mealybug *P. citri* ( $2n = 10$ ) male and female individuals are both diploid, however in males, at the stage of blastula, the haploid chromosome set of paternal origin becomes heterochromatic, even though its complete inertia has been considered questionable. Data presented on the cytogenetic characterization of the chromosomes of *P. citri*. We report on (i) the fluorescence karyotype (D287/170), which to our knowledge is the first banded karyotype of a mealybug to be described; (ii) the chromosome localization of constitutive heterochromatin; (iii) the chromosome localization of rDNA sites; (iv) NORs activity. Our data also show, for the first time, that in the heterochromatic chromosome set ribosomal genes are still active.

Foldi, I. 1998. Margarodidae. Pages 421-441 in: Kozár, F., Catalogue of Palaeartic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Reviews species in *Dimargarodes*, *Drosicha*, *Gueriniella*, *Icerya*, *Kuwania*, *Marchalina*, *Matsucoccus*, *Monophleboides*, *Monophlebus*, *Neomargarodes*, *Palaeococcus*, *Porphyrophora*, *Promargarodes*, *Pseudaspidopectus*, *Steingelia* and *Xylococcus*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Fontana, P. & Pellizzari, G. 1998. On the identity of the genus *Lecanopsis* Targioni Tozzetti. Pages 16-17 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *L. rhyzophila* rejected as type species; *L. formicarum* proposed to replace it.

**Franco, J.C. & Marotta, S.** 1998. A survey of the mealybugs in citrus groves in Portugal. Page 17 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Survey of mealybugs in 76 citrus groves of Portugal; *Planooccus citri*, *P. calceolariae*, *P. viburni* and *P. longispinus* were identified and their abundance discussed.

**Gerling, D. & Wysoki, M.** 1997. David Rosen (1936-1997). Biocontrol News and Information 18(2.): 21-22. Notes: Obituary.

**Gerson, U. & Izraylevich, S.** 1997. A review of host utilization by *Hemisarcoptes* (Acari: Hemisarcoptidae) parasitic on scale insects. Systematic and Applied Acarology 2: 33-42.

Notes: Host utilization patterns of species of *Hemisarcoptes*, which parasitize Diaspididae, are reviewed. The mites optimally parasitize ovipositing females, on which they exhibit an aggregated distribution and produce the most progeny. However, *Hemisarcoptes* spp. cannot attack this stage of *Aonidiella aurantii* because the host body is appressed to its shield, the parasite therefore subsists on younger host stages. Due to the slower development of univoltine scales in colder climates, ovipositing females are available to the mites only briefly, and so suboptimal host immature stages are mostly attacked. Host plants of the scales affect mite life history by having rough or smooth surfaces, which affect access beneath diaspidid shield covers. During their deutonymphal (hypopodial) stage, species of *Hemisarcoptes* are disseminated by coccinellids of the genus *Chilocorus*. These deutonymphs appear to obtain some molt-inducing chemicals from the coccinellids, which may therefore be regarded as true hosts. Deutonymphs prefer to settle on glabrous areas on the underside of beetle elytra; these areas differ in size among species of *Chilocorus* and thus influence their mite-carrying capacity. The diet of coccinellid larvae affected the sex ratio of mites which had sojourned on them. These different patterns of host utilization may affect the efficacy of *Hemisarcoptes* spp. as biological control agents.

**Gertsson, C.A.** 1997. [New species and new province-records of scale insects from Sweden (Homoptera: Coccoidea).] Nya arter och nya landskapsfynd av sköldlöss från Sverige. (In Swedish with summary in English.) Entomologisk Tidskrift. Stockholm 118: 111-118.

Notes: Fifty-one Swedish province records of scale insects belonging to 8 families are presented; new records for Sweden are *Atrococcus achilleae*, *Euripersia tomlini*, *Rhizoecus albidus*, *Eulecanium douglasi* and *Leucaspis pini*; notes of general morphology of each family, host plants and localities of collections.

**Ghabbour, M.W.** 1998. Descriptions of the first instars of the genera *Lepidosaphes* Shimer and *Insulaspis* Mamet (Hemiptera: Coccoidea: Diaspididae). Page 17 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Descriptions and illustrations of first-instar nymphs of *L. beckii*, *L. ficus* and *L. ulmi*; morphology compared to *Insulaspis pallidula* and *I. tapleyi*; key provided.

**Ghabbour, M.W. & Hamon, A.V.** 1998. A new genus and new species of the family Diaspididae (Hemiptera: Coccoidea). Pages 17-18 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *Hyparrheniaspis campbelli* gen. et sp. nov., is described on the basis of specimens collected in Florida on *Hyparrhenia rufa*, *Ctenium aromaticum* and an undetermined poaceous plant; *H. campbelli* is assignable to the tribe Lepidosaphedini based on the characters of the first-instar nymph but the characters of the second-

- instar nymph and adult female are abnormal for species of this tribe.
- Gilione, J.H. 1998. The Asterolecaniidae of South Africa. Page 18 in VIIIth International Symposium on Scale Insect Studies. 41 pp.
- Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The scale insect family Asterolecaniidae (pit scales) contains about 250 species in about 23 genera, of which 15 have been recorded in South Africa. Of these 15, four are exotics, with two species on oak and two on bamboo. One new species introduced on *Cunonia capensis*.
- Godfrey, L.D. & Pickel, C. 1998. Seasonal dynamics and management schemes for a subterranean mealybug, *Rhizoecus kondonis* Kuwana, pest of alfalfa. The Southwestern Entomologist 23(4): 343-350.
- Notes: This mealybug is a subterranean pest of alfalfa, prunes and other crops primarily in the Sacramento Valley of California. Root feeding results in chlorotic, stunted alfalfa plants.
- Gowda, D.K.S. & Manjunath, D. 1998. *Hibiscus cannabinus* as a trap crop of mealybug in mulberry. Insect and Environment 4: 2, 46.
- Notes: In studies in Karnataka, India, *Hibiscus cannabinus* was shown to be suitable as a trap crop for *Maconellicoccus hirsutus* infesting mulberry.
- Gowda, D.K.S., Manjunath, D., Prasad, K.S., Katiyar, R.L., Kishore, R. & Datta, R.K. 1997. Natural enemy complex of the pink mealy bug *Maconellicoccus hirsutus* (Green) in mulberry crop system. Indian Journal of Sericulture 36(1): 55-56.
- Notes: This mealybug is known to attack more than 125 plant species, including {*Morus alba*}. Paper discusses 16 parasitoids and 31 predators. Only {*Cryptolaemus montrouzieri*} has been exploited as a biocontrol agent.
- Grafton-Cardwell, E.E., Ouyang, Y. & Salse, J. 1998. Insecticide resistance and esterase enzyme variation in the California red scale (Homoptera: Diaspididae). Journal of Economic Entomology 9: 812-819.
- Notes: A population of California red scale, *Aonidiella aurantii* (Maskell), was found to be resistant to the organophosphates chlorpyrifos and methidathion, and to the carbamate carbaryl when compared with a susceptible population. The esterase inhibitor S,S,S-tributyl phosphotriothioate increased chlorpyrifos toxicity in the resistant population to a greater extent than in the susceptible population, suggesting that esterase enzymes were involved in chlorpyrifos, but not methidathion or carbaryl resistance. The esterase banding patterns of both populations were characterized using cellulose acetate electrophoresis. There was variation between sexes and stages of scale in the relative mobility, frequency of occurrence, and activity of the esterase bands. The data suggests that the EST-3 band is involved in insecticide resistance in California red scale and that the EST-3 band in nongravid 3rd-instar females could be used for a diagnostic test for resistance.
- Granadino, C.A. & Cave, R.D. 1997. Within-tree distribution of seven insect pests of soursop (*Annona muricata*) in Honduras. (In English with summary in Spanish.) CEIBA 38: 161-166.
- Notes: The spatial distribution of *Corythucha gossypii*, *Calloconophora caliginosa*, *Membracis mexicana*, *Parasaissetia nigra*, *Saissetia oleae*, *Bephratelloides cubensis* and *Cerconota anonella* on soursop (*Annona muricata*) was investigated during 1991 at 4 orchards in Honduras. All insects, except *P. nigra* and *S. oleae*, were mainly found in the middle third of the tree canopy. *P. nigra* and *S. oleae* were mainly found in the middle and bottom sections. Infestations by *P. nigra* were greater on the southern side of trees, whereas infestations by *C. anonella* were greater on the northern side.
- Granara de Willink, M.C. 1998. [Systematic relocation of the "Delta cochineal" (Homoptera: Coccidae).] Reubicación sistemática de "la cochinilla del Delta" (Homoptera: Coccidae). (In Spanish with summary in English.) Insecta Mundi 12: 149-153.
- Notes: *Mesolecanium deltae* Lizer y Trelles, 1917 and *Lecanium perlatum*

- Cockerell, 1898, are known as citrus pests in Argentina, Brazil, Paraguay and Uruguay. The study of the material leads to the conclusion that they are synonymous, and the species is better placed in the genus *Parthenolecanium*, so *Parthenolecanium perlatum* (Cockerell) is proposed as a new combination.
- Guenaoui, Y. & Dahliz, A. 1997. A new pest in Algeria: *Phyllocnistis citrella* Stainton (Lepidoptera: Gracilariidae). Bulletin SROP 20: 63-70.  
Notes: This study mentions another increasingly serious economic pest of citrus, *Parlatoria ziziphii*; any solution for *P. citrella* must also acknowledge the presence of *P. ziziphii*.
- Gullan, P.J. & Brookes, H.M. 1998. Giant females and bird-of-paradise flies: Notes on the biology of *Callipappus* Guerin-Meneville (Hemiptera: Margarodidae). Australian Journal of Entomology 37: 2-7.  
Notes: Review of this endemic Australian genus; distribution; life history; natural enemies; host plants.
- Gullan, P. & Cook, L. 1998. Are cochineal insects Eriococcids? Page 19 in VIIIth International Symposium on Scale Insect Studies. 41 pp.  
Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Scale insects of the genus *Dactylopius*, which all feed on cacti and are the source of a carmine dye, are commonly called cochineal insects. Currently there are nine described species placed in their own family, the Dactylopiidae, based on a few unique morphological features. We have reviewed available biological, morphological and karyotype information on *Dactylopius* and carried cladistic analyses of the morphological data (from first-instar nymphs plus adult females, and adult males separately) and molecular data (from the nuclear gene 18sDNA and the mitochondrial gene cytochrome oxidase II) from *Dactylopius* and its potential relatives. We suggest that *Dactylopius* belongs to the Eriococcidae.
- Gullan, P.J. & Hodgson, C.J. 1998. A new genus of Australian soft scale insect (Hemiptera: Coccidae) with species on *Capparis* (Capparaceae) and *Doryphora* (Monimiaceae) from New South Wales. Proceedings of the Linnean Society of New South Wales 119: 197-217.  
Notes: Descriptions and illustrations of *Austrolecanium*, new gen., *Austrolecanium sassafras*, new sp., and *Austrolecanium cappari* (Froggatt), comb. nov.; hosts; biological notes.
- Halbert, S.E. 1997. Entomology section. Tri-ology 36: 4-9.  
Notes: Species recorded include *Ceroplastes rusci*, *Morganella longispina* and *Thysanofiorinia nephelii*.
- Hamid, H.A., Michelakis, S.E. & Vacante, V. 1997. The use of *Cryptolaemus montrouzieri* (Mulsant) for the control of *Planococcus citri* (Risso) in Crete - Greece. Bulletin OILB/SROP (Sect. Reg. Ouest Palearctique) 20: 7, 7-12.  
Notes: [Integrated control in citrus fruit crops. Proceedings of the meeting held at Florence, Italy, 29 August 1996.] The citrus mealybug, *Planococcus citri*, is a major pest of citrus orchards in Crete. In order to reduce the use of chemical insecticides, experiments were conducted to develop integrated control methods. The predator *Cryptolaemus montrouzieri* was released at three predator:prey ratios (1:10, 1:15 and 1:30) on potted orange trees infested with *P. citri* in a greenhouse. The effect of *C. montrouzieri* on populations of *P. citri* was also compared with that of *Nephus reunioni* and the insecticide methidathion under controlled temperature (25-30°C) and relative humidity (55-70%), with *P. citri* maintained on pumpkins (*Cucurbita moschata*). Five adults of each predator were released, and methidathion was applied at a concentration of 0.1%. *C. montrouzieri* effectively reduced populations of *P. citri*. A predator:prey ratio of 1:15, in most cases, resulted in lower populations of *P. citri*. When compared with *N. reunioni*, *C. montrouzieri* caused a significant reduction in the pest population. In most cases, significant differences in pest reductions were not detected between *C. montrouzieri* and

methidathion.

Hamon, A.B. & Mason, G.J. 1997. Fig wax scale, *Ceroplastes rusci* (L.), in Florida (Homoptera: Coccoidea: Coccidae). Entomology Circular, Florida Department of Agriculture and Consumer Services Division of Plant Industry No. 380: 1-2.

Notes: Field description; distribution; extensive list of host plants; brief biological notes; economic importance; parasites.

Hanks, L.M. & Denno, R.F. 1998. Dispersal and adaptive deme formation in sedentary coccoid insects. Pages 239-262. in Mopper, S. & Strauss, S.Y., Eds., Genetic Structure and Local Adaptation in Natural Insect Populations: Effects of Ecology, Life History, and Behavior. Chapman & Hall, New York. xix + 449 pp.

Notes: Evaluation of potential for demic adaptation in Coccoidea; review of the natural history of coccoids; examination of stage-related dispersal behavior to determine whether coccoid populations are especially likely to be reproductively isolated on individual host, which sets the stage for adaptation of host genotype; species mentioned include *Aonidiella aurantii*, *Aspidiotus destructor*, *Aulacaspis tegalensis*, *Carulaspis minima*, *Chrysomphalus aonidum*, *Dactylopius coccus*, *D. confusus*, *Diaspis boisduvalii*, *D. echinocacti*, *Eriococcus coriaceus*, *E. orariensis*, *Ferrisia virgata*, *Greenaspis decurvata*, *Lepidosaphes beckii*, *L. conchiformis*, *L. ulmi*, *Melanaspis glomerata*, *M. tenebricosa*, *Pseudaonidia duplex*, *Pseudaulacaspis pentagona*, *Pulvinaria vitis*, *Pulvinariella mesembryanthemi*, *Quadraspidiotus perniciosus* and *Saissetia oleae*.

Hara, A.H., Hata, T.Y., Hu, B.K.S. & Tsang, M.M.C. 1997. Hot-air induced thermotolerance of red ginger flowers and mealybugs to postharvest hot-water immersion. *Postharvest Biology and Technology* 12(1): 101-108.

Notes: Species discussed include *Planococcus citri*, *Pseudococcus longispinus* and *P. viburni*.

Hara, A.H., Hata, T.Y. & Jacobsen, C.M. 1998. Efficacy of Merit 75 WP, Pinpoint 15 G, and Dursban 50 W against pests of red ginger, 1996. Pages 106-107. in Saxena, K.N., Ed., *Arthropod Management Tests*, Vol. 23 Entomological Society of America, Lanham, MD.

Notes: Chemical control substances evaluated against *Planococcus citri*, *Pseudococcus affinis*, *P. longispinus* and *Pulvinaria psidii*.

Harries, V. & Wilhelm, R. 1998. [Pear psylla: principles of sustainable management and avoidance of resistance in commercial orchards (IRAC guideline).] (In German with summary in English.) *Nachrichtenblatt für den Deutschen Pflanzenschutzdienst*. Berlin 50: 64-67.

Notes: [Original title: Birnenblattsauger: Konzept zur nachhaltigen Kontrolle und Resistenzvermeidung im gewerblichen Obstbau (IRAC-Richtlinie).] A principle objective of the Insecticide Resistance Action Committee (IRAC) is to secure a prolonged effective life of reliable insecticides and acaricides. An essential contribution towards achieving this objective is the development and implementation of resistance management guidelines for specific pests of fruit through the IRAC Fruit Crops Working Group (FCWG). Further key pests, in particular *Myzus persicae* and *Aonidiella aurantii*, are presently being studied. Discussion of classifying the risk of cross resistance, and product-related recommendations for control.

Hassan, E. 1997. Chlorpyrifos toxicity to *Aphytis lingnanensis* Compere (Hymenoptera: Aphelinidae) a parasitoid of California red scale, *Aonidiella aurantii* (Mask.) in citrus. (In English with summary in German.) *Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz* 104: 102-104.

Notes: A study was conducted to examine the effect of residues of chlorpyrifos on *Aphytis lingnanensis*, a parasitoid of *Aonidiella aurantii*. At rates of 0.1 and 0.5% active ingredient, chlorpyrifos was highly toxic to the parasitoid on the day of spraying and continued to be toxic 48 h after spraying on citrus leaves.

Hassan, E. & Summers, R.G. 1997. Testing the toxicity effects on California

red scale parasitoid (*Aphytis lingnanensis* Compere) of two insecticides used to control California red scale (*Aonidiella aurantii* Mask.) on citrus in the laboratory. (In English with summary in German.) Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz 104: 415-418.

Notes: A standard laboratory method was applied to assess the effect of dry insecticide residues of methomyl and methidathion on *Aphytis lingnanensis* (a parasitoid of *Aonidiella aurantii*). Methomyl at 0.005% per litre was less toxic than at 0.05% per litre, and less toxic than methidathion at 0.005 and 0.05% per litre.

He, G.F., Bao, W.M., Lu, A.P. & Zhang, G.X. 1998. A biological study of armored scale, *Abgrallaspis cyanophylli* with emphasis on temperature and humidity relations. (In Chinese with summary in English.) Chinese Journal of Biological Control 14: 1-3.

Notes: The armoured scale, *Abgrallaspis cyanophylli*, is an important plant pest. Its biological characteristics, especially the influence of temperature and humidity on its development, survival and fecundity, were studied in the laboratory. The survival rate at 25 deg C was high at 75.9%, whereas at 30 deg C it was only 44.7%. The nymphal stage lasted from 37.0 to 64.5 days at 20 to 28 deg C. The number of crawlers per female was greatest (142.1) at 28 deg C. The average longevity of females decreased with increasing temperatures (200.2 days at 20 deg C and 62.1 day at 30 deg C). The survival rate at RH 75% was higher than that at either RH 60% or at 90%.

Heckroth, H.P., Fiala, B., Gullan, P.J., Idris, A.H. & Maschwitz, U. 2 1998. The soft scale (Coccidae) associates of Malaysian ant-plants. Journal of Tropical Ecology 14: 427-443.

Notes: Myrmecophytic species of the Palaeotropical plant genus *Macaranga* (Euphorbiaceae) have hollow stems that are almost always occupied by ants of the genus *Crematogaster* and scale insects of the family Coccidae. The coccids have a cryptic endophytic lifestyle and are confined to this microhabitat. They are much more diverse than previously recognised. First data are presented on the diversity, prevalence, specificity and distribution of the coccids associated with myrmecophytic *Macaranga* species. Twenty-two species of Coccidae in total, including 15 previously unknown from *Macaranga*, were discovered from 19 species of *Macaranga* in Peninsular Malaysia and Borneo. The original describers tentatively assigned the known coccid species to *Coccus* (Coccinae) but the *Macaranga* coccids still require taxonomic research to establish their correct placing. The coccids varied in their host-plant specificity from species that occurred in most of the sampled *Macaranga* to one species that was found almost exclusively only on a single host species. In addition to their occurrence on *Macaranga*, only *C. macarangae* *C. secretus* and morphospecies C. 214 were found on rare occasions in the stem interior of a few other myrmecophytes and in a non-myrmecophytic liana, but did not regularly colonise these plants. Most of the coccids can be regarded as highly specific at the plant genus level.

Heckroth, H.P., Fiala, B. & Maschwitz, U. 1998. Scale Insects (Hemiptera: Coccoidea: Coccidae) as a food source for ants in the southeast Asian ant-plant system *Crematogaster* (Hymenoptera: Formicidae) - *Macaranga* (Euphorbiaceae). Pages 19-20 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. In the common system nine species of soft scales are known to live regularly as endophytes in the hollow stems of these plants. Since the nutrition of ant colonies is based on nutrient rich foodbodies which are produced by the plants under the stipules and on the leaf surface, the role of the coccids in the ant-plant system is not yet clear. Because of the cryptic lifestyle of the coccids, no coccid-ant interactions have been previously observed. We investigated coccids as a source of honeydew and found that honeydew was secreted by 8 species and

that worker ants could survive for several weeks with honeydew as the only food source. However, the feeding on coccids and the use of them as a protein rich food by the ants could not be observed, neither under normal conditions nor under conditions of colony starvation.

Heidari, M. 1998. Intrinsic rate of increase and temperature coefficients of the Comstock mealybug: *Pseudococcus comstocki* (Kuwana) (Hemiptera: Coccoidea: Pseudococcidae). Page 20 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The demographic statistics and temperature requirements for the development of the Comstock mealybug were determined under laboratory conditions. Temperature proved to have a significant effect on development, survival, reproduction, longevity and the sex ratio of this mealybug.

Heimpel, G.E. & Rosenheim, J.A. 1998. Egg limitation in parasitoids: a review of the evidence and a case study. *Biological Control* 11: 160-168.

Notes: The literature on egg limitation in parasitoids was reviewed, and partial evidence was found for the life history theory prediction that a nontrivial proportion of parasitoids should exhaust their egg supply during their lifetime. Subsequently, substantial egg limitation was demonstrated in the synovigenic parasitoid *Aphytis aonidiae*, a uniparental ectoparasitoid of *Quadraspidiotus perniciosus* (*Diaspidiotus perniciosus*) and probably the dominant natural enemy of this pest in California. The possible factors determining this are discussed.

Heimpel, G.E., Rosenheim, J.A. & Kattari, D. 1997. Adult feeding and lifetime reproductive success in the parasitoid *Aphytis melinus*. *Entomologia Experimentalis et Applicata* 83: 305-315.

Notes: Host is *Aonidiella aurantii*.

Helmy, E.I., Hindy, M.A., Hassan, N.A. & El-Imery, S.M. 1997. Comparison between aerial and ground spraying against the California red scale, *Aonidiella aurantii* (Mask.) and *Dialeurodes citri* (Ashmead) on citrus trees. (In English with summary in Arabic.) *Egyptian Journal of Agricultural Research* 75: 601-609.

Notes: The efficiency of Misrona Super Oil to control various life stages of *Aonidiella aurantii* and *Dialeurodes citri*, infesting sweet oranges in Egypt, was investigated during 1994. Two spraying methods were used, a conventional ground spray and a low volume aerial spray by helicopter. Both methods resulted in sufficient insect control, but aerial spraying was more efficient. No phytotoxicity was observed. Immature stages of both pests were more susceptible than pupal and adult stages.

Henderson, R. 1998. The structure and function of the test of New Zealand male soft scale insects. Page 21 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Male scale insects (Hemiptera: Coccoidea) undergo a metamorphosis from scale-like nymph through prepupa and pupa to winged adult. The last nymphal instar before the prepupa secretes a protective covering or test under which these complex life changes take place. Each family of scale insects is characterised by a different type of male covering, whether cocoon, cap or test. Male mealybugs make rather fluffy cocoons from cottony wax strands, Eriococcids produce woven wax covers, while armoured scales incorporate their moulted skins into waxy caps. The Coccidae or soft scale construct glassy wax tests. The rows of hexagonal waxplates found in the male tests of most New Zealand Coccidae are apparently unique in the way they are constructed. Scanning electron micrographs show the detail and diversity of the hinge types and how the hexagonal plate structure of the test is distinct from the back plate suture.

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

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.

**Heraty, J.M. & Schauff, M.E.** 1998. Mandibular teeth in Chalcidoidea: function and phylogeny. *Journal of Natural History* 32: 1227-1244.

Notes: Taxonomic study of Aphelinidae and Encyrtidae (Hymenoptera: Chalcidoidea) based on survey for presence of a specialized ventroapical mandibular tooth that is formed through modification of a seta into a stout socketed spine. Observations of *Comperiella bifasciata* and *Encarsia* sp. nr. *perniciosi* emerging from California red scale (*Aonidiella aurantii*) showed that the tooth is used for shearing off pieces of the mummified host remains and the scale cover during formation of the exit hole. The tooth occurs in both sexes, and in taxa with a broad host range such as *Encarsia*, which attack both armoured scales and whiteflies. Problems associated with character homology, function and phylogeny are discussed.

**Herren, H.R.** 1998. The biological control program of IITA: from concept to reality. Pages 18-30. in: Yaninek, J.S. & Herren, H.R., Eds., *Biological control : a sustainable solution to crop pest problems in Africa*. International Institute of Tropical Agriculture, Ibadan, Nigeria. 210 pp.

Notes: Proceedings of the Inaugural Conference and Workshop of the IITA Biological Control Program Center for Africa, 5-9 December 1988, Cotonou, People's Republic of Benin. Control of *Phenacoccus manihoti* is one of the primary goals of the Biological Control Program of the IITA.

**Hickel, E.R., Schuck, E. & Ducroquet, J.P.H.J.** 1997. [Purging of fruit crop planting stock: alternative method for preventing pest dissemination.] Expurgo de mudas de frutíferas de clima temperado: método alternativo para evitar disseminação de pragas. (In Portuguese.) *Agropecuaria Catarinense* 10: 8-11.

Notes: Chemical fumigation of grape rootstocks (Paulsen 1103), peach (cv. Pialo), plum (cv. Leticia) and kiwifruit planting stock was fumigated for 96 h with phosphine. All treatments resulted in total elimination of *Eurhizococcus brasiliensis* cysts. However, phosphine at the 2 higher rates was toxic to peach planting stock. Recommendations for more refined application method.

**Hippe, C. & Frey, J.E.** 1998. Biology of the horse chestnut scale, *Pulvinaria regalis* Canard (Hemiptera: Coccoidea), in Switzerland. Page 21 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Discussion of biology and parasitoids (*Coccophagus lycimnia* and *C. semicircularis*).

**Hodgson, C.J. & Henderson, R.C.** 1998. A new genus with two new species of soft scale insect (Hemiptera: Coccoidea: Coccidae) from New Zealand. *Journal of the Royal Society of New Zealand* 28(4): 605-639.

Notes: A soft scale genus, *Pounamococcus* Henderson & Hodgson, new genus, is introduced to take two new species, *P. tubulus* and *P. cuneatus* Henderson & Hodgson, described from New Zealand.

**Hohn, H., Hopli, H.U. & Graf, B.** 1998. [Branch sampling studies 1997/98 in apple trees.] *Astprobenuntersuchungen 1997/98 an Apfelbaumen*. (In German with summary in French.) *Obst- und Weinbau* 134: 129-131, 133.

Notes: Monitoring of insect and mite pests in apples was studied in 4 areas of Switzerland in 1997-98, with special reference to the use of branch samples. The results for 1998 on the incidence of pests are compared with a 5-year average for 1994-98. Coccidae infestations decreased, aphid infestation stabilized at a medium level and red spider mite (*Tetranychus urticae*) infestations increased.

**Hole, U.B. & Salunkhe, G.N.** 1998. Evaluation of rose cultivars against red

scale (*Aonidiella aurantii* Maskell). Journal of Maharashtra Agricultural Universities 22: 199-201.

Notes: Studies with thirty cultivars of *Rosa* spp. evaluated against red scale *Aonidiella aurantii* under field conditions in India indicated that cv. Mabella had the lowest population of scales, whereas cv. Maharaja S.S.N. was affected by the greatest number of scales. The cultivars with greater amounts of moisture, chlorophyll, nitrogen, phosphorus and lower amounts of carbohydrates coupled with a greater number of thorns per unit area appeared to have greater infestation levels of scales.

Hu, J.S., Sether, D.M., Ullman, D.E. & Lockhart, B.E. 1997. Mealybug wilt of pineapple: pineapple viruses and two-step heat treatment of pineapple crowns. (In English with summaries in French & Spanish) Acta Horticulturae 423: 385-492.

Notes: Proceedings of the Second International Pineapple Symposium held at Trois-Ilets, Martinique, 20-24 February 1995. An electron microscope assay able to detect pineapple closterovirus (PCV) from samples equivalent to less than 1 mg leaf tissue was developed and used to identify pineapple leaf materials having high PCV level. The letter was then purified at concentrations never achieved before. Monoclonal antibodies to PCV was produced using partially purified virus. From about 300 cell lines, 38 were found to be promising. Six of them were selected for cloning. Four clones were selected for production of ascites. A badnavirus (PBV) was found from samples and then amplified in PCR tests; the PBV may be important to mealybug-wilt etiology. Influence of temperature considered.

Hughes, G. & Samita, S. 1998. Analysis of patterns of pineapple mealybug wilt disease in Sri Lanka. Plant Disease 82: 885-890.

Notes: Mealybug wilt disease of pineapple has a complicated etiology, which is not yet fully understood. As a result, assessments of the disease in the field, such as those that are made in the context of evaluation of disease control methods, are usually based on symptomatology. Field assessments, based on symptoms of mealybug wilt disease, were made in the Kurunegala and Gampaha districts of Sri Lanka. These data were fitted to statistical probability distributions as a method of summarizing the spatial pattern of disease incidence. Most plots showed aggregated patterns of diseased plants, but there were some exceptions. Summarizing patterns of disease incidence by means of fitting statistical probability distributions provides a basis for significance testing in cases where factors affecting disease incidence are the subject of field experimentation. Some examples of this methodology are given.

Hywel-Jones, N.L., Evans, H.C. & Yan, J. 1997. A re-evaluation of the leafhopper pathogen *Torrubiella hemipterigena*, its anamorph *Verticillium hemipterigenum* and *V. pseudohemipterigenum* sp. nov. Mycological Research 101: 1242-1246.

Notes: *Torrubiella hemipterigena* and its anamorph, *Verticillium hemipterigenum*, are re-described from collections made on Cicadellidae in Thailand. A new species, *Verticillium pseudohemipterigenum*, collected on *Bambusaspis* sp. on bamboo in Trinidad and Surinam, is proposed. Based on these collections, the taxonomic status of the genera *Verticillium* and *Hirsutella* is discussed.

Hywel-Jones, N.L. & Samuels, G.J. 1998. Three species of *Hypocrella* with large stromata pathogenic on scale insects. Mycology 90: 36-46.

Notes: Three species of *Hypocrella* characterized by large stromata and living on scale insects are described or redescribed. Two rarely reported species, *H. gaertneriana* and *H. schizostachyi*, are associated with bamboo scale insects and are redescribed from South America and Thailand, respectively. The new species *H. africana* is described from scale insects on wood in Africa.

Islam, K.S. & Copland, M.J.W. 1997. Host preferences and progeny sex ratio in a solitary koinobiont mealybug endoparasitoid, *Anagyrus pseudococci* (Girault), in response to its host stage. Biocontrol Science and Technology 7(3): 449-

Notes: Mealybug host is *Planococcus citri*.

Islam, K.S., Perera, H.A.S. & Copland, M.J.W. 1997. The effects of parasitism by an encyrtid parasitoid, *Anagyrus pseudococci* on the survival, reproduction and physiological changes of the mealybug, *Planococcus citri*. *Entomologia Experimentalis et Applicata* 84(1): 77-83.

Notes: Survival, reproduction and some biochemical changes in the citrus mealybug, *Planococcus citri* (Risso) parasitized by the endoparasitoid, *Anagyrus pseudococci* (Girault) are reported. The parasitized younger mealybugs were more likely to die than be successfully parasitized. The mean duration (+SE) required for mortality other than mummification was identified. Hosts parasitized in the first instar did not produce any mummies while the second and third instar nymphs and adult stages of the mealybugs were mummified on average 8 to 11 days after attack. Parasitization caused cessation of normal fecundity as well as induction of early egg maturation of the mealybugs. The mealybugs parasitized in the adult stage produced a few eggs but the fecundity of unparasitized mealybugs was about 40 fold higher than that of parasitized mature adults. Parasitized pre-ovipositing and mature adults laid eggs within 24 h of attack. SDS-PAGE analysis of the body content of the parasitized mealybugs after 24 h and 48 h of parasitization and before egg hatch revealed an increase in the concentration of some proteins. The possible effect of parasitism on the changes of the reproductive physiology of the host is discussed.

Jactel, H., Menassieu, P., Ceria, A., Burban, C., Regad, J., Normand, S. & Carcreff, E. 1998. [An outbreak of the scale insect *Matsucoccus feytaudi*, which initiated decline of maritime pine in Corsica.] Une pullulation de la cochenille *Matsucoccus feytaudi* provoque un debut de deperissement du pin maritime en Corse. (In French with summary in English.) *Revue Forestière Française* 50: 33-45.

Notes: The use of pheromone traps led to the discovery of scale insect (*Matsucoccus feytaudi*) infesting maritime pine (*Pinus pinaster*) in Corsica in 1994. An epidemiological survey conducted at the seat of the infection, supplemented by genetic determination of the origin of the insects, indicated that there was a serious risk of an epidemic. In 1997, the initial symptoms of decline and dieback were noted in *P. pinaster* stands within the contaminated area. Control methods are discussed: both chemical control and widespread felling appear to be unrealistic. Further field trials are required before massive entrapment using pheromone traps can be implemented. In the short- and medium-term, the most promising control methods appear to be carefully planned remedial thinning, and the use of resistant *P. pinaster* genotypes.

Jaipurjar, S.K., Kumar, P. & Ramani, R. 1998. An air-dry method for cytological preparation of lac insect [*Kerria lacca*] (Coccoidea: Homoptera). *Insect Environment* 4: 2, 46.

Jaiswal, A.K., Sharma, K.K. & Agarwal, S.C. 1998. An efficient and indigenous device for lac-insect pest management. *Tropical Science* 38: 81-86.

Notes: A simple device is described which uses a size gradient and light attraction to separate predators, beneficial parasitoids (parasitizing predators of the lac insect) and inimical parasitoids of the Indian lac insect *Kerria lacca*. Used-up broodlac (twigs carrying resin encrustation with dead lac insects) is kept in a container and a meshed side unit separates the beneficial parasitoids which can be released to augment the natural population and control predators.

Jaiswal, A.K., Sharma, K.K., Sushil, S.N., Bhattacharya, A. & Mishra, Y.D. 1998. Lac associated insect fauna during storage. *Shashpa* 5: 2, 133-136.

Notes: The insect fauna associated with lac insects, *Kerria lacca*, was studied under storage conditions. The lac insect predator, *Pseudohypatopa pulverea* was the most commonly found predator and the predator's parasitoid, *Pristomerus sulci*, was also found.

- Jalaluddin, S.M. & Sadakathulla, S. 1998. Effect of Atso oil emulsion sprays in the control of mealy bug *Maconellicoccus hirsutus* infesting guava fruits. *Entomon* 23: 2, 151-152.
- Notes: Also, an inorganic oil emulsion spray gave good control of *Maconellicoccus hirsutus* on guava in India. Concentrations of 3 and 2% resulted in average populations of 0.77 and 3.03 individuals/cm<sup>2</sup> area of fruit, respectively, after 3 days.
- Japoshvili, G.O. 1998. On the population dynamics of the plum scale *Sphaerolecanium prunastri* Fonscolombe (Coccoidea: Coccidae) in Georgia. Page 22 in VIIIth International Symposium on Scale Insect Studies. 41 pp.
- Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. This species is a widespread pest of stone fruit throughout Europe, most of Asia and North America. Discussion of population dynamics and parasitoids.
- Jiao, Y. 1997. [Studies on the biology of *Chilocorus bijugus* Mulsant.] (In Chinese with summary in English.) *Natural Enemies of Insects* 19: 59-61,54.
- Notes: This lady beetle is an important predator of *Ericerus pela*.
- Jiao, Y., Chen, Y., Ye, S., Wang, Z., Wang, S. & Mao, Y. 1997. A study on *Chilocorus bijugus* Mulsant (Coccinellidae, Coleoptera). (In Chinese with summary in English.) *Forest Research* 10: 328-331.
- Notes: *C. bijugus* causes severe damage to the 2nd instar of white wax insect, *Ericerus pela*, in Kunming.
- Jimenez, S.T., Fuentes, R.L.E., Tapia, H.A., Mascarua, E., M.A., Martinez, R.E. & Caballero, M.J. 1997. *Coffea arabica* L., a new host plant for *Acetobacter diazotrophicus* and isolation of other nitrogen-fixing acetobacteria. *Applied and Environmental Microbiology* 63(9): 3676-3683.
- Notes: *Acetobacter diazotrophicus* was isolated from coffee plant tissues and from rhizosphere soils. Isolation frequencies ranged from 15 to 40% and were dependent on soil pH. Attempts to isolate this bacterial species from coffee fruit, from inside vesicular-arbuscular mycorrhizal fungi spores, or from mealybugs (*Planococcus citri*) associated with coffee plants were not successful.
- Johnson-Cicalese, J., Baxendale, F., Riordan, T. & Heng-Moss, T. 1998. Identification of mealybug- (Homoptera: Pseudococidae) resistant turf-type buffalograss germplasm. *Journal of Economic Entomology* 91: 340-346.
- Notes: Two species of mealybugs, *Tridiscus sporoboli* (Cockerell) and *Trionymus* sp., have emerged as potentially serious pests of turf-type buffalograss, *Buchloe dactyloides* (Nuttall) Engelman. Sixty-two buffalograss selections were screened for resistance to these mealybugs in 4 greenhouse trials. In field tests, mealybug infestations were highly variable, both within and among plots. However, in most cases, selections evaluated in the field showed similar responses as in greenhouse trials. Pubescence was positively correlated with buffalograss susceptibility to mealybugs. A glabrous leaf surface is suggested as a possible mechanism of resistance.
- Johnson, R.H., Young, B.L. & Alstad, D.N. 1997. Responses of ponderosa pine growth and volatile terpene concentrations to manipulation of soil water and sunlight availability. (In English with summary in French.) *Canadian Journal of Forest Research* 27: 1794-1804.
- Notes: A field manipulation of resources that may control the balance of growth versus differentiation (secondary metabolism and storage) in ponderosa pine (*Pinus ponderosa*) needles was performed by supplementing 10 mature trees with water, limiting water to 10 trees, and maintaining 10 controls. Within all trees, 2 or 3 branches were covered with shade cloth bags (60% light reduction). Within 4 months, watering increased sun-exposed needle mass and volatile terpene levels by approximately 35% above controls. Sampling at 12 months indicated a continuation of this trend. By 16 months of age, water-limited sun needles exhibited increased terpenes that approximated the levels of watered trees. The subsequent needle year class (1992) was produced under 14 months of combined water and shade

treatment. Masses of 4-month-old 1992 needles were greatest among watered trees; however, shading interacted to constrain watering effects to the same levels of control and water-limited trees. Volatile terpenes of the 4-month sun needles were highest among watered trees and intermediate among water-limited trees. Shading reduced all measures of needle terpenes, starch, and resin canal number but increased nitrogen content. No predictable trade-offs were observed between needle growth and differentiation processes. Scale insect (*Nuculaspis californica*) densities on 4-month-old needles grown during the second year of treatment were not affected by either water or light availability.

Jonsson, A.M. 1998. Bark lesions on beech (*Fagus sylvatica*) and their relation to epiphytes and site variables in Scania, south Sweden. *Scandinavian Journal of Forest Research* 13: 297-305.

Notes: Beech bark lesions, and the most common lichen and fungal epiphytes on beech (*Fagus sylvatica*) stems were studied at 48 sites in Scania, south Sweden. The bark lesions can be caused by beech bark disease (the result of an interaction between the beech scale, *Cryptococcus fagisuga*, the fungal pathogen *Nectria coccinea* var. *faginata*) and temperature damage, and are manifested by necrotic spots and slime flux. Different site variables and the influence of nitrogen deposition were investigated on lesion occurrence.

Kapatos, E.T., Stratopoulou, E.T. & Sahinoglou, A. 1997. Spatial pattern of *Saissetia oleae* (Homoptera: Coccidae) in Greece. *Environmental Entomology* 26: 1202-1207.

Notes: The spatial pattern and the spatial density dependence of mortality of *Saissetia oleae* (Olivier) were studied under field conditions. The results indicated that the distribution of *S. oleae* was highly aggregated and the degree of aggregation changed considerably during the generation, as indicated by the values of the exponent  $k$  of negative binomial distribution and the  $I$ -delta index of aggregation. Aggregation increased during the ovipositional period in summer and during winter, whereas it decreased during autumn and spring. The increased aggregation during summer was caused by the combined effect of crawler behavior as they searched for settlement, and of mortality, which is negatively related to population density. During autumn, and possibly during spring when the main action of natural enemies occurred, the reduced aggregation was caused by the direct density dependence of mortality. This relationship was determined to a certain extent by the action of the internal parasitoid *Metaphycus helvolus* (Compere). The increased aggregation during winter was attributed to an inverse density-dependent relationship between mortality and population density and also to larval movement from leaves to branches. A strong relationship between the mean and variance of population density (Taylor power law) was established with 2 types of sampling units (leaf, branch). The corresponding 2 values of the coefficient  $b$  were remarkably similar. However, the exponent  $k$  of negative binomial and the Morisita index of aggregation ( $I$ -delta) were found best to describe changes in the spatial pattern during the generation compared with the Taylor relationship.

Karaca, I., Senal, D., Colkesen, T. & Ozgokce, S. 1998. Observations on the oleander scale, *Aspidiotus nerii* Bouche (Hemiptera: Diaspididae) and its natural enemies on blueleaf wattle in the Adana province of Turkey. Page 23 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The biology of *A. nerii* and overall efficiency of its parasitoid *Aphytis melinus* and predators (*Chilocorus bipustulatus*, *Rhyzobius lophantae* and *Cybocephalus fodori minor*) were studied.

Katsoyannos, P. 1997. Status and importance of *Rhyzobius forestieri* (Col.: Coccinellidae) on citrus at Chios Island, Greece, nine years after its introduction. *Entomophaga* 42: 387-392.

Notes: The originally Australian coccidophagous predator *Rhyzobius forestieri* (Coleoptera: Coccinellidae), imported from California into Greece in 1981, was first released on citrus at Cambos, Chios, in 1983 against soft scales *Coccus pseudomagnoliarum* and *Saissetia oleae* (Homoptera: Coccidae). It was successfully established in two orchards there. During the following decade, *R. forestieri* spontaneously dispersed throughout the Cambos coastal plain. In July 1992, a survey of coccidophagous coccinellids was carried out, to follow up on the dispersal of *R. forestieri* on citrus and to compare its population size with that of the main native coccidophagous coccinellids. The samplings were made in four selected scale-infested orchards of Cambos spaced 1-2 km apart. Of a total of 337 adults and 237 larvae of coccidophagous coccinellids found, *R. forestieri* comprised 84.0% and 75.1%, respectively. It was present in all four localities; in two, *R. forestieri* adults and larvae were by far the most abundant coccidophagous coccinellids.

Katsoyannos, P. & Stathas, G.J. 1997. Phenology of *Melanaspis inopinata* on pistachio trees in Greece. *Phytoparasitica* 25: 331-332.

Notes: Observations on the phenology of *Melanaspis inopinata*, which is viviparous, were carried out at Avlon, Attica, in central Greece, during 1990-92. *M. inopinata* developed one annual generation on pistachio. Females overwintered as infertile adults. Reproductive activity began in late April or the first half of May. The first adult males appeared in late June or early July. Melanization of the body of immature females was first observed in early September and all females were melanized by early November. Ovulation was first observed in mid- or late March. An average of 79 plus or minus 16 eggs/female was found in dissections at a late stage of ovulation prior to the onset of viviparous activity.

Keller, S. 1997. The genus *Neozygites* (Zygomycetes, Entomophthorales) with special reference to species found in tropical regions. *Sydowia* 49: 118-146.

Notes: Several collections of mites (Acari: Tetranychidae, Phytoseiidae), mealybugs (Homoptera: Pseudococcidae) and aphids (Homoptera: Aphididae, Lachnidae) infected with Entomophthorales mainly from West Africa, South America and the Philippines were examined. All fungi found on Tetranychidae including the green cassava mite, *Mononychellus tanajoa*, were assigned to *N. floridana*. Species found on the phytoseiid *Euseius citrifolius* were identified as *N. acaricida*, comb. nov. and *N. cf. acaridis*, respectively. All material from mealybugs (*Rastrococcus invadens* and *Coccidohystrix insolita*) was identified as *N. fumosa*. An emended description of this species is given. The fungi from *Aphis craccivora* and *A. fabae* were identified as *N. fresenii*. A new species, *N. cinarae* attacking the lachnid *Cinara pilicornis*, is described. The life-cycles of *N. floridana* and *N. fresenii* are described and compared. A key to all known species and a short characterisation is provided.

Khajuria, D.R. & Sharma, H.K. 1997. Use of miscible oil and insecticidal combinations in management of San Jose scale (*Quadraspidiotus perniciosus*) on apple (*Malus domestica*). *Indian Journal of Agricultural Sciences* 67: 488-489.

Notes: In a field experiment in 1992/93 at Bajaura, Himachal Pradesh, India, 15- to 20-year-old Royal Delicious apple (*M. domestica* (*M. pumila*)) trees with 30-50% scale (*Quadraspidiotus perniciosus*) infestation on twigs were treated with 2% miscible oil before flowering (1.3 cm green-tip stage), followed by an insecticide application after flowering (peak crawler emergence in summer). Significantly lower scale infestation was observed before harvest in all treatments compared with the control treatment. The best treatment for controlling San Jose scale was 2% miscible oil followed by a spray of 0.4% chlorpyrifos in May (average population of 0.4 scales/twig and 0.7 scales/fruit). The next most effective treatments were 2% miscible oil followed by either 0.06% methomyl or 0.2% chlorpyrifos. It is concluded that miscible oil followed by a spray of chlorpyrifos in the first week of May is necessary for adequate protection of fruits from San Jose scale infestation in the lower

Kullu valley.

**Khoualdia, O., Rhouma, A., Brun, J. & Marro, J.P.** 1997. [Biological control of white scale. Introduction of an exotic predator in the palm grove of Segdoud.] Lutte biologique contre la cochenille blanche. Introduction d'un predateur exotique dans la palmeraie de Segdoud. (In French with summary in English.) *Phytoma* 49: 494.

Notes: Field studies were carried out in 1992 and 1994 in a date palm grove (cv. Deglet Nour) in Tunisia to investigate *Chilocorus bipustulatus* var. *iranensis* as a biological control agent of *Parlatoria blanchardii* (*Parlatoria blanchardii*). The methods of acclimation and release are discussed. This control method resulted in an acceptable level of *P. blanchardii* infestation.

**Kim, K.C. & Lee, H.B.** 1998. Natural enemies of the black pine bast scale (*Matsucoccus thunbergianae*) in the black pine forests. (In English with summary in Korean.) *Korean Journal of Applied Entomology* 37: 1, 73-80.

Notes: The natural enemies of *Matsucoccus thunbergianae* were surveyed in *Pinus thunbergii* forests in Korea Republic. The 24 species of predatory insects in 7 families of spiders are listed.

**Kim, J., Morimoto, K. & Kim, J.K.** 1998. [Studies on the natural enemies of *Protopulvinaria mangiferae* (Green) (Homoptera: Coccidae).] (In Korean with summary in English.) *Journal of Forest Science (Kangwon National University)* 14: 128-137.

Notes: In Fukuoka, Japan, the natural enemies of *Protopulvinaria mangiferae* were confirmed as 6 primary parasitoids, 3 hyperparasitoids, and 6 predators. Among the primary parasitoids, *Aneristus ceroplastae* [*Coccophagus ceroplastae*], *Microterys flavus* and *C. yoshidae* were relatively abundant. *C. ceroplastae* and *C. yoshidae* were solitary endoparasitoids, whereas *M. flavus* was a gregarious endoparasitoid. *Tetrastichus* sp. was a hyperparasitoid and solitary ectoparasitic to the pupae of *C. ceroplastae* and *M. flavus*. The seasonal fluctuation of parasitism and adult emergence of the important parasitoids was investigated in Fukuoka. Among the predators, *Rhyzobius forestieri* and *Chilocorus kuwanae* were relatively abundant, and seasonal fluctuation of adult emergence and consumption of the host were studied. As the first record from Japan, *R. forestieri* was collected on leaves of *Elaeocarpus sylvestris* with heavy infestations of *P. mangiferae*.

**Köhler, G.** 1998. Eriococcidae. Pages 371-402 in: Kozár, F., Ed., *Catalogue of Palaearctic Coccoidea*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Species reviewed in 17 genera. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

**Kontodimas, D.C.** 1997. First record of the predatory insect *Nephus bisignatus* (Boheman) (Coleoptera: Coccinellidae) in Greece. *Annales de l'Institut Phytopathologique Benaki* 18: 61-63.

Notes: This predator of mealybugs was recorded on *Thuja orientalis* and *Pistacia lentiscus* infested with *Planococcus citri*.

**Kosztarab, M.** 1998. Status and future of human resources in Coccidology. Page 23 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. This paper reviews the responses to a survey on the current status of researchers active in coccidology, emphasizing work in systematics, but also including work on morphology, biology, ecology, biological and chemical control of scale insects, and preparation of databases. The 39 responses provide a short assessment for 28 countries, including 14 US states, with the activities and/or whereabouts of about 160 researchers. Twelve, or 42% of active researchers (32), will reach retirement age within five years; but the average time for retirement of the 32 researchers is 11.7 years. The conclusions show a

of women in graduate training at present. From among the 20 graduate students in coccidology training, only nine are doing research in systematics.

Koteja, J. 1998. Fossil coccids do exist. Inclusion *Wrosteck* 28: 21.

Notes: Review of family affiliations of fossil coccids such as *Ortheziidae*, *Xylococcidae*, *Matsucoccidae*, *Electrococcidae*, *Monophlebidae*, *Putoidae*, *Eriococcidae*, *Inkaikidae*, *Kermesidae* and *Diaspididae*; mention of one species, *Eriococcus canadensis*.

Koteja, J., Kozár, F., Benedicty, Z.K. & Drozdják, J. 1998. Coccidae. Pages 41-164 in: Kozár, F., Ed., *Catalogue of Palaearctic Coccoidea*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Covers species from 63 genera. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. 1998. [Climatic change and the insects.] *Éghajlatváltozás és rovarvilág*. (In Hungarian.) *Magyar Tudomány* (Hungarian Science) 43: 1069-1076.

Notes: Because of the climatic changes of the past century a number of pest insects and weeds have spread farther north in Hungary; populations and the number of yearly generations have increased; species mentioned include *Pseudaulacaspis pentagona* and *Quadraspidiotus perniciosus*.

Kozár, F. (Ed.) 1998a. P, *Catalogue of Palaearctic Coccoidea*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Covers 372 valid genera, 2170 species assigned to 19 families, 171 synonymous generic and 2235 specific, replacement names or combinations; each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes; indices to scale insect names, host plants and distribution.

Kozár, F. 1998b. Pseudococcidae. Page 452 in: Kozár, F., Ed., *Catalogue of Palaearctic Coccoidea*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Explanation of why this family not covered; citations to other sources of mealybug information.

Kozár, F. & Benedicty, Z.K. 1997. Description of *Coccidohystrix samui* sp. n. (Homoptera: Coccoidea, Pseudococcidae) from Hungary. *Acta Zoologica Academiae Scientiarum Hungaricae* 43(3): 251-255.

Notes: A new species, *C. samui* is described from Hungary (Budapest, Sasbegy). An identification key is given to the Palearctic species of the genus. Zoogeographical considerations are given for the genus. The new species represents a link between Euro-Siberian and Western-Mediterranean subregions.

Kozár, F. & Drozdják, J. 1998. Aclerididae. Pages 11-14 in: Kozár, F., Ed., *Catalogue of Palaearctic Coccoidea*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Covers 13 species in *Aclerda* and *Nipponaclerda*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. & Drozdják, J. 1998a. Asterolecaniidae. Pages 15-33 in: Kozár, F., Ed., *Catalogue of Palaearctic Coccoidea*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Covers species from 12 genera. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. & Drozdják, J. 1998b. Beesonidae. Page 34 in: Kozár, F., *Catalogue of Palaearctic Coccoidea*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Two species (*B. napiformis* and *B. quercicola* reviewed. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. & Drozdják, J. 1998c. Cerococcidae. Pages 35-40. in: Kozár, F. (Ed.), Catalogue of Palaeartic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Reviews 24 species from *Asterococcus*, *Cerococcus*, *Phenacobryum* and *Pollinia*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. & Drozdják, J. 1998d. Conchaspidae. Pages 165-166 in: Kozár, F., Ed., Catalogue of Palaeartic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Reviews *Conchaspis angraeci*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. & Drozdják, J. 1998e. Cryptococcidae. Pages 167-168 in: Kozár, F., Ed., Catalogue of Palaeartic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Reviews *Cryptococcus aceris*, *C. fagisuga* and *C. integricornis*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. & Drozdják, J. 1998f. Dactylopiidae. Pages 169-171 in: Kozár, F., Ed., Catalogue of Palaeartic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Review *Dactylopius ceylonicus*, *D. coccus*, *D. confusus* and *D. tomentosus*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. & Drozdják, J. 1998g. Halimococcidae. Pages 403-404 in: Kozár, F., Ed., Catalogue of Palaeartic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Reviews *Colobopyga kewensis* and *Halimococcus thebaicae*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. & Drozdják, J. 1998h. Kermesidae. Pages 405-415 in: Kozár, F., Ed., Catalogue of Palaeartic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Reviews 38 species from *Allokermes*, *Kermes*, *Kuwanina* and *Nidularia*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Kozár, F. & Drozdják, J. 1998i. Lecanodiaspididae. Pages 416-420 in: Kozár, F., Ed., Catalogue of Palaeartic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary.

Notes: Review *Cosmococcus albizziae*, *C. erythrinae*, *C. euphorbiae*, *Crescoccus candidus*, *Lecanodiaspis africana*, *L. cremastogastris*, *L. sardoa*, *Prosopophora circularis*, *P. pasaniae*, *P. peni*, *P. robiniae*, *P. tingtunensis*, *Psoraleococcus costatus*, *P. foochowensis*, *P. quercus* and *P. verrucosus*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

- Kozár, F. & Drozdják, J. 1998j. Micrococcidae. Pages 442-443 in: Kozár, F., Ed., Catalogue of Palaearctic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.  
Notes: Reviews *Micrococcus bernardi*, *M. bodenheimeri*, *M. dumonti*, *M. rungsi*, *M. silvestri* and *M. similis*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.
- Kozár, F. & Drozdják, J. 1998k. Phoenicococcidae. Page 451 in: Kozár, F., Ed., Catalogue of Palaearctic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.  
Notes: Reviews *Phoenicococcus marlatti*. Lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.
- Kozár, F. & Drozdják, J. 1998l. Tachardiidae. Pages 453-455 in: Kozár, F., Ed., Catalogue of Palaearctic Coccoidea. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.  
Notes: Reviews *Kerria lacca*, *Metatachardia myrica*, *Paratachardina decorella*, *P. theae* and *Tachardina aurantiaca*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.
- Kozár, F., Hippe, C. & Mani, E. 1997. [Key to determine *Quadraspidiotus* (Homoptera: Coccoidea) males and to distinguish them from males of other genera.] Kulcs a *Quadraspidiotus* (Homoptera: Coccoidea) pajzstetu nembe tartozó hímek meghatározásához. (In Hungarian with summary in English.) *Növényvédelem* 33: 321-327.  
Notes: Taxonomic keys for males, useful in distinguishing the *Quadraspidiotus* genus from males of other Homoptera, scale families and genera are presented. It includes differences of flight time and easily observable characters, like the antennal segment or dorsal plate. Based on the description of *Quadraspidiotus perniciosus* (*Diaspidiotus perniciosus*), a nomogram is given to exclude other species.
- Kozár, F. & Konczné Benedicty, Z. 1997. Description of *Coccidohystrix samui* sp. n. (Homoptera: Coccoidea, Pseudococcidae) from Hungary. *Acta Zoologica Academiae Scientiarum Hungaricae* 43: 251-255.  
Notes: A new species, *C. samui* is described from Hungary (Budapest, Sasbegy). An identification key is given to the Palearctic species of the genus. Zoogeographical considerations are given for the genus. The new species represents a link between Euro-Siberian and Western-Mediterranean subregions.
- Kozár, F., Mazzoni, E. & Cravedi, P. 1997. Comparison of flight periods of male *Pseudaulacaspis pentagona* in Hungary and northern Italy. *Bulletin OILB/SROP* (Sect. Reg. Ouest Palearctique) 20: 43-49.  
Notes: Title of conference: Integrated plant protection in stone fruit. Proceedings of the meeting at Zaragoza, Spain, 24-26 September 1996. In recent years the white peach scale, *Pseudaulacaspis pentagona*, has shown a substantial northward expansion of its geographic range within Europe in a short space of time. A monitoring programme using pheromone traps was carried out in Hungary and in northern Italy during 1991-96. The total number of *P. pentagona* males collected in traps was much higher in Italy than Hungary. The number of males in Hungary decreased sharply after 1992. Male catches of the first generation were much higher than those of the second generation in both countries. The beginning and the peak of the first flight period in Italy were similar in each year. In Hungary, this phenological stage was much more variable, with the timing of the first generation varying by as much as six weeks between different years. The timing of the start of the second flight period showed large variations in both countries (5-6 weeks). All flight periods started in Hungary about one

month later than in northern Italy. Two flight periods were found during each year in both countries.

Kozar, F. & Miller, D. 1998. Collecting and analysing *Ortheziola*. Pages 23-24 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. A diverse array of collecting methods was used to find specimens of moss-infesting ortheziids, including Berlese funnels, litter screens, DVAC and visual inspection of the host plants. The effectiveness of these methods will be explored and compared. In many instances, collections using these methods have been stored as bulk samples and contain a wealth of scale-insect specimens that generally have been ignored by scale systematists. Using these methods, a large series of ortheziids has been discovered and a revision of the genus *Ortheziola* has been completed. This genus now contains 16 species, 13 from Africa, 2 from Europe and 1 from Nepal. Samples were examined from other zoogeographical regions, but no representatives of *Ortheziola* were found. The genus has several interesting and unique characters that demonstrate its monophyletic origins. Analysis of its phylogeny provides some interesting hypotheses when compared with its distribution.

Kreiter, P. & Dijoux, L. 1998. [White peach scale in a peach orchard: A control example in the maritime Alps.] La cochenille blanche du murier en verger de pecher: Un exemple de lutte dans les Alpes-Maritimes. (In French with summary in English.) *Phytoma* 50: 36-40.

Notes: A field study was carried out during 1996 in a peach orchard (cv. Anita, Daisy and July Lady) in southeastern France to investigate the life history of *Pseudaulacaspis pentagona* and possible control methods. Three generations per year were present and egg deposition began in early April. The most effective application periods for insecticides were mid-April, end of June and end of August. Control methods were high-pressure spraying of water on crowns, use of organophosphorus insecticides, and use of natural enemies (*Encarsia berlesei*, *Aphytis proclia*, *Rhyzobius satelles*, *Chilocorus bipustulatus* and *Ablerus perspeciosus* (*Azotus perspeciosus*)). High pressure spraying resulted in more efficient control, and the use of natural enemies resulted in good control and low costs.

Kreiter, P. & Panis, A. 1998. (In French with summary in English.) *Bulletin de la Société Entomologique de France* 103: 263-271.

Notes: Original title: Inventaire des ennemis naturels de la cochenille blanche du murier *Pseudaulacaspis pentagona* (Targioni-Tozzetti, 1886) dans le monde (Homoptera, Diaspididae). The natural enemies of *Pseudaulacaspis pentagona* are listed with their distribution. Many of these are polyphagous or hyperparasitic and therefore of little use as biological control agents.

Kreiter, P., Pinet, C., Panis, A. & Dijoux, L. 1997. [Study on the biological cycle of the white scale of peach *Pseudaulacaspis pentagona* (Targioni-Tozzetti) (Homoptera, Diaspididae) and its natural enemies in Emilie-Romagne (Italy).] (In French.) *Bulletin OILB/SROP* (Sect. Reg. Ouest Palearctique) 20: 14-20.

Notes: Original title: Etude du cycle biologique de la cochenille blanche du pecher *Pseudaulacaspis pentagona* (Targioni-Tozzetti) (Homoptera, Diaspididae) et ses ennemis naturels en Emilie-Romagne (Italie). Title of conference: Integrated plant protection in stone fruit. Proceedings of the meeting at Zaragoza, Spain, 24-26 September 1996. In field studies in Emilie-Romagne, Italy, in 1995, *Pseudaulacaspis pentagona* had 3 generations in the year. The first was present from approximately April-July, the 2nd from July to September and the 3rd from September, overwintering as gravid females. The natural enemies of the insect include the parasitoids *Encarsia berlesi* and *Aphytis proclia*, the predators *Rhyzobius satelles* (*Rhyzobius satelles*), *Chilocorus bipustulatus*, *Cybocephalus rufifrons* and *Arthrocnodax diaspidis*. Hyperparasitoids identified were *Ablerus perspeciosus* (*Azotus*

*perspeciosus*) (from *E. berlesi* and *A. proclia*), *Zaomma lambinus* (from *E. berlesi*) and *Thysanus ater*.

Krüger, O. & McGavin, G.C. 1998. The influence of ants on the guild structure of *Acacia* insect communities in Mkomazi Game Reserve, north-east Tanzania. (In English with summary in French.) *African Journal of Ecology* 36: 213-220.

Notes: Mention is made of coccoids and their parasites that were collected among the 41,099 insect specimens from 133 families.

Kucel, P. & Ngabirano, H. 1997. Effect of striped mealybug (*Ferrisia virgata* Cockerell) on marketable quality of Uganda Robusta coffee (*Coffea canephora* Pierre). Pages 771-778. in: Dix-septieme colloque scientifique international sur le cafe, Nairobi, Kenya, 20-25 juillet 1997. Association Scientifique Internationale du Cafe (ASIC), Paris.

Notes: In field experiments in Uganda in 1994-95, the effects of damage caused by *Ferrisia virgata* on yields of 6 clonal varieties of Robusta coffee (*Coffea canephora*) were investigated. Attack of the berry clusters by *F. virgata* interrupted normal bean development, leading to premature ripening and drying of berries on primaries. Such berries were of lower marketable quality. Mean bean size was reduced by 7.7%. Roast colour, centre-cut appearance and liquor quality were reduced.

Kumar, M.V.S. & Chakraborty, N. 1997. Biology of *Scymnus nubilus* Mulsant (Coleoptera Coccinellidae), a native predator of pink mealy bug, *Maconellicoccus hirsutus* (Green) (Hemiptera : Pseudococcidae). *Journal of Entomological Research*. New Delhi 21: 329-334.

Notes: The life cycle of *Scymnus nubilus*, the principal indigenous predator of the pseudococcid *Maconellicoccus hirsutus*, which causes tukra disease of mulberries in West Bengal, India, was studied in the laboratory under controlled conditions (25-28 deg C and RH 65-70%).

Kunkel, H. 1997. 1.2.3 Soft scales as beneficial insects. 1.2.3.1 Scale insect honeydew as forage for honey production. Pages 291-302. in: Ben-Dov, Y. & Hodgson, C.J., Eds., *Soft Scale Insects - Their Biology, Natural Enemies and Control* [Vol. 7A]. Elsevier, Amsterdam & New York. 452 pp.

Notes: Topics are distribution and diversity of species visited by honeybees, regions where the honeybee is endemic (Norway and Greece), regions where the honeybee has been introduced (U.S., New Zealand & South America), attractiveness of honeydew, amounts of honeydew, factors affecting the build-up of scale insect populations, and the role of apiculturists; species mentioned include *Dactylopius coccus*, *Ericerus pela*, *Coccus hemicyphus*, *Physokermes hemicyphus*, *P. piceae*, *Parthenolecanium piceae*, *P. rufulum*, *P. corni*, *P. fletcheri*, *Phyllostoma myrtilli*, *Kermes quercus*, *Marchalina hellenica*, *Ceroplastes rusci*, *Eulecanium sericeum*, *Pulvinaria pistaciae*, *Aclerda berlesii*, *Xylococcus macroparpi*, *Neopulvinaria innumerabilis*, *Ultracoelostoma assimile* and *Toumeyella parvicornis*.

La Notte, P., Buzkan, N., Choueiri, E., Minafra, A. & Martelli, G.P. 1997. Acquisition and transmission of grapevine virus A by the mealybug *Pseudococcus longispinus*. *Journal of Plant Pathology* 79: 79-85.

Notes: Transmission of grapevine virus A (GVA) by the pseudococcid mealybug *Pseudococcus longispinus* was studied. Phases of the transmission process (acquisition access time, retention, and inoculation access time) were checked by bioassays using *Nicotiana cleavelandii* and RT-PCR. Virus was acquired either from infected *N. cleavelandii* or from a purified preparation through a stretched parafilm membrane. Evidence was obtained that *P. longispinus* instars transmit GVA in a semi-persistent manner: they acquired GVA in as little as 15 min when feeding on *N. cleavelandii* or 12 h when feeding on purified virus preparations through a membrane; they retained the virus for up to 48 h when fasting, but no longer than 15 h when allowed to feed on herbaceous hosts following serial transfers; they were able to transmit GVA to healthy plants with no latent period, after a 30 min feeding

(the shortest inoculation access time tested). A preliminary survey of populations of different mealybug species collected in the vineyards of different Mediterranean countries showed that 77% contained GVA and 33% contained grapevine leafroll-associated virus 3 (GLRaV-3). Many samples, including a population of the coccid mealybug *Ceroplastes rusci* from Tunisia, contained both viruses.

**Labanowski, G. & Soika, G.** 1997. [New and lesser known pests occurring on ornamental trees and shrubs.] Nowe i mniej znane szkodniki występujące na drzewach i krzewach ozdobnych.] (In Polish with summary in English.) *Progress in Plant Protection* 37: 218-223.

Notes: In surveys in 1994-96, several species were recorded for the first time from Poland including *Unaspis euonymi* on *Euonymus japonicus*.

**Labanowski, G. & Soika, G.** 1998. [Euonymus scale - a potential pest of euonymus in Poland.] Tarcznik trzmielinowiec - potencjalny szkodnik trzmieliny w Polsce. (In Polish.) *Ochrona Roslin* 42: 12-13.

Notes: A description is given of the biology, development and reproduction of *Unaspis euonymi* on *Euonymus* species.

**Lagowska, B.** 1998. Morphological variation in *Coccus hesperidum* L. (Hemiptera, Coccoidea: Coccidae). Page 24 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Study of the variation of some morphological characters in adult female *C. hesperidum* collected on *Citrus*, *Ficus*, *Hedera*, *Iresine* and *Schefflera*. Four measured and six meristic characters were selected for biometric study. Discussion of mean values, range of variation and frequency distribution of these features.

**Lambdin, P.** 1998. *Cerococcus michaeli* (Hemiptera: Cerococcidae): a new species of false pit scale from New Zealand. *Entomological News* 109 (5): 297-300.

Notes: Description and illustration; this species is the second indigenous species to New Zealand and eighth species from the Australian Region in the genus; modified key provided to separate *C. michaeli* from other known species in this taxon; recorded on host *Dysoxylum spectabile*.

**Lambdin, P.L.** 1998a. Those bloody scale insects. Pages 24-25 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The cochineal scale was used as a source of dye by the Aztecs prior to the 1520 conquest of Mexico by Cortez. The introduction of this deep red dye into Europe enhanced the textile industry and contributed to the industrial dominance of the region for the next two centuries. Although the dye principle of cochineal is carminic acid and is obtained from the insect's body, the source of this material has remained a mystery. As such, an evaluation of the haemocytes in the cochineal scale, *Dactylopius confusus* was completed and compared with those haemocytes found in *Phenacoccus gossypii* and *Pseudococcus longispinus* to determine potential sites for the acid. We found only four basic cell types in the pseudococcids. However, the cochineal scale possessed five cell types. The four common cell types are easily distinguished morphologically and include prohaemocytes, typical granulocytes, oenocytoids and plasmacytes. The fifth and newly identified polyglycogranulocyte (PG-granulocyte) is specific to the cochineal scale and comprises the largest proportion of the haemocytes in all *D. confusus* samples. The structure of the PG-granulocyte will be described. Based on our observations, we hypothesize that this PG-granulocyte has been modified from the typical granulocyte and is potentially the means for the synthesis of the carminic acid. Investigations are underway to document the cell types in other species of scale insects and to isolate the associated proteins on the rough endoplasmic reticulum.

Lambert, J.D. & Moran, N.A. 1998. Deleterious mutations destabilize ribosomal RNA in endosymbiotic bacteria. *Proceedings of the National Academy of Science*. Washington 95: 8, 4458-4462.

Notes: In populations that are small and asexual, mutations with slight negative effects on fitness will drift to fixation more often than in large or sexual populations in which they will be eliminated by selection. If such mutations occur in substantial numbers, the combined effects of long-term asexuality and small population size may result in substantial accumulation of mildly deleterious substitutions. Prokaryotic endosymbionts of animals that are transmitted maternally for very long periods are effectively asexual and experience smaller effective population size than their free-living relatives. The contrast between such endosymbionts and related free-living bacteria allows us to test whether a population structure imposing frequent bottlenecks and asexuality does lead to an accumulation of slightly deleterious substitutions. The authors show that several independently derived insect endosymbionts (including *Pseudococcus longispinus*), each with a long history of maternal transmission, have accumulated destabilizing base substitutions in the highly conserved 16S rRNA.

Laranjeira, F.F. 1997. [Infestation of rufous scale on *Mimosa caesalpiniaefolia* Benth. used as windbreak in orange groves.] Infestação de cochonilha pardinha em sansao-do-campo usado como cerca viva em pomares de laranja. (In Portuguese with summary in English.) *Bragantia* 56: 289-290.

Notes: In October 1996, in Bebedouro county, Sao Paulo, Brazil, some plants of "sansao-do-campo" (*Mimosa caesalpiniaefolia*) used as a windbreak, were found infested by *Selenaspidus articulatus*. This observation suggests that windbreaks can influence the incidence of insect pests in citrus groves.

Lenfant, C. & Marro, J.P. 1997. [Biological control against the black scale *Saissetia oleae* Olivier (Homoptera: Coccidae).] Lutte biologique contre *Saissetia oleae* Olivier (Homoptera: Coccidae) avec *Metaphycus bartletti* Annecke et Mynhardt (Hymenoptera: Encyrtidae). (In French with summary in English.) *Annales ANPP* 2: 291-298.

Notes: Temperature relationships; development; parasite development & fecundity.

Lenteren, J.C. van 1998. Designing and implementing quality control of beneficial insects: towards more reliable biological pest control. *Sting* No. 18: 2-32.

Notes: *Planococcus citri* mentioned as host for *Leptomastix dactylopii*.

Lenteren, J.C. van, Drost, Y.C., Roermund, H.J.W. van & Posthuma-Doodeman, C.J.A.M. 1997. Aphelinid parasitoids as sustainable biological control agents in greenhouses. *Journal of Applied Entomology* 121: 473-485.

Notes: Aphelinid parasitoids have been used for the control of pests in greenhouses since the 1920s, but large scale application started approximately 25 years ago. Today, several aphelinid parasitoids are commercially used for the biological control of scale (Coccoidea), aphid (Aphididae) and whitefly (Aleyrodidae) pests in greenhouses. A success story is the biological control of greenhouse whitefly, *Trialeurodes vaporariorum*, with the aphelinid *Encarsia formosa*. *E. formosa* is applied on 5000 ha of vegetable crops worldwide. Weekly, more than 20 million individuals of *E. formosa* are mass reared and shipped to growers in 20 countries. About 10 years ago, another whitefly species, *Bemisia* sp., developed to pest status, and a search for control of scales and aphids in greenhouses is summarized, as well as the status of commercial biological control with aphelinid parasitoids. The questions of whether effective natural enemies can be identified before introduction and if autotoparasitoids should be imported and released are addressed. Finally, the usefulness of parasitoid biotype studies to recognize suitable candidates for biological control is considered.

Levitin, E. & Cohen, E. 1998. The involvement of acetylcholinesterase in resistance of the California red scale *Aonidiella aurantii* to organophosphorus pesticides. *Entomologia Experimentalis et Applicata* 88: 115-121.

Notes: Laboratory toxicity bioassays using chlorpyrifos (Dursban) confirmed the notion that development of resistance is responsible for widespread failures to control the California red scale, *Aonidiella aurantii* by applying organophosphorus (OP) compounds in citrus groves in Israel.

Li, T.R. 1997. Bionomics of *Dysmicoccus brevipes* (Cockerell) and its control. (In Chinese.) *Entomological Knowledge* 34: 149-152.

Li, S.J. & Zhao, H.B. 1997. Study on selection of geographical provenances of *Pinus tabulaeformis* resistant to *Matsucoccus matsumurae* Kuwana. (In Chinese with summary in English.) *Scientia Silvae Sinicae* 33: 307-320.

Notes: A provenance trial of *Pinus tabulaeformis* resistant to *Matsucoccus matsumurae* was carried out in Liaoyang and Benxi, China. Infestation by nymphs of *M. matsumurae* was recorded on 8- and 10-yr-old trees. Resistance to the scale insect varied significantly with provenance.

Liang, T., Ai, S.J. & Zhang, Q.X. 1997. Bionomics of *Quadrastpidiotus perniciosus* (Comstock) and its control. (In Chinese.) *Entomological Knowledge* 34: 152-153.

Lin, Y., Peng, Y.K. & Chen, S.Z. 1997. Studies on the bionomics of *Aulacaspis citri* Chen and its control. (In Chinese with summary in English.) *Journal of Southwest Agricultural University (Nanchong, Sichuan, China)* 19: 442-446.

Notes: *Aulacaspis citri* is an important scale insect infesting Citrus orchards in Sichuan, China. In 1987-95, systematic field sampling was combined with indoor feeding experiment to study its biological characteristics. Five generations of the pest were found to occur in one year with wide overlap of the generations. *Telsimia emarginata*, *Cryptolaemus montrouzieri*, *Pseudoscymnus kurohime*, *Chilocorus kuwanae*, *C. nigritus* (*C. nigrita*), *Chrysopa sinica* (*Chrysoperla nipponensis*), *Chrysopa formosa*, *C. shansiensis* (*Chrysoperla carnea*) and *Aphytis* sp. were identified as natural enemies, but their predatory rate was low, resulting in poor effectiveness of biological control. Thorough removal of bryophytes and spraying the tree crowns with contact or systemic insecticides to control overwintering larvae and adults are recommended as the key measures for control.

Lin, T., Yan, S.C., Shao, J.W. & Liu, J.X. 1997. The spatial distribution pattern of *Lepidosaphes salicina*. (In Chinese with summary in English.) *Journal of Northeast Forestry University* 25: 97-99.

Notes: The spatial distribution pattern of *Lepidosaphes salicina* was investigated in the Heilongjiang province, China, at the end of August and beginning of September 1993. Twenty-four trees were sampled over the experimental area using 120 x 1-cm<sup>2</sup> quadrats per tree. The distribution was investigated using the chi-squared statistic. Generally, the distribution fitted the Negative Binomial and the Nyman distributions, but not the Poisson distribution. The clumped nature of the insect's distribution was described by Iwao's model.

Lin, T., Yu, W., Liu, K.Y., Li, C.D., Li, S.Z. & Liu, J.X. 1997. The bionomics of willow oyster scale (*Lepidosaphes salicina*). (In Chinese with summary in English.) *Journal of Northeast Forestry University* 25: 71-73.

Notes: The life history of *Lepidosaphes salicina* was investigated in Heilongjiang province, China, in 1992-93. There was one generation per year. Between 3 and 110 eggs overwintered within the shell of each female. The 1st-instar larvae began to emerge in late May, and the 2nd-instar larvae about 24 days later. The males then pupated, which took 8-10 days. The females did not pass through a pupal stage before emerging as adults at the beginning of July. Egg-laying began in early August, peaked in mid- to late August, and ceased by mid-September. The egg period lasted 290-300 days.

Lit, I.L. 1997. [Integrated pest control in olive groves.] *La lotta integrata contro i fitofagi dell'olivo*. (In Italian with summary in English.) [Conference

paper: Mediterranean olive culture: status and prospects of olive culture and reserach. Held in Rende (CS), Italy, 26-28 January 1995.] 443-457.

Notes: [Original conference title: L'olivicoltura mediterranea: stato e prospettive della coltura e della ricerca. Rende (CS), Italy, 26-28 gennaio 1995.] Problems of integrated control of olive pests are outlined. The methods involved include: classic biological control of *Saccococcus oleae*, *Saissetia oleae* and *Parlatoria oleae*; the use of traps to monitor *S. oleae* and *Prays oleae*; and mass trapping of *B. oleae*. Cultural methods, such as pruning, fertilization and the timing of harvest, are also important.

Lit, I.L. 1997a. New records and additional notes on Philippine mealybugs (Pseudococcidae, Coccoidea, Hemiptera). *Philippine Entomology* 11: 33-47.

Notes: Corrects errors made in previous Lit and Calilung papers: genus *Imperaticoccus* and *I. celatus* are synonymized with *Kiritshenkella* and *K. lingnani*; *Paracoccus neocarens* is presented as a new combination; *Allobucco morrisoni* is transferred to *Paracoccus* and *P. interceptus* is proposed as new name; *Synacanthococcus bispinosus* is redescribed and lectotypified.

Lit, I.L. 1997b. First report of the family Lecanodiaspididae and other new records and notes on Philippine scale insects (Coccoidea, Hemiptera). *Philippine Entomology* 11: 87-95.

Notes: New records include *Psoraleococcus multipori*, *Saccaspis pseudomiliaris*, *Coccus celatus*, *Aulacaspis sumatrensis* and *Eriococcus araucariae*; other species reviewed include *Aclerda coganicola*, *Saccaspis bambusae*, *Aulacaspis madiunensis*, *A. sumatrensis*, *A. tuberculata*, *Hemiberlesia lataniae*, *Eriococcus araucariae*, *E. philippinensis* and *Crypticerya jacobsoni*; taxonomic notes; local distributions; hosts.

Lit, I.L., Caasi-Lit, M. & Calilung, V.J. 1998. The mealybugs (Pseudococcidae, Coccoidea, Hemiptera) of eggplant (*Solanum melongena* Linn.) in the Philippines. *Philippine Entomology* 12: 29-41.

Notes: Review of *Coccidohystrix insolita*, *Ferrisia virgata* and *Planococcus minor*; taxonomic discussion; illustrations; key; synonymy; brief descriptions.

Lit, I.L. & Gullan, P.J. 1998. Comparative morphology of the anal tubercle and associated structures of some lac insects (Hemiptera: Coccoidea: Kerriidae). Page 25 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 1st - Sept. 6th, 1998.] Abstract only. Specimens of *Kerria lacca*, *Austrotachardia acaciae*, *Austrotachardia* sp. ex *Cassinia* and *Paratachardina decorellis* were examined under the scanning electron microscope (SEM). SEM images were compared with light microscopy observations. The anal tubercles and associated structures of each species are described and compared. The presence of what appears to be vestiges of an anal cleft or plate in *Paratachardina* is interpreted as suggesting possible evolution of the lac insects from a lecanoid ancestor that possessed an anal cleft or plate. The results provide easy interpretation of characters under light microscopy.

Liu, J.X., Liu, K.Y., Yan, S.C., Lin, T., Chi, D.F., Wu, Q.Y., Li, F.R. & Li, C.S. 1997. Regulations of the outbreak of *Quadraspidotus gigas*. (In Chinese with summary in English.) *Journal of Northeast Forestry University* 25: 1-4.

Notes: Experiments were conducted in the Hongqi forest, Daqing city, Heilongjiang province in 1993 and 1994 to investigate the occurrence of outbreaks of *Quadraspidotus gigas* (*Diaspidiotus gigas*) on species of *Populus* and to determine variables affecting such outbreaks. The density of *D. gigas* was greater on the middle parts of the tree trunks than on the upper or lower parts. Pest density on the north- and east-facing sides of the trunk was more than double that on the south- and west-facing sides. First-instar larvae emerged in late June and temperatures on the north- and east-facing sides were lower and favoured survival.

Climatic data collected in the forest from 1951 to 1977 was analysed and a regression equation proposed to predict future outbreaks.

Liu, K.Y., Liu, J.X., Yan, S.C., Li, C.D., Lin, T., Deng, L.W., Li, W.H. & Rong, L.J. 1997a. Control threshold of willow oyster scale. (In Chinese with summary in English.) Journal of Northeast Forestry University 25: 1-4.

Notes: Control threshold levels for *Lepidosaphes salicina* were determined for 9-year-old poplar (*Populus*) plantations in Heilongjiang province, China, by regression analysis, using experimental data collected in 1992. Threshold levels of loss of timber volume were set first at 16%, with a pest density of 14.7 insects/cm<sup>2</sup>, second at 30% with 21.93 insects/cm<sup>2</sup>, and finally at 60% with 37.39 insects/cm<sup>2</sup>. When pest densities were below the first level, natural predators were recommended for keeping the pest population in check. A combination of natural and artificial methods was recommended to keep pest populations below the second level, and if pest populations exceeded the third level then chemical control, coupled with the removal of severely infested trees, was necessary.

Lockhart, B.E.L., Kiratiya-Angul, K., Jones, P., Eng, L., Silva, P. De, Lockhart, N., Deema, N. & Sangalang, J. 1997. Identification of *Piper* yellow mottle virus, a mealybug-transmitted badnavirus infecting *Piper* spp. in Southeast Asia. *European Journal of Plant Pathology* 103: 303-311.

Notes: *Planococcus citri* infected *P. nigrum* with this virus.

Longo, S., Marotta, S., Pellizzari, G., Russo, A. & Tranfaglia, A. 1998. A zoogeographical analysis of the Italian scale insect fauna. Page 25 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

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.

Lubulwa, G. & McMeniman, S. 1998. ACIAR-supported biological control projects in the South Pacific (1983-1996): an economic assessment. *Biocontrol News and Information* 19: 91N-98N.

Notes: Estimates are presented of benefits (to the year 2013) from 10 biological control projects in the South Pacific supported by the Australian Centre for International Agricultural Research (ACIAR) between 1983 and 1996. The projects aimed to control passion fruit white scale (*Pseudaulacaspis pentagona*) as well as other pests.

Lunderstadt, J. 1998. Impact of external factors on the population dynamics of beech scale (*Cryptococcus fagisuga*) (Hom., Pseudococcidae) in beech (*Fagus sylvatica*) stands during the latency stage. *Journal of Applied Entomology* 122: 319-322.

Notes: [Ed. Note: Beech scale belongs to Eriococcidae.] Investigation of infestation dynamics of *Cryptococcus fagisuga* on host, *Fagus sylvatica* during latency stage from 1988 to 1995 by means of a differential analysis. In almost all cases the beeches of the higher diameter classes on the strongly thinned plots were attacked significantly more than the corresponding ones on the moderately thinned plots. Increasing infestation was promoted by a decreasing flushing status on dry stands and by an increasing flushing status on moister stands.

Lurie, S., Fallik, E., Klein, J.D., Kozar, F. & Kovacs, K. 1998. Postharvest heat treatment of apples to control San Jose scale (*Quadraspidiotus perniciosus* Comstock) and Blue Mold (*Penicillium expansum* Link) and maintain fruit firmness. *Journal of the American Society for Horticultural Science* 123: 110-114.

Notes: Optimum temperatures established for control of pests without damage to fruit.

Lutete, D., Tata Hangy, K. & Kasu, T. 1997. [Occurrence in Zaire of *Stictococcus vayssierei*, a pest on cassava (*Manihot esculenta*).] Presence au Zaire de *Stictococcus vayssierei* (Homoptera, Stictococcidae), un ravageur du manioc (*Manihot esculenta*). (In French with summary in English.) *Journal of African Zoology* 111: 71-73.

Notes: Pest outbreaks of *Stictococcus vayssierei* Richard have been recently observed in the low-Zaire and are commented upon.

Ma, L., Li, C.D., Liu, J.Q., Sun, Y., Wang, X.L. & Ji, Y.J. 1997. Predatory function of *Chilocorus kuwanae* Silvestri on *Quadraspidiotus gigas* (Thiem et Gerneck). (In Chinese with summary in English.) *Journal of Northeast Forestry University* 25: 64-67.

Notes: *Quadraspidiotus gigas* (*Diaspidiotus gigas*) is a major pest

infesting poplar (*Populus*) in Northeast China. *Chilocorus kuwanae* is a natural enemy of this pest which can provide useful control. Numbers of pests which can be eliminated per day by adults and different larval stages of *C. kuwanae* were calculated.

Ma, L., Li, C.D., Liu, J.Q., Sun, Y., Wang, X.O. & Ji, Y.J. 1997a. The life course of *Chilocorus kuwanae* Silvestri. (In Chinese with summary in English.) Journal of Northeast Forestry University 25: 59-61.

Notes: *Chilocorus kuwanae* is a key natural enemy for *Quadraspidiotus gigas* (*Diaspidiotus gigas*) in the forest region of Northeast China. The life cycle and death cause of *C. kuwanae* were observed and analysed. The life-span of overwintering adults was 72 days. The larval period of ladybirds at 19.59-22.62 deg C lasted 21 days. Parasitism by *Homalotylus flaminus* on the larvae of ladybirds was the main mortality factor.

Mahbuba, J. & Islam, K.S. 1997. Arrestment response of *Metaphycus helvolus* (Hymenoptera: Encyrtidae) to honeydew of brown soft scale. Bangladesh Journal of Entomology 7: 47-54.

Notes: The searching behaviour of *Metaphycus helvolus*, a parasitoid of *Coccus hesperidum*, was investigated on honeydew-contaminated and clean leaf surfaces of *Nerium oleander*. The attraction/arrestment stimuli associated with the honeydew of the scale increased the searching capacity of the parasitoid. The females exhibited arrestment, frequent antennation, reduced walking speed and higher degrees of turning on honeydew-contaminated areas than on clean areas. On losing contact with the honeydew-contaminated area, the parasitoids showed increased turning (klinokinetic response), which oriented them towards the contaminated area again. Retention response of naive (inexperienced) females on the honeydew-treated leaf was higher than that of experienced ones. The results are discussed in relation to host location by *M. helvolus* and to the possibility of using honeydew in biological control programmes.

Mahmoud, F.A., Hamdy, M.K. & Hegazi, A.G. 1998. Antimicrobial activity of secretory materials of some scale insects. Page 26 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The antimicrobial activity of the secretory materials associated with the test or wax covers of five scale insects was tested for Gram-positive and Gram-negative bacteria. The scale insect studies were the margarodid *Icerya aegyptiaca*, the soft wax scale *Ceroplastes rusci* and three hard scales: *Aonidiella aurantii*, *Lepidosaphes beckii* and *Parlatoria ziziphus*. The results of these observations revealed that there were some highly significant antimicrobial activity associated with the secretory materials of these three scale species which varied according to type of the pathogenic bacteria it was used against, being most effective against *Staphylococcus aureus*, but least effective against *Corynebacterium pseudotuberculosis*.

Maity, D.K., Sahoo, A.K. & Mandal, S.K. 1998. Evaluation of laboratory hosts for rearing and mass multiplication of *Planococcus minor* (Maskell) (Pseudococcidae: Hemiptera). Environment & Ecology 16: 3, 530-532.

Notes: The mealybug *Planococcus minor* was successfully reared on sprouted potato tubers, pumpkins, elephant foot yam (*Amorphophallus campanulatus*) and taro corms. The average duration of development, preoviposition and oviposition periods, average fecundity and female:male ratios determined. *P. minor* failed to develop on elephant foot yam.

Mani, E., Kozar, F., Schwaller, F. & Hippe, C. 1997. The occurrence and biology of the mulberry scale, *Pseudaulacaspis pentagona* (Targioni-Tozzetti) (Homoptera: Diaspididae), in Switzerland. (In German.) Mitteilungen der Schweizerischen Entomologischen Gesellschaft 70: 399-408.

Notes: In recent years the thermophilous mulberry scale, *Pseudaulacaspis pentagona*, well-known from southern Europe, was found north of the Alps. Locally, populations became established and increased. However, this polyphagous insect has only been found on ornamental trees in towns so far

(mainly on *Sophora japonica*, *Aesculus* spp., *Catalpa bignonioides*, *Juglans* spp.), but not in orchards. The rate of parasitization, mainly by *Encarsia berlesei*, varied from 8 to 60%. Chemical control of the pest is only necessary when the attack is severe. In the years 1992-96 pheromone traps were used to study the distribution of the mulberry scale and the flight of the males. There are two separate generations per year in northern Switzerland. The flight of the males of the first generation starts in the middle/at the end of June and continues until the middle/end of July; the flight of the second generation lasts from the middle/end of August to the end of September/middle of October. Due to adverse climatic conditions the flight of the second generation often is poor.

Mani, M. & Krishnamoorthy, A. 1997a. Suppression of spherical mealybug, *Nipaecoccus viridis* (Newstead) (Homoptera: Pseudococcidae) on jack fruit. *Entomon* 22: 161-163.

Notes: The spherical mealybug, *Nipaecoccus viridis* (Newstead), a sporadic but often a severe pest on jack fruit *Atrocarpus heterophyllus* Lam. was suppressed by the encyrtid parasitoid *Anagyrus dactylopii* (How.) and the drosophilid predator *Cacoxenus perspicax* (Knab) within a month.

Mani, M. & Krishnamoorthy, A. 1997b. Biological suppression of the soft green scale, *Coccus viridis* (Green) and the green shield scale, *Chloropulvinaria psidii* (Maskell) on sapota. *Pest Management in Horticultural Ecosystems* 3: 114-116.

Notes: The coccinellid predators *Chilocorus nigrita* and *Cryptolaemus montrouzieri* were found to be effective against *Coccus viridis* and *Chloropulvinaria psidii* (*Pulvinaria psidii*) in sapota (*Manilkara zapota*) in Bangalore, Karnataka, India.

Mani, M. & Krishnamoorthy, A. 1998. Biological control studies on the mango green shield scale *Chloropulvinaria polygonata* (Ckll.) (Homoptera, Coccidae) in India. *Entomon* 23(2): 105-110.

Notes: The green shield scale *Chloropulvinaria polygonata* (Ckll.) has become a serious pest of mango in the Indian subcontinent in spite of the application of insecticides. *C. polygonata* was attacked by three parasitoids namely *Coccophagus bivittatus*, *C. nigricorpus* sp. nr. *Metaphycus helvolus*, and three predators viz. *Cryptolaemus montrouzieri*, *Mallada astur* and *Spalgis epius* in mango orchards around Bangalore. The coccinellid *C. montrouzieri* is a new record on *C. polygonata*, though it has been recorded on other species of *Chloropulvinaria*. A study conducted on the predatory potential of *C. montrouzieri* revealed that the predator consumed about 2400 eggs of *C. polygonata* in its larval developmental period of +15.40 days. *C. montrouzieri* was found to be very effective in suppressing the scale population in two mango orchards near Bangalore.

Mani, M. & Krishnamoorthy, A. 1998a. *Kerria communis* (Mahdn.) and its natural enemies on custard apple in Karnataka. *Insect Environment* 4: 2, 38-39.

Notes: During January 1997, *Kerria communis* was recorded from custard apple (*Annona squamosa*) at Bangalore, Karnataka, India. Large numbers of the encyrtid parasitoids *Erencyrtus dewitzi* [*E. dewitzi*] and *Parechthrodryinus clavicornis* were reared from the pest, and small numbers of the noctuid predator *Eublemma amabilis* were also recorded. By December 1997, all plants were free from infestation, which was thought to be due to high levels of parasitism by the encyrtids.

Mani, M., Lakshmi, V.J. & Krishnamoorthy, A. 1997. Side effects of some pesticides on the adult longevity, progeny production and prey consumption of *Cryptolaemus montrouzieri* Mulsant (Coccinellidae, Coleoptera). *Indian Journal of Plant Protection* 25(1): 48-51.

Notes: The influence of six selective pesticides on the adult longevity, progeny production and prey consumption of the ladybird beetle *Cryptolaemus montrouzieri*, an excellent predator of several mealybug species, was studied. The adult longevity of both the sexes of the predator was not adversely affected by the pesticidal treatments. The

longevity varied from 32 to 46 days in males from 121 to 138 days in females exposed to different treatments. Diflubenzuron (200 ppm) was the only insecticide tested that had a pronounced effect on the adult females yielding only 278 progenies compared to 419 by the untreated females. A maximum number of 142 mealybugs (*Planococcus citri* (Risso)) was consumed by chlorpyrifos treated larvae of *C. montrouzieri*. However, the prey consumption by the larvae treated with other pesticides did not vary much from the untreated batch. It is suggested that these selective pesticides - except diflubenzuron could be considered in the integrated pest management programmes.

**Mardzhanyan, M.A.** 1997. Revision of the subfamily Sphaeridiinae (Coleoptera, Hydrophilidae) in Armenia. (In Russian with summary in English.) *Entomologicheskoe Obozrenye* 76: 153-171.

Notes: Margarodidae species mentioned as hosts.

**Marotta, S. & Franco, J.C.** 1998. Is the genus *Lusitanococcus* Neves, a junior synonym of *Cucullococcus* Ferris (Hemiptera: Coccoidea: Pseudococcidae). Page 27 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The genus *Lusitanococcus* was established by Neves in 1954 to include *arrabidensis*, a new species of mealybug collected in Portugal on *Erica arborea* and *E. lusitanica*. Later, on the basis of the original illustration and description, some workers have considered *Lusitanococcus* as a subjective synonym of *Cucullococcus*, while others have considered it a valid genus. New specimens have been collected in the topotypic locality on the same host plant and these have been compared with type specimens of *L. arrabidensis* and with *vaccinii*, the type species of *Cucullococcus*. From this study, we conclude that (i) the genus *Lusitanococcus* is a junior subjective synonym of *Cucullococcus*, and that (ii) *arrabidensis* is a valid species. Discussion of the generic characters of *Cucullococcus*.

**Marotta, S. & Pagano, G.** 1997. [Research on *Delottococcus euphorbiae* (Ezzat & McConnell) (Homoptera Coccoidea Pseudococcidae) II. Bio-ethological.] *Ricerche su Delottococcus euphorbiae* (Ezzat & McConnell) (Homoptera Coccoidea Pseudococcidae) II. Osservazioni bio-etologiche. (In Italian with summary in English.) *Entomologica* 31: 99-115.

Notes: This is a South African mealybug living on geranium and succulent plants; pest status in Italy and southern France; biological notes; geographical distribution; host plants; ethological observations; key to Italian mealybugs on geranium.

**Marotta, S., Russo, A. & Matile-Ferrero, D.** 1997. *Phenacoccus asphodeli* Goux, 1942 a rare Mediterranean species newly found in Italy (Homoptera: Coccoidea: Pseudococcidae). *Annales de la Société Entomologique de France* 33: 435-439.

Notes: *Phenacoccus asphodeli* Goux, 1942 (Homoptera, Coccoidea, Pseudococcidae) is redescribed and illustrated. The lectotype is here designated. The species is newly recorded from Italy. *Phenacoccus mutinensis* Menozzi, 1933, lectotype here designated, is transferred to the genus *Heliococcus*; it becomes *Heliococcus mutinensis* (Menozzi) comb. n. *Heliococcus mutinensis* (Menozzi, 1933) syn. n. is synonymized with *Heliococcus bohemicus* Sulc, 1912. A key for the identification of the Italian species of *Phenacoccus* is given.

**Marotta, S. & Tranfaglia, A.** 1998. A new morphological structure on *Kermes vermilio* (Planchon) (Hemiptera: Coccoidea: Kermesidae). Page 27 in VIIIth International Symposium on Scale Insect Studies 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *Kermes vermilio* is a common scale insect living on *Quercus ilex* in southern Italian urban environments. Morphological studies on the young instars of both sexes have shown the presence of ventral frontal lobes. These lobes are situated just anteromedially to each basal antennal segment and have a membranous

appearance. Previously, similar lobes were only known in many species of the family Eriococcidae. These structures are here recorded in Kermesidae for the first time and it is considered likely that they are also present in other species of the family. Their function is unknown.

Martinez, M. de los A. & Moraima, S. 1997. [*Antoninoides* Ferris (Homoptera: Pseudococcidae) in sugarcane, new genus for Cuba.] *Antoninoides* Ferris (Homoptera: Pseudococcidae) en cana de azucar, nuevo genero para Cuba. (In Spanish with summary in English.) *Revista de Protección Vegetal* 12: 55-56.

Notes: The genus *Antoninoides* is reported for the first time on sugarcane in Cuba. Morphological characteristics are described.

Matile-Ferrero, D. & Dauphin, P. 1997. [Occurrence of *Parafairmairia gracilis* Green (Homoptera Coccidae) in Gironde]. Présence en Gironde de *Parafairmairia gracilis* Green (Homoptera Coccidae). (In French.) *Bulletin de la Société Linnéenne de Bordeaux* 25: 159-161.

Notes: Field description; hosts; distribution.

Mendel, Z. 1998. Biogeography of *Matsucoccus josephi* (Homoptera: Matsucoccidae) as related to host resistance in *Pinus brutia* and *Pinus halepensis*. (In French with summary in English.) *Canadian Journal of Forest Research* 28: 323-330.

Notes: The range of the scale *Matsucoccus josephi* was outlined as related to that of its hosts *Pinus halepensis* and *Pinus brutia* in the Mediterranean and Black Sea regions. Population density of *M. josephi* and host susceptibility were investigated in 53 provenances of *P. halepensis* and 4 subspecies of *P. brutia*. The primary range of *M. josephi* is eastern Mediterranean and corresponds to that of *P. brutia* subsp. *brutia*, which is highly resistant to *M. josephi*. Provenances of *P. halepensis* from Greece and the Near East are quite resistant, as compared with those of the West Mediterranean. *Pinus brutia* subsp. *pityusa* (*P. pityusa*), *P. brutia* subsp. *stankewiczii* (*P. pityusa* var. *stankewiczii*), and *P. brutia* subsp. *eldarica* (*P. eldarica*) are highly susceptible. Speciation of *M. josephi* could have occurred in the south of the areas between the Black and the Caspian Seas from a progenitor that came into contact with *P. brutia* subsp. *brutia* after speciation of *P. brutia* and *P. halepensis* and the formation and isolation of the four subspecies of the former. The resistance to *M. josephi* of pines of the subsection *Halepenses*, viz. *P. brutia brutia*, is believed to be the result of coevolution.

Mendel, Z., Assael, F., Zeidan, S. & Zehav A. 1998. Classical biological control of *Palaeococcus fuscipennis* (Burmeister) (Homoptera: Margarodidae) in Israel. *Biological Control* 12: 151-157.

Notes: *Palaeococcus fuscipennis* is rarely observed in pine forests in Mediterranean and Central European countries. It was discovered in Israel in 1990 in a single pine stand in Nahal 'Iron (northern Samaria). Between the time of its detection and the summer of 1996, the scale insect had spread to the NE and NW, infesting 1300 ha of forest of *Pinus brutia* ssp. *brutia* Tenore, *P. halepensis* Miller, *P. pinea* L., and *P. canariensis* C. Smith. Infested trees were covered with honeydew and with stems and crowns displaying thick layers of sooty mold. Association of the scale with several predacious arthropods, including large populations of the coccinellid *Rodolia cardinalis* Mulsant (Coleoptera: Coccinellidae), failed to reduce its population level and spread to new plantations. In 1994 and 1995 two specific natural enemies of *P. fuscipennis*, the coccinellid *Novius cruentatus* Mulsant and the parasitoid *Cryptochetum jorgepastori* Cadahia (Diptera: Cryptochetidae), were introduced from "Marismas del Dial Nature Reserve" SE of Huelva in southern Spain and released at a single site in 'Iron forest in Nahal 'Iron. In the summer of 1996, both enemies were detected over most of the range of the pest. A large decrease in the pest's population density and in the sooty mold cover was observed at the site of release of its natural enemies. Our findings suggest that *N. cruentatus* is the major contributor so far to the population reduction of

*P. fuscipennis*.

Mendel, Z., Gross, S., Steinberg, S., Cohen, M. & Blumberg, D. 1998. Trials to control the citrus mealybug in citrus orchards by inundative releases of natural enemies. Page 28 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *Planococcus citri* has become a major pest in Israel, owing to the intensive planting of highly susceptible varieties, the introduction of Insect Growth Regulators (which have an adverse effect upon coccinellid populations) and also to the development of resistance to chlorpyrifos by the mealybug. We investigated the possibility of managing the mealybug populations in citrus plantations by inundative release of predators and parasitoids such as *Cryptolaemus montrouzieri*, *Symphorobius sanctus*, *Leptomastix dactylopii* and *Anagyrus pseudococci*.

Merchant, M. & Hoelscher-Cox, J. 1997. Biological control of citrus mealybug in an indoor shopping mall. Report, Biological Control Program (Texas Agricultural Extension Service, The Texas A&M University System 1996-97: 17-18.

Notes: *Leptomastix dactylopii* was released on ficus trees to control *Planococcus citri*; results encouraging.

Miller, D., Ben-Dov, Y. & Gibson, G. 1998. Scalenet: a searchable information system on scale insects. Pages 28-29 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st Sept. 6th, 1998.] Abstract only. Systematic information on the scale insects of the world is currently being compiled and synthesized in a database system called BASIS. The information is organized by scale insect family and is searchable at a site on the World Wide Web called ScaleNet at <http://www.sel.barc.usda.gov/scalenet/scalenet.htm>. The site provides general information on scale insects, including sections on economic importance, life histories, distribution and ecology, classification, and the biographies of scale insect taxonomists. A query system provides information on valid names and a complete systematic catalogue for any valid genus or species. For a particular scale insect species, queries will give the following information: host plants, geographical distribution, references for a given species, a checklist of all valid species in a family or genus, biological notes, and remarks about each species. It also will give all the coccoid species that occur on a particular host, all coccoid species recorded from a particular zoogeographic region, country or country subunit, and the scientific name for any common name of a scale insect. A useful query enables the user to search for all references with any of five selected words in a publication title, periodical name or annotation.

Miller, D.R. & Davidson, J.A. 1997. Obituary: Richard F. Wilkey (1925-1995). Pan-Pacific Entomologist 73: 201-203.

Miller, D.R. & Davidson, J.A. 1998. A new species of armored scale (Hemiptera: Coccoidea: Diaspididae) previously confused with *Hemiberlesia diffinis* (Newstead). Proceedings of the Entomological Society of Washington 100: 193-201.

Notes: Description and illustration of *Hemiberlesia neodiffinis*, new sp., recorded in eastern and midwestern U.S.; pest of tulip poplar and lilac; originally a tropical species from the Caribbean Islands, Central America, South America and Mexico; *Asidiotus fabernii* is transferred to *Quadraspidiotus*, new comb.

Miller, D.R. & Gimpel, M.E. 1999. New combinations, new synonymy, and homonymy in the Eriococcidae, new homonymy and synonymy in the Cerococcidae, and transfer of *Cancerococcus Koteja* to the Margarodidae (Hemiptera: Coccoidea). Proceedings of the Entomological Society of Washington 101(1): 212-218.

Notes: A database and catalog of the eriococcid and cerococcid scale

insects of the world is nearly complete and soon will be in press and placed on the World Wide Web. Before this is done, new combinations and other taxonomic changes need to be validated in print. This publication includes *Neokaweckia* Tang and Hao as a new synonym of *Eriococcus*, proposal of *Neotrichococcus* as a new name for *Trichococcus* Borchsenius, and new combinations in the family Eriococcidae; a new homonym and synonym in the Cerococcidae; and transfer of *Cancerococcus* from Eriococcidae to Margarodidae.

Miller, D.R., Gullan, P.J. & Williams, D.J. 1998. Family placement of species previously included in the scale insect genus *Sphaerococcus* Maskell (Hemiptera: Coccoidea). Proceedings of the Entomological Society of Washington 100: 286-305.

Notes: The genus "*Sphaerococcus*" Maskell includes many rotund scale insects that do not seem to fit elsewhere; family placement of many species into Pseudococcidae is questionable or unknown; purpose of paper is to provide correct family placement of each species described in this genus; 12 taxa are transferred to new families; five new combinations and one new synonymy.

Miller, D.R. & Williams, D.J. 1998. *Melzeria horni* Green (Hemiptera: Coccoidea: Eriococcidae): redescription of a poorly known felt scale. Proceedings of the Entomological Society of Washington 100: 458-463.

Notes: Redescription of species and evidence of support for placement in family Eriococcidae.

Miller, R.H. & Jones, M.J. 1998(1997). Fluctuation in a population of ground pearls, *Porphyrophora tritici* (Bodenheimer) (Homoptera: Margarodidae), in barley in northern Syria. *Rachis* 16: 84-88.

Notes: A barley field on an ICARDA research farm near the village of Boudier, 60 km southeast of Aleppo, Syria, was 95% infested with *P. tritici* during spring 1987. Annual rainfall in this area is about 220 mm, falling during October to April. Information is presented on the plant infestation and population composition (first instar nymphs and second instar cysts) of *P. tritici* on the barley landrace Arabi Abiad, grown on this field during the 1987-88 and 1988-89 seasons after cultivation by disc to a depth of about 10 cm. During the 1987-88 season, number of plants infested by *P. tritici* decreased from about 35% in January to <5% in May; no infestation was observed during 1988-89. The effects on insect infestation of the farming systems involving barley in Syria's marginal rainfed areas, and particularly grazing by sheep, are mentioned.

Mishra, Y.D., Bhattacharya, A., Sushil, S.N. & Agrawal, S.C. 1998. *Adansonia digitata* Linn (Fam: Bombacaceae) as a lac host plant - a first record. *Insect and Environment* 4: 2, 49.

Notes: A lac insect identified as *Kerria fici* was recorded infesting *Adansonia digitata*, a tree of economic importance for its timber, edible fruits and medicinal uses, around Ranchi, Bihar, India.

Mizrahi, Y., Nerd, Y. & Nobel, P.S. 1997. Cacti as crops. *Horticultural Reviews* 18: 291-319.

Notes: Includes discussion of *Dactylopius coccus* utilized for dye production.

Mkrtchyan, L.P. 1998. [On evolutionary trends of the genitalia of the ground pearls of the family Margarodidae (Homoptera, Coccinea).] (In Russian with summary in English.) *Entomologicheskoe Obozrenye* 77: 46-53.

Notes: Evolution of the genitalia in the ground pearls of the family Margarodidae has resulted in the reduction of the testes, formation of a new organ -- sperm bundles, and in some representatives of the family, also in the progressive development of the penis. These morpho-functional changes lead to intensifying of the insemination function in males, peculiar for the short active life.

Mkrtchian, L.P. & Sarkissov, R.N. 1998. Some characteristics of the development of the sex organs in Margarodid males. Page 29 in VIIIth International Symposium of Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. A comparative study of the male organs of three subfamilies of the margarodidae (Margarodinae, Monophlebinae and Coelostomidiinae) has shown that some morpho-functional rearrangements occur in their ontogenesis during the pre-imaginal period. These changes lead to a reduction of the testes and formation of an evolutionary new structure, a spermsac filled with semen bundles. Two types of construction are distinguished.

**Moglan, I.A. & Moglan, V.** 1997. [Hymenopteran parasitoids (Hymenoptera, Chalcidoidea) which restrain the species *Sphaerolecanium prunastri* Fonscolombe (Homoptera, Coccidae) in the central zone of Moldavia.] (In French with summary in English.) *Analele Stiintifice ale Universitatii "Al I Cuza" din Iasi*. (Serie Noua) Sectiunea I Biologie Animala 41/43: 45-50.

Notes: Original title: Hymenoptères parasitoides (Hymenoptera, Chalcidoidea) qui restreignent l'espèce *Sphaerolecanium prunastri* Fonscolombe (Homoptera, Coccidae) dans la zone moyenne de la Moldavie. Surveys were carried out during 1981-85 at Iasi, Romania, to monitor parasitoids of *Sphaerolecanium prunastri* on *Prunus cerasifera* var. *pisardii*. *Coccophagus lycimnia*, *Metaphycus silvestrii*, *Discodes coccophagus*, *Microterys hortulanus*, *Pachyneuron concolor* (*P. muscarum*) and *Cerapterocerus mirabilis* were found. Parasitism in larvae varied between 9.8 (1983) and 37.1% (1985), and in females between 42.3 (1981) and 87.7% (1983).

**Moglan, I.A. & Moglan, V.** 1997a. The efficiency of parasitoids (Hymenoptera, Chalcidoidea) to decrease the number of the coccid *Parthenolecanium corni* Bouche (Homoptera, Coccidae) in southern Moldavia. *Analele Stiintifice ale Universitatii "Al I Cuza" din Iasi*. (Serie Noua) Sectiunea I Biologie Animala 41/43: 39-44.

Notes: Original title: L'efficience des parasitoides (Hymenoptera, Chalcidoidea) dans la diminution du coccide *Parthenolecanium corni* Bouche (Homoptera, Coccidae) dans le sud de la Moldavie. Surveys were carried out during 1978-1984 at Malu Alb, Galati district, Romania, to investigate parasitoids of *Parthenolecanium corni* on *Robinia pseudoacacia*. *Pachyneuron concolor* (*P. muscarum*), *Blastothrix longipennis*, *Metaphycus insidiosus*, *M. stagnarum*, *Tetrastichus trjapitzini*, *Tetrastichus* sp., *Coccophagus lycimnia* and *Marietta picta* were found. Parasitism in larvae varied between 10.1 (1982) and 71.8% (1979), and in females between 32.3 (1984) and 87.1% (1979).

**Mohammad, Z.K., Gabbour, M.W. & Tawfit, M.H.** 1998. Population dynamics of *Aonidiella orientalis* Newstead (Coccoidea: Diaspididae) and its parasite *Habrolepis aspidioti* Annecke (Hymenoptera: Encyrtidae). Page 29 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The fluctuation and seasonal abundance of *Aonidiella orientalis* and its parasite *Habrolepis aspidioti* on *Ficus nitida* trees were studied at Giza governorate between 1995-1997. During the first year, 4 population peaks were noted for *A. orientalis* and 5 peaks for the parasitoid although only 3 and 4 peaks respectively were noted in the second year. The effects of such climatic factors as temperature, relative humidity, photoperiod, dew point and wind velocity were considered.

**Moorhouse, R.J.** 1997. The diet of the North Island kaka (*Nestor meridionalis septentrionalis*) on Kapiti Island. *New Zealand Journal of Ecology* 21(2) 141-152.

Notes: Food of the North Island kaka (*Nestor meridionalis septentrionalis*) on Kapiti Island was identified while quantifying the foraging activity of nine radio-tagged birds from March 1991 to January 1992. A diverse range of food was taken, including wood-boring invertebrates, scale insects, seeds, nectar or pollen, fruits, and sap.

**Mopper, S. & Strauss, S.Y.** 1998. Genetic Structure and Local Adaptation in

Natural Insect Populations: Effects of Ecology, Life History, and Behavior. Chapman and Hall, New York. xix + 449 pp.

Notes: The four parts of this book are: local adaptation, empirical evidence from case studies (population structure and the conundrum of local adaptation, deme formation in a dispersive gall-forming midge (*Asphondylia* sp.), prevention of deme formation by the pinyon needle scale (*Matsucoccus acalyptus*) - problems of specializing in a dynamic system, local adaptation in specialist herbivores - theory and evidence); foundations of local adaptation, the genetic basis of host-plant use and the nature of selection (population-level adaptation to host-plant chemicals - the role of cytochrome P450 monooxygenases, assessment of genetic variation in the presence of maternal or paternal effects in herbivorous insects, the strength of selection - intraspecific variation in host-plant quality and the fitness of herbivores), life history, behaviour and genetic structure (intrademic genetic structure and natural selection in insects, social behaviour and its effects on colony- and microgeographic genetic structure in phytophagous insect populations, dispersal and adaptive deme formation in sedentary coccoid insects, life-history strategies and the genetic structure of phytophagous insect populations); and local adaptation, host-race formation and speciation (differential adaptation in spatially heterogeneous environments and host-parasite coevolution, scale-dependent evolution of specialization in a checkerspot butterfly (*Euphydryas editha* (*Occidryas editha*)) - from individuals to metapopulations and ecotypes.

Moralev, S.N. & Bazyukin, A.B. 1997. Using multidimensional statistical analysis to study the dependence of anticholinesterase effectiveness of organophosphorus inhibitors on their structure. (In Russian.) Journal of Evolutionary Biochemistry and Physiology 33(3): 302-307.

Notes: Factor, cluster and multifactor analyses of data from the literature on mammalian and insect cholinesterase (CE) sensitivity to organophosphorus inhibitors (OPI), the derivatives of dialkyl phosphoric acids, were carried out. Three groups of enzymes are identified: one of them is derived from Arthropoda CE (aphids, flies, corn earworm, mealybug, red spider mite). The enzymes differ mainly in the nature of the dependence of enzyme sensitivity on the structure of OPI molecule alkyl radicals. This fact is apparently determined by differences in the structure of the active surface of these enzymes. It is shown that in the series and groups of enzymes studied, the structure of the cleaved OPI moiety does not affect the nature of the dependence of anticholinesterase activity on the structure of the phosphoryl portion and vice versa.

Morgan, D.J.W. & Hare, J.D. 1998. Innate and learned cues: scale cover selection by *Aphytis melinus* (Hymenoptera: Aphelinidae). Journal of Insect Behavior 11: 463-479.

Notes: *Aphytis melinus* recognizes and accepts covers of its host, California red scale, *Aonidiella aurantii*, before assessing the size or quality of the scale body beneath. The role of a non-volatile kairomone, O-caffeoyltyrosine, and prior experience with hosts on the recognition (antennal drumming) and acceptance (ovipositor probing) of scale covers differing in age and, therefore, size was evaluated. Results for host acceptance differed from those for host recognition. Wasps given experience with large hosts accepted more covers with kairomone than wasps in other treatments, but the size preference did not vary among treatments. When the kairomone was removed, however, wasps given experience with large hosts under large covers preferred larger covers. Host recognition and acceptance are controlled by different behavioral mechanisms. Prior experience with hosts does not alter host recognition but does affect the rate of acceptance. The quality of the experience does not affect the acceptance of covers containing natural levels of kairomone but does affect host acceptance when the kairomone is removed. Experience with hosts alters the motivation of wasps to accept covers, and the direction of this effect is determined by the size (quality) of body the

wasps were given during the experience.

Mugo, H.M., Omondi, G.O. & Ndugo, S.M. 1997. Biological control of coffee insect pests in Kenya. Pages 646-652. in: Dix-septieme colloque scientifique international sur le cafe, Nairobi, Kenya, 20-25 juillet 1997. Association Scientifique Internationale du Cafe (ASIC), Paris.

Notes: Investigations in Kenya into the biological control of several spp. including *Coccus alpina* and *Aspidiotus* sp. on coffee; descriptions.

Mussey, G.J. & Potter, D.A. 1997. Phenological correlations between flowering plants and activity of urban landscape pests in Kentucky. *Journal of Economic Entomology* 90: 1615-1627.

Notes: Seasonal appearance of 33 insect pests of urban landscapes together with flowering phenology of 34 species of common woody ornamental plants were systematically monitored for 3 yr in central Kentucky. Base temperatures and degree-day requirements corresponding to these events also were determined. Phenological sequences of plant flowering and insect activity were highly consistent between years. For example, crawlers of the oystershell scale, *Lepidosaphes ulmi* (L.), hatched first in each year, followed by those of pine needle scale, *Chionaspis pinifoliae* (Fitch); euonymus scale, *Unaspis euonymi* (Comstock); juniper scale, *Carulaspis juniperi* (Bouche); calico scale, *Eulecanium cerasorum* (Cockerell); walnut scale, *Quadraspidiotus juglansregiae* (Comstock); a cottony maple leaf scale, *Pulvinaria acericola* (Walsh & Riley); and obscure scale, *Melanaspis obscura* (Comstock). Plant phenology was generally a better predictor of insect activity than was calendar date. Comparison of the temporal deviation between plant-insect correlations in Kentucky and Michigan suggests that some phenological predictors are consistent across geographic regions, whereas others are not. A phenology calendar was developed that facilitates prediction of pest activity and timing of control actions by horticultural professionals and lay persons.

Myers, J.H., Savoie, A. & van Randen, E. 1998. Eradication and pest management. *Annual Review of Entomology* 43: 471-491.

Notes: *Parlatoria blanchardi*, the date palm scale, mentioned as an eradication project.

Narayanaswamy, K.C. & Reddy, D.N.R. 1997. Mulberry scale insect fauna of the world - a review. *Indian Journal of Sericulture* 36: 1-10.

Notes: The harmfulness, biology, seasonal incidence, natural enemies and management of some important scale insect pests (belonging to the Diaspididae, Margarodidae, Coccidae and Dactylopiidae) of mulberry are reviewed.

Neuenschwander, P 1997. Biological control as the basis of plant protection in West and Central Africa: The experience of the International Institute of Tropical Agriculture. Page 34 in: Robertson, H.G., Ed., *Insects in African economy and environment*. Entomological Society of Southern Africa, Pretoria, South Africa.

Notes: [Joint Congress of the Entomological Society of Southern Africa (11th Congress) and the African Association of Insect Scientists (12th Congress), Stellenbosch, South Africa, June 30-July 4, 1997] Discussions of the control of *Phenacoccus manihoti* by *Apoanagyrus* (*Epidinocarsis*) *lopezi* and *Rastrococcus invadens* by *Gyranusoidea tebygi* and *Anagyrus mangicola*.

Obrycki, J.J. & Kring, T.J. 1998. Predaceous Coccinellidae in biological control. *Annual Review of Entomology* 43: 295-321.

Notes: Coccinellidae are important natural enemies of pest species, including mealybugs and scales; example given on successful biological control of cottony-cushion scale by *Rodolia cardinalis*; *R. cardinalis* also released against *Icerya purchasi*; three *Chilocorus* spp. mentioned against *Aonidiella aurantii*.

Ohe, W. von der, Bosche, U. & Ohe, K. von der 1997. [Chemistry of honeydew from spruce.] (In German with summaries in English and French) *Apidologie* 28: 3-4, 161-163.

Notes: [Summaries only] Analytical parameters such as taste, honeydew elements and electrical conductivity are necessary but not sufficient for specification of honeydew honeys. Chemical, physical and microscopic analyses were carried out on honeydew, content of honey sacs and honey. Honeydew of Coccidae differ from those of Lachnidae in electrical conductivity.

Oka, H., Ito, Y., Yamada, S., Kagami, T., Hayakawa, J., Harada, K., Atsumi, E., Suzuki, M., Suzuki, M. & Odani, H. 1997. Separation of lac dye components by high-speed counter-current chromatography. *Journal of Chromatography A* 813: 71-77.

Notes: Lac dye is a natural food additive extracted from a stick lac which is a secretion of the insect *Coccus laccae* (*Laccifer lacca* Kerr) and is widely used for coloring food. It is known that its red color is derived from a water-soluble pigment including laccaic acids A, B, C, and E. The quantities of these components vary according to the locality and season. For food sanitation and safe manufacturing practice, therefore, the development of a simple and precise method for identification of each component is required. High-speed counter-current chromatography (HSCCC), an advanced liquid-liquid partition method that does not require a solid support, has been used as a powerful technique for the purification of lac dye components in these experiments.

Padi, B. 1997. Prospects for the control of cocoa mealybugs. Pages 249-263 in: *Proceedings First International Cocoa Pests and Diseases Seminar*, Accra, Ghana, 6-10 November, 1995. Cocoa Research Institute, Accra, Ghana.

Notes: Cocoa swollen shoot virus (CSSV) disease in Ghana and other West African countries has been devastating, causing heavy losses in crop production since its discovery in 1934. Past attempts to control the Pseudococcidae vectors with chemicals and natural enemies were unsuccessful. The present control method of removing infected trees showing visible symptoms, as well as surrounding trees, has also achieved limited success. The possibility of exploiting the use of natural enemies, semiochemicals, tolerant or cocoa varieties unattractive to pseudococcids, and the sterile male technique for effective vector control are considered.

Padi, B. 1997a. Morphological variation in cocoa mealybugs. *Proceedings First International Cocoa Pests and Diseases Seminar* 218-237.

Notes: [Meeting held in Accra, Ghana, 6-10 November, 1995.] Morphological studies using discriminant function analysis (DFA) and principal component analysis (PCA) confirmed previous observations that *Planococcus citri* exhibited a wide range of intra-specific morphological variations but failed to identify any new *Planococcus* species. Two new morphological variants of *P. citri* suspected to be new *Planococcus* species, based on the conventional identification method, were distinguished by DFA but not by PCA and were tentatively named *Planococcus* sp. A and *Planococcus* sp. nr. *P. minor*. The study identified a number of measured characters for the separation of *P. citri* and *Planococcoides njalensis* collected from Tafo, Ghana, and *Planococcus kenyae* collected from coffee (*Coffea arabica*) in Nairobi, Kenya. Measured characters that might be useful for separation of species within the genus *Planococcus* were also identified. The results are discussed in relation to the control of cocoa swollen shoot virus [cacao swollen shoot virus] in Ghana.

Padi, B. 1997b. Parthenogenesis in mealybugs occurring on cocoa. *Proceedings First International Cocoa Pests and Diseases Seminar* 242-248.

Notes: [Meeting held in Accra, Ghana, 6-10 November, 1995.] Three separate studies were conducted in 1992 and 1994-95 to investigate parthenogenesis in *Planococcoides njalensis*, *Planococcus citri* and *Ferrisia virgata*. In the first study, fecundity and survival of offspring were compared in laboratory-reared virgin females of *P. njalensis* and *P. citri* of different maternal origin, and between unmated and mated females of *F. virgata*. In the second study, fecundity and offspring survival were compared between

unmated and mated females of *P. njalensis* and *P. citri* of different maternal origin over three generations. In the third study, fecundity and offspring survival of mated and unmated female *P. citri* siblings of female products of parthenogenesis were compared. It was concluded that for the three mealybug species, reproduction is both sexual and parthenogenetic but that at some stage, yet to be determined, it becomes imperative for females produced by parthenogenesis to be mated for the continuation of subsequent generations.

**Padmanaban, B., Daniel, M. & Jose, C.T.** 1997. A non-destructive method to estimate surface area of areca fruit for entomological studies. *Journal of Plantation Crops* 25: 103-105.

Notes: A non-destructive method is described for estimating surface area of arecanut (*Areca catechu*) fruit at various stages of fruit development and to estimate crop losses due to *Aonidiella orientalis*. A correlation matrix was developed for the length, breadth and surface area of areca fruit at different stages of development, and a model was developed to describe the relationship. A further study was conducted to develop a similar model for scale infestation size and yield loss.

**Paloukis, S.S., Navrozidis, E.I. & Kukuryanis, V.H.** 1997. Contribution to the integrated control of *Pseudaulacaspis pentagona* Targ.-Toz. (Homoptera: Diaspididae) on kiwifruit trees (*Actinidia chinensis*). *Acta Horticulturae* 444: 797-802.

Notes: [Proceedings of the Third International Symposium on Kiwifruit, Thessaloniki, Greece, Esfakiotakis, E. & Porlingis, J., Eds.] This scale is a pest especially in areas where continuous use of pesticides has destroyed its natural enemies such as *Encarsia berlesei*. This study examines bioecology and integrated control techniques.

**Panis, A. & Pinet, C.** 1998. On the effectiveness of two *Plagiomerus* species (Hymenoptera, Encyrtidae) as parasitoids of *Diaspis* species under glass in southeast France. Page 31 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *Plagiomerus diaspidis* Crawford is known to parasitise the cactus scale *Diaspis echinocacti* Bouche. *P. diaspidis* was found in Tenerife (Canary Is, Spain) for the first time on *Opuntia ferox* infested with *D. echinocacti*. A laboratory culture was produced and scale control was then tried in a glasshouse in southeastern France with cactaceous plants infested with low to average infestations of the cactus scale. Unfortunately, the populations remained stable after release and so *P. diaspidis* cannot be considered as an effective parasitoid under Mediterranean glasshouse conditions. In addition, another (undescribed) species of *Plagiomerus* was also found commonly parasitizing three *Diaspis* species under wet tropical glasshouse conditions in southeastern France but it failed to control them. Some biological characteristics of this species also described.

**Panis, A. & Pinet, C.** 1998a. On the effectiveness of the diaspidid parasitoid *Coccidencyrtus malloi* Blanchard (Hymenoptera, Encyrtidae) under glasshouse conditions in southeastern France. Page 31 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *Coccidencyrtus malloi* is known to parasitise the Boisduval scale, *Diaspis boisduvalii* on orchids in Argentina. This species was accidentally imported with neotropical orchids into glasshouses in southeastern France. A Brazilian line of *C. malloi* was cultured for experimental release on orchids infested with low to average populations of this scale. This culture provided good control, except on *Cattleya* x under dry atmospheric conditions. Another line of *C. malloi* of undetermined origin was found in a large, wet glasshouse with relative humidity varying between 60-80%g. This glasshouse had two *Diaspis* species living on exotic ornamentals but *C. malloi* failed to attack these scales

- when the colonies were mixed and was confined to *Diaspis bromeliae* in a few small areas which had an almost water-saturated atmosphere.
- Peck, S.B., Heraty, J., Landry, B. & Sinclair, B.J. 1998. Introduced insect fauna of an oceanic archipelago: the Galápagos Islands, Ecuador. *American Entomologist* 44(4): 219-237.
- Notes: Scale species listed include *Aspidiotus destructor*, *Asterolecanium pustulans*, *A. puteanum*, *Coccus hesperidum*, *C. viridis*, *Ferrisia virgata*, *Geococcus coffeae*, *Hemiberlesia lataniae*, *Howardia biclavis*, *Icerya purchasi*, *Melanaspis odontoglossi*, *Orthezia insignis*, *Parlatoria crotonis*, *Parasaissetia nigra*, *Planococcus citri*, *Pseudaulacaspis major*, *Saissetia coffeae*, *S. miranda*, *S. neglecta* and *Selenaspidis articulatus*.
- Pellizzari-Scaltriti, G. & Dalla Montà, L. 1997. 1945-1995: Fifty years of incidental insect-pest introduction to Italy. *Acta Phytopathologica et Entomologica Hungarica* 32: 171-183.
- Notes: More than one hundred exotic insect pests have been introduced to Italy in the years between 1945-1995. The new introduced species (115) are arranged in chronological lists according to the main host plants. They are mainly pests of ornamentals, woody plants and *Citrus*. Homoptera comprises 76% of the total number of introduced species. Countries of origin and hosts surveyed.
- Pellizzari-Scaltriti, G. & Dalla Montà, L. 1997a. [Insect pests introduced into Italy from 1945 to 1995.] Gli insetti fitofagi introdotti in Italia dal 1945 al 1995. (In Italian with summary in English.) *Informatore Fitopatologia* 10: 4-12.
- Notes: More than one hundred exotic insect pests have been introduced to Italy in the years between 1945-1995. The new introduced species (115) are ordered in chronological lists according to the main host plants. They are mainly pests of ornamentals, woody plants and *Citrus*. Homoptera comprises 76% of the total number of introduced species. Countries of origin and hosts surveyed.
- Pellizzari-Scaltriti, G. & Fontana, P. 1998. Observations on the life history of *Lecanopsis clodiensis* (Pellizzari). Page 31 in VIIIth International Symposium on Scale Insect Studies. 41 pp.
- Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The biology of *Lecanopsis clodiensis* has been studied in Italy, where this widespread species lives on Gramineae. *L. clodiensis* has one generation/year. Discussion of biology, reproductive behavior in natural environments (a sandy beach and a meadow), and in the laboratory, mating behavior and the capacity of displacement of adult females.
- Pena, J.E., Mohyuddin, A.I. & Wysoki, M. 1998. A review of the pest management situation in mango agroecosystems. *Phytoparasitica* 26(2): 129-148.
- Notes: Integrated pest management programs for mango must be based on sampling and on economic thresholds, and must take into account the effects of cultural practices, horticultural sprays and disease control on pest and natural enemy interactions. An analysis of the mass of information available on the different mango pests, which include scales and mealybugs; as well as suggestions for future entomological research.
- Petercord, R. 1997. [Physiological reactions of beech trees *Fagus sylvatica* L. attacked by beech scale *Cryptococcus fagisuga* Lind.] Physiologische Reaktion der Rotbuche *Fagus sylvatica* L. auf den Befall durch die Buchenwollschildlaus *Cryptococcus fagisuga* Lind. (In German with summary in English.) *Mitteilungen der Deutschen Gesellschaft für Allgemeine und Angewandte Entomologie*. Bremen 11: 569-573.
- Notes: *Fagus sylvatica* and *Cryptococcus fagisuga* are subject to a highly specific intimate host parasite relationship, so the nutrient quality of the host is an important factor influencing the fluctuation of the pest. In 1994-96, 120 beech trees in the forest district of Bovenden near Göttingen, Germany, were investigated genetically, physiologically and ethologically in a pair comparison. Genetic differences between uninfested

and infested beech trees were exhibited at the gene locus A of isocitrate dehydrogenase (IDH-A). Differences in bark compound distribution between uninfested beeches and beeches with decreasing infestation were established.

**Peterson, M.A. & Denno, R.F.** 1998. Life-history strategies and the genetic structure of phytophagous insect populations. Pages 263-322. in: Mopper, S. & Strauss, S.Y., Eds., Genetic Structure and Local Adaptation in Natural Insect Populations: Effects of Ecology, Life History, and Behavior. Chapman & Hall, New York. xix + 449 pp.

Notes: Ecological and population genetic data for phytophagous insect species including *Nuculaspis californica*.

**Podsiadlo, E.** 1998. Morphology of some developmental stages of *Quadraspidiotus zonatus* (Frauenfeld). Page 32 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The first and second instars of *Q. zonatus* are described and illustrated. Sexual dimorphism is discussed in both instars.

**Pollini, A. & Bariselli, M.** 1998. [Strategy of integrated control against the migration of larvae of the San Jose scale (*Comstockaspis perniciososa*) in pear orchards in Emilia-Romagna (Italy).] Pages 79-80. in: First transnational workshop on biological, integrated and rational control: status and perspectives with regard to regional and European experiences Service Regional de la Protection des Vegetaux, Nord Pas-De-Calais, Loos-en-Gohelle.

Notes: [Original title: Strategie de lutte integree contre la migration des larves de pou de San Jose (*Comstockaspis perniciososa*) en vergers de poiriers en Emilia-Romagna (Italie). Conference held in Lille, France, 21-23 January 1998.] The San Jose scale (*Comstockaspis perniciososa* (*Diaspidiotus perniciosus*)) is an increasing threat to pome fruits orchards in the region Emilia-Romagna, Italy. A field study was carried out during 1996 in 2 pear orchards (cultivars Rosada and William). Applications after leaf fall with polysulfide, buprofezin or white oil products were the basis of the control strategy. High infestation levels demand insecticide spraying during spring and summer at larvae hatching. Microencapsulated formulations of fenitrothion and chlorpyrifos provided good control when applied in spring (at the start of migration of first generation larvae) and resulted in a reduced number of sprayings later in the season.

**Ponsonby, D.J. & Copland, M.J.W.** 1998. Environmental influences on fecundity, egg viability and egg cannibalism in the scale insect predator, *Chilocorus nigritus*. (In English with summary in French.) *Biocontrol* 43: 1, 39-52.

Notes: The effects of temperature on age-specific fecundity, egg viability and egg cannibalism were examined in the coccidophagous coccinellid, *Chilocorus nigritus* being fed on the cyanophyllum scale, *Abgrallaspis cyanophylli*. There were no significant differences in lifetime fecundity or oviposition rate at constant temperatures in the range of 20 to 30°C although there was a trend for both parameters to increase with increasing temperatures.

**Porcelli, F.** 1998. Fine morphology of the antennae of *Diaspis echinocacti* (Bouche) (Hemiptera: Coccoidea: Diaspididae). Page 32 in VIIIth International Symposium of Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Discussion of antennae in the Diaspididae. Examination by means of crystal violet and Transmission Electron Microscopy, as well as Scanning Electron Microscopy.

**Porcelli, F. & Garonna, A.P.** 1998. A multi-contributors database for all aspects of the biology and control of the Diaspididae. Page 33 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The difficulties of studying the

Diaspididae from an Agricultural Entomology point of view are recognized by the authors. A multi-contributors database, which includes all aspects of biological control, host-plant relationships, world distribution and taxonomy, is submitted for the attention of researchers engaged in the control of armoured scale insect pests.

Prasad Kumar, Divakar, B.N., Hegde, N.K. & Ganigara, B.S. 1998. Nature of damage and efficacy of insecticides against mealybug, *Ferrisia virgata* (Ckll.) on black pepper cuttings. *Pest Management in Horticultural Ecosystems* 4: 52-53.

Notes: Among 6 insecticides tested against *Ferrisia virgata* in black pepper (*Piper nigrum*) cuttings under glass in Karnataka, India, dimethoate, parathion-methyl and quinalphos were the most effective.

Qin, T.K., Gullan, P.J. & Beattie, A.C. 1998. Biogeography of the wax scales (Insecta: Hemiptera: Coccidae: Ceroplastinae). *Journal of Biogeography* 25: 37-45.

Notes: Modern and native distributions of wax scales (Such as *Ceroplastes ceriferus*, *C. sinensis*) are documented and an area cladogram including seventy species is presented. Wax scales are distributed worldwide, but most species are native to either South America or Africa. Native distribution pattern is discussed in relation to their host-plant specificity and to the dispersal and vicariance theories of biogeography. The vicariance theory is preferred, because the pattern can be explained satisfactorily by plate tectonics but not by dispersal from a centre of origin. The wax scale group probably originated in the combined South American-African continent at least 97 million years ago.

Qin, H.Z., Tang, S.J. & Feng, J.R. 1997. Preliminary study on *Aonidiella taxus* Leonardi. (In Chinese with summary in English.) *Journal of Shanghai Agricultural College* 15: 109-113.

Notes: From studies in 1994-95, it was concluded that *Aonidiella taxus* has 3 or 4 generations every year in Shanghai, China. Fertilized female adults of the third generation and 2nd-instar nymphs of the fourth generation overwinter on leaves of *Yew Podocarpus* sp. or *Taxus* sp.). Nymphs of each generation are present from mid-May to late July, late July to the beginning of October, mid-September to late November, and mid-October to late November, respectively. It is suggested that control efforts should be concentrated on the first generation. The effectiveness of a pesticide, Dieteling (of unspecified composition), for control of the pest is discussed.

Raciti, E., Tumminelli, R., Conti, D., Marano, G., Barraco, D., Dinatale, A. & Fisicaro, R. 1997. [*Planococcus citri* on citrus.] Il cotonello degli agrumi. (In Italian.) *Informatore Agrario* 53: 11, 67-70.

Notes: The results of an integrated control program conducted at 35 citrus (orange and lemon) farms in eastern Sicily in 1993-96 are summarized, with particular reference to the biological control of the pseudococcid *Planococcus citri* by releases of the encyrtid *Leptomastix dactylopii* and the coccinellid *Cryptolaemus montrouzieri*. *L. dactylopii* was introduced at rates of 1500-4500 individuals/ha in 2 or more periods from end of May to end of July. *C. montrouzieri* was released in May at the rate of about 300 individuals/ha in citrus groves with a visible presence of *P. citri* when climatic conditions were not favourable to the activity of *L. dactylopii*. The predator was also released at the rate of about 600 individuals/ha in late summer (August-September) in citrus groves with high infestations of *P. citri*. In some cases, the activity of beneficial insects was disturbed by ants, especially *Linepithema humile*, and it was therefore necessary to control these by applying gum to the trunks of adult trees and chlorpyrifos to the trunks of young trees. Selective insecticides were used when necessary against other pests. The costs of control were compared with those using traditional methods in 1990-92. With the program of integrated defense adopted on the 35 farms, the total number of insecticide treatments made per year was reduced by monitoring key pests

and beneficial insects and intervening only when the economic thresholds were exceeded. The mean cost of integrated management was not reduced compared to traditional management because of the high costs of rearing beneficial insects, but the tendency over the years was for a reduction in costs.

**Rahiman, P.A. & Vijayalakshmi, C.K.** 1998. *Spalgius epius* Westwood (Lepidoptera: Lycaenidae) - a potential predator of coffee mealy bugs. *Journal of Entomological Research*. New Delhi 22: 2, 191-192.

Notes: The predatory potential of *Spalgius epius* [*S. epeus*] on a pseudococcid complex comprising *Planococcus citri*, *P. lilacinus* and *Ferrisia virgata* was studied on coffee in the field in Chundale, Kerala, India, during 1997. The extent of predation varied from 54.72 to 68.38%.

**Rajagopal, B.K., Viraktamath, C.A. & Gowda, V.N.** 1997. Incidence of ant associated mealy bug, *Xenococcus annandalei* (Homoptera: Pseudococcidae) on grapes in south India. *Entomon* 22: 165-166.

Notes: The pseudococcid *Xenococcus annandalei* is reported causing economic damage to grape vine (var. Bangalore Blue) in Bangalore, Karnataka, India. Damage was caused by sucking sap from rootlets and affected vines showed reduced vigour, shortening of fruit bearing canes, and a reduction in the size of fruit bunches and yield. *X. annandalei* was also found on the roots of *Oxalis latifolia*, *Euphorbia hirta*, *Blepharis mollinginifolia* and *Ageratum conyzoides*.

**Redak, R.A. & Bethke, J.A.** 1998. Control of brown soft scale on ficus under greenhouse conditions, winter 1997. Pages 344. in: Saxena, K.N., Ed., *Arthropod Management Tests*, Vol. 23. Entomological Society of America, Lanham, MD.

Notes: Chemical control substances evaluated against *Coccus hesperidum*.

**Reddy, K.B. & Seetharama, H.G.** 1997. Integrated management of mealybugs in coffee. *Indian Coffee* 61: 3, 26-28.

Notes: The biology and association with Formicidae of *Planococcus citri*, *P. lilacinus* and *P. minor* in coffee in India is described. Biological control is discussed, including the use of *Cryptolaemus montrouzieri* (predator) and *Leptomastix dactylopii* (parasitoid), techniques to rear them on large scale, and cost benefit analysis. Integrated control measures, including the control of Formicidae with quinalphos, parathion or malathion, destruction of formicid nests, removal and destruction of weeds harbouring the pseudococcids are also discussed.

**Remadevi, O.K. & Raja Muthukrishnan** 1998. *Inglisia bivalvata* Green (Hemiptera: Coccidae), causal agent for the dieback and death of sandal (*Santalum album*). *Journal of Tropical Forest Science* 10: 388-397.

Notes: *Inglisia bivalvata* causes dieback of branches and, in severe cases, death of saplings and young trees of *Santalum album*. This paper reports observations on the biology, host trees, natural enemies and control of the pest from surveys and investigations carried out at the Institute of Wood Science at Bangalore and in the sandal field station at Hoskote (Karnataka) and in forests and plantations in the southern states of India (Karnataka, Tamil Nadu, Andhra Pradesh and Orissa) conducted in 1993-96. Parasites and predators help in the biological control of the pest, for which 5 hymenopteran parasites are reported for the first time. Quinalphos and chlorpyrifos (chlorpyrifos) were effective in controlling pest attack. *Polyalthia longifolia*, *P. pendula*, *Acacia mangium* and *Dalbergia sissoo* are reported as new plant hosts.

**Remadevi, O.K., Raja Muthukrishnan & Santhakumaran, L.N.** 1997. Natural infestation of lac insect, *Kerria lacca* (Kerr.), on *Acacia auriculaeformis* - threat or boon? *Wood News* 7: 13-14.

Notes: As part of an afforestation programme at B.B.H. Mines, Chitradurga, 120,000 saplings of *Acacia auriculaeformis* (*Acacia auriculiformis*), a multipurpose tree, were raised on mine dumps. In July 1997, 5- to 6-yr-old plants, showing good growth, were found to be attacked by the lac insect, *Kerria lacca*. As many as 6% of the trees were heavily attacked by lac

insects and the infestation appears to be a threat to the survival of the plantation. It was recommended that the heavily infected branches be cut and burned and the remaining branches be thoroughly drenched in an insecticide, which was chosen to be Quinalphos. In different circumstances, *Acacia auriculiformis* would be a suitable host for the lac insect for commercial lac production.

Remadevi, O.K., Raja Muthukrishnan & Santhakumaran, L.N. 1998. Studies on the sap-sucking pests of *Santalum album* L. in nurseries and plantations. ACIAR Proceedings Series 84: 200-203.

Notes: [Proceedings of an international seminar held on 18-19 December 1997 at the Institute of Wood Science and Technology, Bangalore, India.] Among the different insect pests including defoliators, stem borers and termites, the role of sap-sucking insects belonging mainly to the family Coccidae, is crucial because they are deleterious to the normal health, growth and reproduction of sandal trees. The main coccids which cause dieback and lessening of fruit setting are *Saissetia* sp., *Inglisia bivalvata*, *Ceroplastes ceriferus* and *Kerria lacca*, all belonging to the family Coccidae. Details of the habits, damage potential, nature of damage and control measures are included.

Renard, S., Calatayud, P.A., Pierre, J.S. & Le Ru, B. 1998. Recognition behavior of the cassava mealybug *Phenacoccus manihoti* Matile-Ferrero (Homoptera: Pseudococcidae) at the leaf surface of different host plants. *Journal of Insect Behavior* 11: 429-450.

Notes: The testing behaviour and test probing which are a part of host-plant acceptance behaviour were studied in *P. manihoti*. Attention was focused on the testing behaviour of three plants of the *Manihot* genus (2 varieties of cassava and a hybrid of cassava and *M. glaziovii*) and a weed of cassava fields (*Talinum* sp.). This enabled not only the characterization of the associated behaviour but also demonstration that the mealybug is able to distinguish between different host plants when walking on the leaf. The video description of the test probing of 1st- and 4th-instar larvae on the two cassava varieties shows that the succession of the phases is similar. After a first phase characterized by the repeated intervention of the mealybug sensorial organs, a second phase, more mechanical, with up-and-down head movements, is observed. At this time, the stylets pass through the epidermic and inner tissues. Finally, a third phase, during which the mealybug becomes more agitated, is observed: it stands up using its rear legs and pushes the upper part of its body against the plant. The stylets continue their progression, which is principally intercellular, until they reach the phloem. Longer and longer immobility periods are observed over a period of time. The coupled videocamera and electrical penetration graph technique were used to observe the relations existing between outer and inner plant events, i.e., between the behavioural items and the electrical signals characteristic of the stylet pathway in the plant.

Richard, C. 1998. Ortheziidae. Pages 444-450 in: Kozár, F., Ed., *Catalogue of Palaearctic Coccoidea*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary. 526 pp.

Notes: Reviews *Arctorthezia cataphracta*, *A. occidentalis*, *A. vardziae*, *Newsteadia floccosa*, *N. kanayana*, *Nipponorthezia ardisiae*, *N. hispanica*, *Orthezia arenariae*, *O. insignis*, *O. shirakensis*, *O. urticae* and *O. yasushii*. Each entry lists citations to original descriptions, new generic combinations, redescriptions, revisions and monographs; distributions; host plants; brief biological notes.

Richmond, J.E. & Cowley, J.M. 1998. Pineapple mealybug in New Zealand? *Orchardist* 71: 71.

Notes: An adult pineapple mealybug, *Dysmicoccus brevipes*, was found in a plum orchard in Auckland, New Zealand in November 1997. The specimen was collected during a national pest and disease survey of stonefruit. Mealybug experts in both New Zealand and overseas confirmed the

identification. This is the first record of *D. brevipes* in New Zealand. In a subsequent survey in April 1998, the diaspidid was not detected, suggesting that *D. brevipes* failed to establish or that populations are currently below detectable levels on host crops.

Ripka, G., Magowski, W.L. & Reider, K. 1997. Recent data on the knowledge of the fauna of tarsonemid mites (Acari: Heterostigmata) on ornamental trees and shrubs. *Folia Entomologica Hungarica* 58: 159-168.

Notes: The authors report the results of studies done in 1990-1996 in road trees, parks, green areas of housing estates and arboreta. Out of the 269 woody plant species studied, tarsonemid mites were found on 48 species. 52.7% of the recorded tarsonemid mite species occurred on plant parts infested with gall mites (Acari: Eriophyoidea); 22.9% were found present with scale-insects (Homoptera: Coccoidea). The tarsonemid mites have not been observed causing damage to examined plant species.

Rivero, L.A.P. & Godfray, H.C.J. 1997. The dynamics of egg production, oviposition and resorption in a parasitoid wasp. *Functional Ecology* 11: 2, 184-188.

Notes: The extent to which parasitoid wasps are limited by their egg supply is very important in understanding their reproductive strategies. Egg reserves are dynamic, with most wasps maturing new eggs throughout their life (synovigeny) and many species resorbing eggs that are not used in oviposition. The extent to which a solitary parasitoid, *Leptomastix dactylopii*, which is synovigenic and practices egg resorption, modulates its egg reserves was investigated in the light of its experience in finding hosts, *Planococcus citri*. Newly-emerged wasps were allowed to experience one of four environments of increasing value in terms of reproductive opportunities. It was proposed that wasps that experienced good quality environments would maintain more mature eggs ready for oviposition. Dissection of wasps subject to different periods of host deprivation after the experimental treatment failed to confirm the hypothesis: egg load was independent of experience. It was also proposed that any adjustment of egg supply to make up for eggs oviposited would be effected through a reduction in egg resorption. Instead, wasps quickly made up for eggs oviposited by increased egg production.

Rong, I.H. & Grobbelaar, E. 1998. South African records of associations between fungi and arthropods. *African Plant Protection* 4: 1, 43-63.

Notes: Concern about the use of pesticides has stimulated research on natural methods of insect control. Many examples exist of interactions between fungi and arthropods, some of which have been exploited for the control of agricultural pests. An overview is presented of fungus-arthropod associations recorded in South Africa and their distribution, type and validity are discussed. Records include members of the arthropod classes Arachnida, Diplopoda and Insecta, the best-studied being the Homoptera (scale insects) and Isoptera (termites).

Rostaman 1997. [Pests and diseases of sandalwood in Kabupaten Kupang.] Hama dan penyakit tanaman cendana di Kabupaten Kupang. (In Indonesian with summary in English.) *Duta Rimba* 23: 209-210, 41-48.

Notes: The most important pests and diseases of sandalwood (*Santalum album*) in this part of East Nusa Tenggara (Timor) include white scales (*Chionaspis* sp., which cause mortality). The white scales could be controlled by natural enemies, manual removal, and spraying with insecticides. Other pests and diseases which do not cause significant damage include green/black scales (*Coccus viridis*, *Saissetia coffeae*), and mealy bugs (*Pseudococcus lilacinus* [*Planococcus lilacinus*]).

Russo, A. & Mazzeo, G. 1997. [Contribution to the zoogeographical study of coccid fauna from Sicily.] Contributo allo studio zoogeografico della coccidiofauna della Sicilia. (In Italian with summary in English.) *Naturalista siciliano* S. IV, XXI (1-2): 45-55.

Notes: 159 scale species recorded in Sicily; basic distributional patterns established.

Russo, A. & Mazzeo, G. 1997a. A new species of *Dysmicoccus* Ferris (Homoptera Coccoidea Pseudococcidae) from Sicily. (In Italian with summary in English.) *Bollettino di Zoologia Agraria e Bachicoltura*. Milano 29: 151-156.

Notes: A description is given of the adult female of *Dysmicoccus psoraleae*, sp. nov., from specimens living on *Psoralea bituminosa* in Sicily, Italy in 1995. *D. boninsis* is also recorded from sorghum in the Bahamas, and from sugarcane in Porto Rico (Puerto Rico), Western Samoa, Bahamas and Mauritius.

Russo, A., Mazzeo, G., Suma, P. & Longo, S. 1998. A study on the biology of *Dactylopius coccus* Costa (Hemiptera: Coccoidea) in the greenhouse in Sicily. Page 33 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. A study on the biology of *D. coccus* was undertaken to evaluate the possibility of mass-rearing this species for industrial purposes. Almost daily observations were carried out using 2 or 3 year old cladodes of *Opuntia ficus indica* rooted in polyethylene vases, in a greenhouse situated near the Faculty of Agricultural Sciences of the University of Catania. Three reproductive cycles were studied. The duration of each developmental stage and of the total life cycle, female fecundity and the effects of some abiotic limiting factors.

Samson, P.R. & Harris, W.J. 1998. Seasonal phenology and distribution in soil in sugarcane fields of the pink ground pearl, *Eumargarodes laingi* Jakubski, with notes on *Promargarodes* spp. (Hemiptera: Margarodidae). *Australian Journal of Entomology* 37: 130-136.

Notes: The distribution of cysts of *Eumargarodes laingi* in soil and the seasonal phenology of the different life stages were examined in sugarcane fields near Bundaberg, Queensland, Australia. Cysts were widely distributed in soil, occurring in equal numbers in both the planting rows of sugarcane and most or all of the inter-row space. Cysts were smaller at increasing distance from the sugarcane plants. Most cysts were found in the top 20 cm of soil but some occurred to a depth of at least 50 cm. Cysts of *Promargarodes* spp. were also found in one field. These had a similar lateral distribution to *E. laingi* but a greater proportion occurred more than 20 cm deep. Adults of *E. laingi* were found from October to February in the four fields examined in 1993 and 1994. Adults were found in the greatest numbers in November, but they comprised less than 10% of the total *E. laingi* population at any time. A large number of cysts of all sizes was present throughout the year, and the results indicate that most individuals had a life cycle of at least 2 years. The large reservoir of cysts during the adult emergence period explains why *E. laingi* has proved difficult to control with insecticides and with cultural methods during this supposedly vulnerable time.

Santoro, C. 1998. [Rearing of *Saissetia oleae* and its parasitoid *Metaphycus bartletti*.] *Allevamento di Saissetia oleae e del suo parassitoide Metaphycus bartletti*. (In Italian with summary in English.) *Informatore Fitopatologia* 48: 49-53.

Notes: A technique for rearing the coccid *Saissetia oleae* and its encyrtid parasitoid *Metaphycus bartletti* are described. The pest was maintained on plants of oleander (*Nerium oleander*), arauja (*Arauja sericofera*) and potato. Biological data are given for *S. oleae* and *M. bartletti* in relation to the environmental conditions of development and the plant substrate used. In the production unit defined, it was possible to obtain about 250 individuals of *S. oleae* from which emerged 1000-1500 females of *M. bartletti*.

Sarkisov, R.N., Mkrtchian, L.P. & Zakharian, V.A. 1998. A technique to obtain the eggs of the Ararat cochineal. Pages 33-34 in VIIIth International Symposium of Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Ararat cochineal (*Porphyrophora* sp.) produces a valuable, light-resistant red carmine dye. To protect this rare

species and to increase its productivity, a technique for breeding it under artificial conditions has been developed. This has allowed a 5-6 times increase in body-mass yield and, therefore, of dye. Authors have made improvements to this technique to make it more efficient.

Savopoulou-Soultani, M., Papadopoulos, N., Kozár, F., Skoulakis, G. & Sarakatsanis, I. 1997. [First record and seasonal development of *Ritsemia pupifera* in Thessaloniki area.] (In Greek with summary in English.) - Proceedings of the 6th National Entomological Meeting (Chania) 32-35.

Notes: Meetings held October 31 - November 3, 1995. First record of this mealybug in this region; found on elm trees (*Ulmus*); biology.

Schausberger, P. 1998. Survival, development and fecundity in *Euseius finlandicus*, *Typhlodromus pyri* and *Kampimodromus aberrans* (Acari, Phytoseiidae) feeding on the San Jose scale *Quadraspidiotus perniciosus* (Coccinea, Diaspididae). *Journal of Applied Entomology* 122: 53-56.

Notes: Studies were conducted in the laboratory at 25 plus or minus 1 deg C, 65 plus or minus 5% RH and LD 16:8. Crawlers of *Q. perniciosus* must be considered a suboptimal prey. Its nutritional value is discussed in relation to that of more adequate food sources. Data on development and fecundity are also discussed in relation to other phytoseiid species feeding on scale insects.

Schellerich-Kaaden, A.L., Dorow, W.H.O., Liefke, C. & Klein, R.W. 1997. Biology of *Polyrhachis schellerichae*, a specialized bamboo-dwelling ant species from the Malay Peninsula (Insecta: Hymenoptera: Formicidae). *Senckenbergiana Biologica* 77: 77-87.

Notes: The biology of the recently discovered bamboo-dwelling ant *P. schellerichae*, a member of the *P. (Myrmhopla)* hector-species group, was investigated in Selangor, Malaysia. It was found nesting in culm internodes of giant bamboo (Bamusoidea: *Gigantochloa thoi*). The investigated colonies were polydomous, diurnal and lived in tight trophobiosis with a pseudococcid, *Kermicus wroughtoni*, which were kept inside the nest internodes. The trophobiotic partners were transported to new nest internodes during colony enlargement or nest moves. A series of specific morphological and biological features indicate that this ant is specialized on living within giant bamboo culms. *P. schellerichae* is compared with the other ant species also specialized on giant bamboo. For the plants no advantage could be observed so far. This association is seen as a case of mild parasitism.

Schmitz, G. 1997. [The host spectrum of *Pulvinaria regalis* Carnard (Hom., Coccidae),] Zum Wirtspflanzenspektrum von *Pulvinaria regalis* Carnard (Hom., Coccidae). (In German with summary in English.) *Gesunde Pflanzen* 49: 2, 43-46.

Notes: The frequent occurrence of the coccid *Pulvinaria regalis* on trees and shrubs in Bonn, Germany, prompted a closer investigation of the host range of this recently introduced species. The updated list of host plants, including prior host records, now consists of 61 species, 29 genera, 24 families and 14 orders. *Aesculus*, *Acer* and *Tilia* are the most strongly infested genera, followed by *Magnolia* and *Cornus*. The possibility of confusing this species with *Pulvinaria hydrangeae* or *P. betulae* is discussed.

Schmutterer, H. 1998. Some arthropod pests and a semi-parasitic plant attacking neem (*Azadirachta indica*) in Kenya. *Anzeiger Schädlingkunde, Pflanzen(schutz) und Umweltschutz* 71: 36-38.

Notes: In 1996 and 1997, several pests and a semi-parasitic plant species were identified as pests of the neem tree in Kenya. Some damage was caused by a gall mite (*Phyllocoptes* sp.) at Mbita Point in western Kenya in a nursery and on older plants. The potentially dangerous scale insect *Aonidiella orientalis* was widespread in western Kenya but not harmful at the time of the survey. In coastal areas the semi-parasite *Cassytha filiformis* was very common. This plant is able to kill mature trees growing under unfavourable conditions. As in West Africa, fruit bats like *Epomophorus wahlbergi* were useful due to their feeding activity on the

pulp of ripe neem fruit, meaning that depulping (by man) was unnecessary.

Schmutterer, H. 1998a. [The spindle-berry scale, *Unaspis euonymi* (COMST.), a new pest of ornamentals in Germany.] Die Spindelstrauch-Deckelschildlaus *Unaspis euonymi* (COMST.) als neuer Zierpflanzenschädling in Deutschland. (In German with summary in English.) Nachrichtenblatt für den Deutschen Pflanzenschutzdienst. Berlin 50: 170-172.

Notes: *Unaspis euonymi* found for the first time in Germany; host plants include potted ornamental plants, especially *Euonymus japonicus*; often found associated with *Chloropulvinaria floccifera*.

Schmutterer, H. 1998b. The scale insects, whiteflies and psyllids of the neem tree, *Azadirachta indica* (Meliaceae). Page 34 in VIIIth International Symposium of Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. The neem tree, a meliaceous plant of south Asian origin, contains a number of insecticidal ingredients, mainly in its seed kernels. Triterpenoids, especially azadirachtin, are the most important compounds, showing several modes of action in insects of various orders. Commercial neem-based pesticides have been available for some years but homemade products are also effective. About 35 species have been recorded up to now but only a few are pests. The most important diaspidid is the oriental scale, *Aonidiella orientalis*, whereas some other diaspidids and coccids are only minor pests.

Schulthess, F., Neuenschwander, P. & Gounou, S. 1997. Multi-trophic interactions in cassava, *Manihot esculenta*, cropping systems in the subhumid tropics of West Africa. Agriculture, Ecosystems & Environment 66: 211-222.

Notes: The effect of fertilizer and mulch across trophic levels of the cassava ecosystem, i.e., the plant, the cassava mealybug (CM), *Phoenicoccus manihoti*, the encyrtid wasp *Apoanagyrus lopezi* and its hyperparasitoids, was studied in two field experiments planted in southern Benin. Several cassava cultivars with different branching patterns and varying susceptibility to the cassava mealybug were planted on a sandy loamy and a sandy soil, respectively. Four to seven months after application of the soil treatments, differences in N, P, K in the first 50 cm of the soil had mostly disappeared, indicating that the soil nutrients had been taken up by the plant and/or had leached to deeper layers of the soil. The effect on leaf nutrient contents was still visible, however. Differences in response to soil nutrients and dry matter allocation pattern were found between late and early branching cassava. The former was more efficient in utilizing soil nutrients for root production whereas in the latter, harvest indices decreased with increasing soil fertility. With increasing soil fertility, the nutritional status of the plants increased. This led to larger mealybugs, which in turn resulted in a higher proportion of female *Apoanagyrus lopezi*. The overall effect was an enhancement of biological control activity leading to low CM population densities in plots with high soil fertility. Hyperparasitism had no effect on parasitism of *A. lopezi*, and was positively related to both CM and *A. lopezi* numbers. Generally, the infestations were too low to have an effect on growth of cassava leaves or roots. This study shows the beneficial effect that soil fertility can have on the efficiency of a biological control agent.

Sequeira, V. & Bezkorowajnyj, P.G. 1998. Improved management of *Butea monosperma* (Lam.) Taub for lac production. Forest Ecology and Management 102: 225-234.

Notes: Lac, a natural resin produced by the lac insect *Kerria lacca*, is an important income-generating non-wood forest product in India, although production and export has declined over the last 50 years, partly due to large fluctuations in prices and supply and partly due to increasing competition with Thailand. It is expected that the potential for lac production could increase with India's recent changes in forest policy which encourage the natural regeneration of degraded lands. A review is

presented of improved management systems for lac production on *Butea monosperma*, which is the most important lac host tree in India, and is prevalent in degraded areas of the sub-Himalayan plains. The review briefly describes traditional management systems, and gives an account of the 3 operational stages of the improved system - pruning of host plants, inoculation with broodlac, and harvesting and storage of sticklac at crop maturity.

Shabana, Y.M. & Ragab, M.E. 1997. *Alternaria infectoria*, a promising biological control agent for the fig wax scale, *Ceroplastes rusci* (Homoptera: Coccidae), in Egypt. *Biocontrol Science and Technology* 7: 553-564.

Notes: *Alternaria infectoria* was isolated from naturally infected eggs of *Ceroplastes rusci*, a pest of fruit trees and ornamental plants, which were showing different degrees of shrivelling. This fungus proved to be pathogenic to eggs, nymphs and adults of this pest. The fungus had significant effects on both the mortality and hatchability of the eggs ( $P = 0.0001$ ). Three days after exposure to the fungus, nearly one-third (31.5%) of the fungus-treated eggs became discolored and 17% showed moderate shrinking but no mortality. Fifteen days post-application, 91% of the fungus-treated eggs were diseased (74.8% of them were dead) due to *A. infectoria*, while no disease developed on the untreated eggs. Hatching decreased by 39.6% over a 15-day period in the fungus-treated eggs compared to the control. Additionally, crawlers hatching from fungus-treated eggs became infected. The fungus seemed to induce crawlers to enter the settling stage. Seventy-two per cent of the fungus-treated crawlers versus 9% of the untreated controls entered the settling stage 6 days after exposure to the fungal inoculum. The highest level of nymphal mortality attributed to *A. infectoria* occurred when 30% (wet w:v blended mycelium in water containing 0.5% w:v Metamucil) inoculum was applied, and a high relative humidity was maintained for the following 48 h. This is the first record of *A. infectoria* on *C. rusci* and for the genus *Alternaria* as an entomopathogenic fungus.

Sharma, K.K. 1997. Occurrence of lac insect on *Thevetia peruviana* (Pers.) Merrill. *Insect Environment* 3: 29.

Notes: *Thevetia peruviana* was recorded as a new food plant of *Kerria lacca* at Hisar, Haryana, India.

Shaw, P.W., Bradley, S.J. & Walker, J.T.S. 1997. The impact of early season insecticides in an integrated fruit production programme on apple. Pages 283-287. in: *Proceedings of the Fiftieth New Zealand Plant Protection Conference*. New Zealand Plant Protection Society, Rotorua, New Zealand.

Notes: [Conference held at Lincoln University, Canterbury, New Zealand, 18-21 August, 1997.] *Pseudococcus* spp. populations among those monitored.

Shi, G.L., Liu, X.Q., Li, J., Li, L.C. & Yang, F.D. 1997. Studies on the bionomics of *Quadrastipidiotus perniciosus* (Comstock) and its occurrence prediction. (In Chinese with summaries in Chinese & English.) *Scientia Silvae Sinicae* 33: 161-167.

Notes: Life cycle; emergence; eclosion on plant host, Jujube; effect of temperature & humidity; mortality; population density; population sex ratio.

Silva, E.M.B. & Mexia, A. 1998. Histological studies on the stylet pathway, feeding sites and nature of feeding damage by *Planococcus citri* (Risso) (Homoptera: Pseudococcidae) in sweet orange. Page 34 in VIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Studies undertaken on *Citrus sinensis* fruits and leaves to elucidate the stylet pathway, feeding sites and cell damage caused by the citrus mealybug, *Planococcus citri*.

Silva, E.B., Mexia, A. & Vacante, V. 1997. The damage caused by *Planococcus citri* (Risso) on citrus groves. *Bulletin OILB/SROP* (Sect. Reg. Ouest Palearctique) 20: 7, 26-31.

Notes: [Integrated control in citrus fruit crops. Proceedings of the

meeting held at Florence, Italy, 29 August 1996.] Field studies conducted in orange groves in Portugal showed that only medium to high population densities of *Planococcus citri* caused a significant reduction in production, both in terms of fruit weight and fruit size. However, low numbers of *P. citri* caused fruit discoloring, fruit splitting and chlorotic spots. In terms of commercial depreciation of the crop, the number of fruits infested with *P. citri* was more important than the overall population size. This factor also affected risk estimates and economic thresholds for *P. citri*.

Singh, A., Solanki, R.S. & Malik, K. 1997. First record of *Batrachedra* sp. near *psilopa* Meyrick (Lepidoptera: Momphidae) as a parasite of sugarcane mealy bug. *Insect Environment* 3:36-37.

Notes: During observations on sugarcane pests in Uttar Pradesh, India, in 1994-95, larvae feeding on the nymphs of *Saccharicoccus sacchari* were subsequently identified as a species of *Batrachedra* near *B. psilopa*. This was a new host record.

Skillen, E.L., Berisford, C.W., Camann, M.A. & Reardon, R.C. 1997. Semiochemicals of forest and shade tree insects in North America and management applications. Forest Health Technology Enterprise Team, USDA Forest Service, Morgantown, U.S.. 182 pp.

Notes: Information on semiochemicals to control various pests including sap feeders (Margarodidae). Information on chemical compounds, potential and actual use in North America is included.

Smith, D., Smith, N.J. & Smith, K.M. 1998. Effect of abamectin on citrus rust mite *Phyllocoptruta oleivora* and brown citrus rust mite *Tegolophus australis* and the scale natural enemies *Aphytis lingnanensis* and *Chilocorus circumdatus* on oranges. *Plant Protection Quarterly* 13: 136-139.

Notes: Abamectin, applied at three rates caused significant mortality of adults of the scale parasitoid *Aphytis lingnanensis* when they were exposed to freshly sprayed leaves for 24 h. There was no significant residual effect one and two days after spraying. Fenbutatin oxide caused no mortality of *A. lingnanensis*. Parasitoids which survived contact with fresh deposits of abamectin parasitized fewer oleander scale (*Aspidiotus nerii*) than those which were untreated or exposed to fenbutatin oxide. There was no significant residual effect on the percentage of scales parasitized by *A. lingnanensis* exposed one day after spraying.

Soares, A.O., Elias, R.B. & Schanderl, H. 1997. *Encarsia citrina* (Crawford) (Hymenoptera, Aphelinidae), a parasitoid of *Unaspis citri* (Comstock) and *Lepidosaphes beckii* (Newman) (Homoptera, Diaspididae) in citrus orchards of Sao Miguel island (Azores). (In English with summary in Spanish.) *Boletín de Sanidad Vegetal, Plagas* 23: 449-456.

Notes: Two citrus orchards were selected in the Azores, Portugal, in order to determine seasonal abundance and active parasitism of *Encarsia citrina*, in relation to the population structure of the hosts *Unaspis citri* and *Lepidosaphes beckii*. The annual proportion of parasitism in the different developmental stages of the hosts was also determined. *E. citrina* contributed considerably to the biological control of these armored scales, lowering the proportion of larvae and males in the populations of *U. citri* and *L. beckii*, respectively. The greatest flight activity and oviposition occurred in spring and summer and active parasitism on *U. citri* was lower in summer and relatively high in the remaining seasons. In *L. beckii*, summer and spring were seasons of high parasitic activity. Active parasitism and population abundance of *E. citrina*, depended on the presence of susceptible stages for parasitism, and on the abiotic conditions (mainly temperature).

Soika, G. & Labanowski, G. 1997. [Scale insects - dangerous pests of ornamental trees and shrubs.] Czerwce - grozne szkowniki drzew i krzewow ozdobnych. (In Polish with summary in English.) *Progress in Plant Protection* 37: 398-400.

Notes: During 1995-96 in commercial nurseries located in various regions

of Poland, 7 species of scale insects particularly harmful to trees and shrubs were recorded: *Parthenolecanium pomericum* on *Taxus baccata* and *T. media*; *Coccus hesperidum* and *Chloropulvinaria floccifera* on *Ilex aquifolium*; *Lepidosaphes ulmi* on *Buxus sempervirens*; *Carulaspis juniperi* on *Juniperus sabina* and *J. virginiana* "Skyrocket"; and *Pseudochermes fraxini* on *Fraxinus excelsior*.

Solomon, R.C. & Gilbert, C. 1997. Screening of ten sugarcane varieties that are grown commercially in St. Kitts for resistance to *Maconellicoccus hirsutus*. Pages 187-190. in: Proceedings of the West Indies Sugar Technologists 26th Conference, 22-26 September, 1997. Sugar Association of the Caribbean, Bridgetown, Barbados.

Notes: In 1996, stem cuttings of 10 sugarcane varieties were exposed to 2 densities of *M. hirsutus*. Soursop, (*Annona muricata*) and hibiscus (*Hibiscus rosa-sinensis*), both of which are highly susceptible to this insect pest, were used as controls. None of the sugarcane varieties was colonized by *M. hirsutus*. Field trials showed similar results.

Song, S.L. & Huang, B.K. 1997. Notes on *Antonina graminis*, a mealybug on lawn. (In Chinese with summary in English.) Wuyi Science Journal 13: 123-124.

Notes: The distribution, injuriousness and morphology of the pseudococcid *Antonina graminis*, a pest of lawns in Fuzhou City, Fujian Province, China, is given.

Souissi, R. & Le Ru, B. 1997. Comparative life table statistics of *Apoanagyrus lopezi* reared on the cassava mealybug *Phenacoccus manihoti* fed on four host plants. *Entomologia Experimentalis et Applicata* 36: 113-119.

Notes: Total and daily mean fecundities of female parasitoids were strongly influenced by the host plant but there was no link with antibiotic resistance. The mean duration of the oviposition period was also significantly modified by the host plant and was also not correlated to the level of antibiotic resistance.

Souissi, R. & Le Ru, B. 1998. Influence of the host plant of the cassava mealybug *Phenacoccus manihoti* (Hemiptera: Pseudococcidae) on biological characteristics of its parasitoid *Apoanagyrus lopezi* (Hymenoptera: Encyrtidae). *Bulletin of Entomological Research* 88: 75-82.

Notes: The influence of food plant type of the pseudococcid *Phenacoccus manihoti* on the encyrtid parasitoid *Apoanagyrus lopezi* was studied in the laboratory. Four different food plants were used: two cultivars of cassava (Incoza and MM79), Faux caoutchouc, a hybrid of *M. esculenta* x *M. glaziovii*, and talinum (*Talinum triangulare*) a common weed in cassava fields. Plants were selected for different levels of antibiotic resistance to *P. manihoti*. The mortality of *P. manihoti* due to host feeding by the adult parasitoid and the percentage of parasitized *P. manihoti* were significantly lower when hosts were reared on cultivars and the hybrid than when reared on talinum. However, the encapsulation rate was significantly lower in *P. manihoti* reared on talinum. The highest percentage parasitism and the lowest rate of emergence were recorded on cv. Incoza, the most resistant cultivar. The sex ratio did not vary significantly with the food plant used. The total developmental time and size of male and female progeny of *A. lopezi* differed significantly between *P. manihoti* reared on different food plants. Among cassava plants, parasitoid size was positively correlated with development time and negatively with plant resistance. The results suggested that *A. lopezi* might perform better if cassava cultivars were selected for their strong antixenosis but low antibiotic characteristics.

Souissi, R. & Nenon, J.P. 1998. Olfactory responses of parasitoid *Apoanagyrus lopezi* to odor of plants, mealybugs, and plant-mealybug complexes. *Journal of Chemical Ecology* 24: 37-48.

Notes: *Apoanagyrus (Epidinocarsis) lopezi* De Santis is an endoparasitoid used in the biological control of the cassava mealybug *Phenacoccus manihoti* Matile-Ferrero in Africa. The response of naive and mated females

of *A. lopezi* to odors from cassava plant (var. Zanaga), parasitized or unparasitized mealybugs, and plant-mealybug host complexes with or without feeding hosts was investigated in a Y-tube olfactometer. Dual-choice tests revealed that mealybug-infested plants and mealybug-damaged plants were the major sources of volatiles that attract female parasitoids to the microhabitat of its hosts. The emission of volatile chemicals appears not to be limited to the infested plant part but to occur systemically throughout the plant. On their own, unparasitized mealybugs were more attractive than uninvested plants or parasitized mealybugs alone. Parasitization of *P. manihoti* by *A. lopezi* decreased the response of parasitoids to mealybugs or mealybug-plant complexes. Plants infested with unparasitized hosts attracted more female parasitoids than plants infested with parasitized mealybugs. These results indicate that, in the long-range host-searching process, females of *A. lopezi* respond mainly to mealybug-induced synomones, and specific host-derived cues play a minor role.

Speight, M.R., Hails, R.S., Gilbert, M. & Foggo, A. 1998. Horse chestnut scale (*Pulvinaria regalis*) (Homoptera: Coccidae) and urban host tree environment. Ecology (Washington D.C.) 79: 1503-1513.

Notes: The analysis and explanation of the spatial distribution of organisms within a locality are problematic. This study uses a combination of standard analytical methods (Generalized Linear Interactive Modeling (GLIM)) with recently developed spatial statistical techniques (geostatistical analysis), on a model system of insect-plant interactions in an urban setting. Infestations of the horse chestnut scale, *Pulvinaria regalis*, were mapped on three tree species in Oxford, United Kingdom. Various tree parameters were measured, as were aspects of the site in which each tree was growing. Using general linear modeling and geostatistics, the distribution and intensity of scale populations were investigated in relation to these parameters. The trees were separated into those that showed no symptoms of lack of vigor and those that were clearly unhealthy. In both cases, the only parameter that explained much of the variance in the scale egg densities on trees was the impermeability of the substrate surface under the trees, such that as substrates became more impermeable to water and nutrients (for example, as a result of concrete or roadways), the higher were the pest densities on those trees. For the vigorous trees alone, an extra parameter, that of building distance, was also found to be significant, so that trees very close to buildings also showed high pest densities. The spatial dependence of scale insect eggs on trees was found to be anisotropic through the sample area, in the southwest/northeast direction, attributable to wind speed, direction, and canyon effects.

Srivastava, R.P. 1997. Laboratory screening of buprofezin and alcoholic extract of *Alpinia galanga* against mealy bug nymphs, *Drosicha mangiferae* Green. Indian Journal of Entomology 59: 366-368.

Notes: Laboratory studies were conducted to determine the toxicity of buprofezin and an alcoholic extract of *Alpinia galanga* to nymphs of *Drosicha mangiferae*. Treatment with buprofezin (0.625%) and *A. galanga* (3%) resulted in 100% mortality.

Srivastava, R.P. 1997a. Mango Insect Pest Management. International Book Distributing Co., Lucknow. 272 pp.

Notes: The 22 chapters of this book provide information on the pests which attack mango. Each chapter discusses the taxonomy and geographical distribution of the pest, losses caused and nature of damage, alternate hosts, bionomics and life history, control measures, including biological predators, parasitoids and pathogens, plant products, pesticides and cultural methods, and integrated pest management. The mealybugs (*Drosicha mangiferae* and *Perissopneumon ferox*) are among those insects covered.

Stanton, G. & Sanderson, J. 1998. Ball identification guide to greenhouse pests and beneficials. Ball Publishing (GrowerTalks Bookshelf), Batavia, USA. 244 pp.

Notes: This book is divided into 3 parts on integrated pest management in the greenhouse (1 chapter), the identification of major pest groups (10 chapters) and the identification of plant damage of specific crops (1 chapter). Among the major pests are scale insects and mealybugs (Diaspididae, Coccidae, Pseudococcidae and Margarodidae). For each pest group, information is given on plant damage, group characteristics, biology, monitoring methods, identification, life cycle and biological control. A glossary and colour photographs of pests and damage are also included.

**Stathas, G.J.** 1997. First record of *Nemolecanium graniformis* Wunn (Homoptera: Coccidae) in Greece. *Annales de l'Institut Phytopathologique Benaki* 18: 57-59.

Notes: Distribution; recorded on Abietaceae; other pests of this family listed; field description; biology.

**Stevens, P.S., McKenna, C.E., Blank, R.H., Tomkins, A.R. & Steven, D.** 1997. Comparison of armoured scale spray thresholds in kiwifruit. Pages 288-292. in: *Proceedings of the Fiftieth New Zealand Plant Protection Conference*. New Zealand Plant Protection Society, Roturua, New Zealand.

Notes: [Conference held at Lincoln University, Canterbury, New Zealand, 18-21 August, 1997.] *Hemiberlesia rapax*, *H. lataniae* and *Aspidiotus nerii* infestations monitored on *Actinidia deliciosa*.

**Steven, D., Valenzuela, L. & Gonzalez, R.H.** 1997. Kiwifruit pests in Chile. *Acta Horticulturae* 444: 773-777.

Notes: Proceedings of the third international symposium on kiwifruit, Thessaloniki, Greece, 19-22 September 1995, edited by Sfakiotakis, E. & Porlingis, J. Insects and mites collected during 1992 in Chile on kiwifruit leaves were compared to data from New Zealand. *Hemiberlesia rapax*, *H. lataniae* and *Aspidiotus nerii* also appeared in New Zealand. *Saissetia oleae* was fairly common in several Chilean orchards.

**Stiling, P. & Rossi, A.M.** 1998. Deme formation in a dispersive gall-forming midge. Pages 263-322. in: Mopper, S. & Strauss, S.Y., Eds., *Genetic Structure and Local Adaptation in Natural Insect Populations: Effects of Ecology, Life History, and Behavior*. Chapman & Hall, New York. xix + 449 pp.

Notes: *Nuculaspis californica* on *Pinus lambertiana*, *Cryptococcus fagisuga* and *Fagus sylvatica*, *Matsucoccus acalyptus* and *Pinus edulis*, and *Pseudaulacaspis pentagona* on *Morus alba* mentioned in reviews of previous studies concerning deme formation that involved reciprocal transplants of herbivores between conspecific plants.

**Stocki, J.** 1998. [Insect pests on beech trees in the Bieszczady National Park.] *Szkodniki owadzie bukow w Bieszczadzkiem Parku Narodowym*. (In Polish with summary in English.) *Sylwan* 142: 85-98.

Notes: An analysis of insects, their parts, and feeding traces were collected from all parts of trees, and defoliating, secondary, and 'technical' pests on the bark and wood identified. Insect species found most frequently included *Cryptococcus fagi* (*C. fagisuga*). The report contains seven factors outlining the role played by humans in the weakening of the health condition of beech trees growing in this park.

**Stornelli, C., Porcelli, F., Moretti, A. & Logrieco, A.** 1998. [Control of population of *Saissetia oleae* (Olivier) in Apulia, through distribution of fungal isolates from the Mediterranean area.] (In Italian with summary in English.) *Micologia Italiana* 27(2): 11-18.

Notes: Fungal strains, mainly isolated from the mediterranean area, were tested in field in order to control the *Saissetia oleae* populations, one of the insect species causing considerable damage to the olive culture. The biological assays were performed by using a solid formulation, which was prepared by fungal culture grown on rice. The results show that some isolates significantly controlled the crawlers and second instars larvae of the *S. oleae*. In particular, a *Fusarium larvatum* (ITEM 2135) strains showed a high insecticide activity in the short run, causing almost a total mortality of the *S. oleae* larvae (98.6%).

**Stratopoulou, E.T. & Kapatos, E.T.** 1998. Key factors and regulation of

population of *Saissetia oleae* (Hom., Coccidae) on olive trees in the region of Magnesia, Greece. *Journal of Applied Entomology* 122: 501-507.

Notes: Population studies of *Saissetia oleae* were carried out in a heavily infested olive orchard for five consecutive generations. The aim of the study was to investigate the causes of the outbreak and to evaluate the role of natural enemies on the population dynamics. The mortality of crawlers and mortality during autumn and spring, comprising the action of internal parasitoids (mainly *Metaphycus helvolus*) and predators (mainly coccinelids), were the main factors that determined the population changes of *S. oleae* during the course of the study. It was concluded that the outbreak was caused by the reduced action of natural enemies, presumably due to pesticide treatments applied against other olive pests the previous years.

Strauss, S.Y. & Karban, R. 1998. The strength of selection: intraspecific variation in host-plant quality and the fitness of herbivores Pages 156-177 in Mopper, S. & Strauss, S.Y., Eds., *Genetic Structures and Local Adaptation in Natural Insect Populations: Effects of Ecology, Life History, and Behavior*. Chapman & Hall, New York. xix + 449 pp.

Notes: Examples include *Cryptococcus fagisuga* on *Fagus sylvatica* and *Pseudaulacaspis pentagona* on *Morus alba*.

Stuart, R.J., Polavarapu, S., Lewis, E.E. & Gaugler, R. 1997. Differential susceptibility of *Dysmicoccus vaccinii* (Homoptera: Pseudococcidae) to entomopathogenic nematodes (Rhabditida: Heterorhabditidae and Steinernematidae). *Journal of Economic Entomology* 90: 925-932.

Notes: This study demonstrates strong variability in the susceptibility of *D. vaccinii* to different species and strains of entomopathogenic nematodes, and implicates certain heterorhabditids as promising candidates for the biological control of this insect.

Stumpf, C.F. & Lambdin, P.L. 1998. The pit scales (Asterolecaniidae) of the new world. Pages 34-35 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Geographic distribution of genera; host plants; description and illustration of pit scales present in the New World and assessment of similarities; seven new species discovered from specimens obtained from the US National Museum of Natural History; 70 morphological characters evaluated and phylogenetic analysis proposed.

Su, H.J., Hung, T.H., Wu, M.L., Su, H.J., Hung, T.H. & Wu, M.L. 1997. First report of banana streak virus infecting banana cultivars (*Musa* spp.) in Taiwan. *Plant Disease* 81: 5, 550.

Notes: Symptoms of leaf streak disease were detected in bananas imported from Australia to Taiwan. The causal organisms were transmitted by *Planococcus citri* and were identified as banana streak badnavirus and cucumber mosaic cucumovirus. This is the first report of BSV infecting *Musa* spp. in Taiwan.

Su, T.H., Su, C.K. & Vacante, V. 1997. Comparison of *Anagyrus sawadai* Ishii and *Leptomastix dactylopii* Howard (Hymenoptera: Encyrtidae) parasitizing the citrus mealybug, *Planococcus citri* (Homoptera: Pseudococcidae) in Taiwan. *Bulletin OILB/SROP (Sect. Reg. Ouest Palearctique)* 20: 7, 32-44.

Notes: Laboratory experiments were conducted to study the relationship between the citrus mealybug, *Planococcus citri*, and two of its endoparasitoids, *Anagyrus sawadai* and *Leptomastix dactylopii*. In choice tests, *A. sawadai* parasitized 1st- and 2nd-instar nymphs of *P. citri* and produced 4.6 and 14.3 progeny, respectively. *L. dactylopii* parasitized 3rd-instar nymphs and adult females of *P. citri*, and produced 4.3 and 8.5 progeny, respectively. In no-choice tests, *A. sawadai* parasitized 1st- and 2nd-instar nymphs of *P. citri* and produced 12.9 and 22.7 progeny, respectively. *L. dactylopii* parasitized 3rd-instar nymphs and adults of *P. citri*, and produced 7.5 and 19.1 progeny, respectively. The duration of development and adult longevity was also compared. The impact of

regulation by these parasitoids was demonstrated in parasitoid exclusion experiments.

Sudhir, S. & Singh, S. 1997. Description of a new and notes on some other species of *Encyrtus* (Hymenoptera: Encyrtidae) parasitising scale insects in Assam, India. *Oriental Insects*. New Delhi 31: 419-426.

Notes: *Encyrtus noyesi* sp. nov. parasitising *Coccus* sp. on the leaves of *Terminalia chebula* is described from India. This species and *E. albidus* are also recorded from *Coccus* sp. on *Spondias pinnata* and mango. *E. lecaniorum* is recorded from *Coccus* sp. on *Pongamia pinnata*. A key to the Indian species is provided.

Sugimoto, N., Goda, Y., Suzuki, J., Kuroyanagi, M., Yamada, T. & Yoshihira, K. 1998. Structures of minor pigments in cochineal dye. *Natural Medicines* 52: 135-139.

Notes: Two minor pigments with polarities lower than carminic acid were isolated from *Coccus cacti* L. On the bases of NMR and MS data, their structures were determined as 1,3,6-trihydroxy-8-methylanthraquinone (desoxyervthrolaccin) and 1,3-dihydroxy-8-methylanthraquinone. In addition, the amount of the principal pigment, carminic acid, in this insect was determined to be 62.5 g/kg by HPLC.

Sugiura, N. & Takagi, M. 1998. The number of larval instars in *Aphytis yanonensis* DeBach et Rosen and *Coccobius fulvus* (Compere et Annecke) (Hymenoptera: Aphelinidae), two introduced parasitoids of the arrowhead scale, *Unaspis yanonensis* (Kuwana) (Homoptera: Diaspididae). *Entomological Science* 1: 185-188.

Notes: Larval mandible lengths of *Aphytis yanonensis* and *Coccobius fulvus*, parasitoids of *Unaspis yanonensis*, were measured to determine the number of larval instars in these parasitoids. Mandible length frequency distributions over a period of days showed three distinct peaks, indicating that *A. yanonensis* and *C. fulvus* possess three larval instars. Sickle-shaped mandibles were observed in 1st-instar larvae of *C. fulvus* but were lacking in *A. yanonensis*.

Sugonyaev, E.S. 1998. A morphological basis of parasitization strategies of chalcid-wasps (Hymenoptera: Chalcidoidea) infesting soft scale insects (Homoptera: Coccoidea: Coccidae). Pages 35-36 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. A study was undertaken of the morphological and biological adaptations of chalcid wasps for the synchronisation of their life cycles with that of the host, so as to provide optimal conditions for parasitization under temperate conditions. Strategies discussed for overcoming the period when a suitable host stage is absent.

Sugonyaev, E.S. 1998a. [Chalcid wasps (Hymenoptera, Chalcidoidea) parasites on soft scales (Homoptera, Coccidae) in Vietnam. 5. A new species of the genus *Coccophagus* Westwood (Hymenoptera, Aphelinidae).] (In Russian with summary in English.) *Entomologicheskoe Obozrenye* 77: 480-482, 526.

Notes: Host is *Saissetia neglecta*.

Sugonyaev, E.S. 1998b. [Chalcid wasps (Hymenoptera, Chalcidoidea) parasites on soft scales (Homoptera, Coccidae) in Vietnam. 6. A new species of the genus *Encyrtus* Latreille (Hymenoptera, Encyrtidae) inhabitant of ant nests.] (In Russian with summary in English.) *Entomologicheskoe Obozrenye* 77: 497-501, 526.

Notes: Host is *Coccus formicarii*.

Sulaiman, S.F.M. 1997. Impact of weed management on ant density and fruit yield in the control of pineapple wilt disease. (In English with summary in French.) *Acta Horticulturae* 425: 475-484.

Notes: *Dysmicoccus brevipes* causes pineapple wilt disease and *Technomyrmex albipes* plays major role in spreading the disease.

Sun, J., Debarr, G.L., Berisford, C.W. & Schauff, M.E. 1998. Description of a new primary parasitoid, *Zarhopalus* Ashmead (Hymenoptera: Encyrtidae) of

*Oracella acuta* (Homoptera: Pseudococcidae). Canadian Entomologist 130(6): 793-798.

Notes: *Oracella acuta*, the loblolly pine mealybug, is a native North American species infesting pines, *Pinus* sp., in the U.S. *Phenacoccus aceris* and *Pseudococcus maritimus* also mentioned as hosts.

Swindale, L.D. 1997. The globalization of agricultural research: a case study of the control of the cassava mealybug in Africa. Pages 189-194. In The Globalization of Science; the Place of Agricultural Research. International Service for National Agricultural Research, the Hague.

Notes: Discussion of the history of the occurrence and distribution of *Phenacoccus manihoti* and a review of efforts to control it by international agencies.

Szklarzewicz, T. 1998. Structure of ovaries in scale insects. I. Pseudococcidae, Kermesidae, Eriococcidae, and Cryptococcidae (Insecta, Hemiptera, Coccinea). International Journal of Insect Morphology and Embryology 27: 167-172.

Notes: Developing ovaries of the scale insects *Nipaecoccus nipae* and *Cryptococcus fagisuga* contain clusters of interconnected cells (cystocytes) that are arranged into rosettes; polyfusomes occur in the centres of the rosettes. Ovaries of the adults of these scale insects are composed of numerous short telotrophic ovarioles. Tropharia (trophic chambers) of *Dysmicoccus newsteadi*, *Eriococcus buxi*, *C. fagisuga* and *Pseudochermes fraxini* comprise only trophocytes (nurse cells), whereas those of *Kermes quercus* and *Gossyparia spuria* also contain arrested oocytes. The latter probably degenerate. It is suggested that during evolution of scale insects a gradual reduction of germ cells to 4 per cluster (3 trophocytes and 1 oocyte) took place. In light of the obtained results, anagenesis of scale insect ovarioles is discussed.

Szklarzewicz, T. 1998a. Structure of ovaries of scale insects: II. Margarodidae (Insecta, Hemiptera, Coccinea). International Journal of Insect Morphology and Embryology 27(4): 319-324.

Notes: Detailed description of the paired, spindle-shaped ovaries of the second and third instars of the Polish cochineal, *Porphyrophora polonica*. Results seem to confirm the concept of a monophyletic origin of the primitive scale insects (Archaeococcoidea).

Szklarzewicz, T. 1998b. The ovaries of scale insects (Hemiptera, Coccinea). Morphology and phylogenetic conclusions. Folia Histochemica et Cytobiologica 36(4): 157-165.

Notes: Coccoids (Coccinea, Coccoidea, Cocomorpha) are a highly diverse group of ectoparasitic insects. They comprise two subgroups: primitive archaeococcoids (=Orthezioidae sensu Koteja) and advanced neococcoids (=Coccoidea sensu Koteja). The ovaries of coccoids consist of numerous short telotrophic-meroistic ovarioles. The ovarioles of all investigated species share common characters (e.g. the same mechanism of ovariole development, lack of terminal filaments, occurrence of single oocytes in the vitellaria) supporting the concept of monophyletic origin of this group. Despite these characteristics, the ovaries of archaeococcoids and neococcoids differ in the number of germ cells (oocytes + trophocytes) constituting a single ovariole. In primitive families (Ortheziidae, Margarodidae), this number is relatively large (15-28), whereas in advanced ones (Pseudococcidae, Kermesidae, Eriococcidae, Cryptococcidae, Coccidae, Diaspididae) it is small and usually does not exceed eight. The comparative analysis of the ovary structure in the representatives of Coccinea and closely related Aphidinea (aphids) has revealed that: (1) the organization of archaeococcoid ovaries is more similar to those of aphids than to neococcoids and (2) during the evolution of Coccinea a gradual reduction in the number of germ cells in ovarioles took place.

Szklarzewicz, T. & Cichocka, M. 1997. Structure of telotrophic ovarioles in four families of scale insects: Pseudococcidae, Kermesidae, Cryptococcidae and Eriococcidae (Hemiptera, Coccoidea). Acta Biologica Cracoviensia Series

- Zoologia 39 (Suppl. 1): 44.  
 Notes: [22nd Conference on Embryology: Plants, Animals, Humans, Osieczany, Poland, May 14-17, 1997:] Abstract only. *Cryptococcus fagisuga*, *Eriococcus buxi*, *Gossyparia spuria*, *Kermes quercus*, *Pseudochermes fraxini* and *Trionymus newsteadi* among species covered.
- Sztejnberg, A., Doron-Shloush, S. & Gerson, U. 1997. The biology of the acaropathogenic fungus *Hirsutella kirchneri*. *Biocontrol Science and Technology* 7: 577-590.  
 Notes: The acaropathogenic fungus *Hirsutella kirchneri* grew best and produced most mycelia on a medium containing yeast extract, dextrose and agar. Conidial production, however, was maximal on potato dextrose agar (PDA). Among organisms on which the fungus grew on were heat-killed cadavers of a dead *Pseudococcus* sp.
- Tabatadze, E.S. & Yasnosh, V.A. 1997. Control measures of *Lopholeucaspis japonica* Cockerell (Homoptera: coccinea) through integrated citrus pest management. *Bulletin OILB/SROP (Sect. Reg. Ouest Palarctique)* 20: 45-51.  
 Notes: Title of proceedings: Integrated control in citrus fruit crops. Meetings held at Florence, Italy, 29 August 1996. Edited by V. Vacante.] The Diaspidid *Lopholeucaspis japonica* is one of the main pests on Citrus plants along the Black Sea coast of Georgia. At present, indigenous natural enemies are of great value in controlling this pest. The natural enemy complex includes mainly aphelinid (Aphelinidae) parasitoids, predatory coccinellids (Coccinellidae), mites (Acari), spiders (Araneae) and the entomogenous fungus *Aschersonia* sp., previously unknown in the Caucasus. The economic threshold of *L. japonica* was 20-25 scales cm<sup>-1</sup> on trunks or branches. The criteria to determine successful control of *L. japonica* by natural enemies was a 50% population reduction, which was used to develop rational control measures. Chemical control is also recommended.
- Tabatadze, E.W. & Yasnosh, V.A. 1998. The population dynamics and biocontrol of the Japanese scale, *Lopholeucaspis japonica* (Cockerell) in Georgia. Page 36 in VIIIth International Symposium on Scale Insect Studies. 41 pp.  
 Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *L. japonica* was discovered in Georgia in 1931 in Batumi Botanical Garden, where it had probably been introduced from Japan. By the 1950's, it had become widespread and was a major pest on citrus, other fruits, tea, tung and ornamental plants. Japanese scale compared to other diaspidid species; life cycle; chemical control recommendations; natural enemies.
- Takagi, S. 1998. A further study of *Ulucoccus* (Homoptera: Coccoidea: Diaspididae). *Species Diversity* 3: 105-116.  
 Notes: Description and illustrations of *Ulucoccus gombakensis* and *U. danuensis*.
- Takagi, S. & Kondo, T. 1997. Further forms for the Rugaspidiotini-problem II: a new scale insect associated with mango-tree in India (Homoptera: Coccoidea: Diaspididae). *Insecta Matsumurana* 53: 93-99.  
 Notes: *Mangaspis bangalorensis* Takagi & Kondo, new gen., new sp., described and illustrated; host *Mangifera indica*; taxonomic notes.
- Takagi, S., Marusik, Y.M., Ohara, M. & Urbain, B.K. 1997. Records of *Arctorthesia cataphracta* from the Middle Kuril Islands and SEM observations of their wax-secreting organs (Homoptera: Coccoidea: Ortheziidae). (In Japanese with summary in English.) *Bulletin of the Otaru Museum* 10: 1-7.  
 Notes: This species recorded for the first time in the Kuril Islands; found on grasses such as *Carex* spp. and *Calamagrostis langsdorfi*; illustrated with 10 photomicrographs.
- Takagi, S., Tang, F.T., Yasar, B. & Kondo, T. 1997. Further forms for the Rugaspidiotini-problem (Homoptera: Coccoidea: Diaspididae). *Insecta Matsumurana* 53: 81-99.  
 Notes: *Adiscodiaspis tamaricicola*, *Prodiaspis tamaricicola* and

- Circodiaspis sinensis*, all associated with tamarisks, are rearranged to *Prodiaspis sinensis* and *P. tamaricicola*; descriptions; illustrations.
- Takagi, S. & Williams, D.J.** 1998. A new mangrove-infesting species of *Aulacaspis* occurring in southeast Asia, with a revision of *A. vitis* (Homoptera: Coccoidea: Diaspididae). *Insecta Matsumurana* 54: 51-76.
- Notes: Description and illustrations of *Aulacaspis marina*, new sp., pest of *Rhizophora*.
- Tamaki, Y.** 1997. 1.1.2.5 Chemistry of the Test Cover. Pages 55-72. in: Ben-Dov, Y. & Hodgson, C.J., Eds., *Soft Scale Insects: Their Biology, Natural Enemies and Control* [Vol. 7A]. Elsevier, Amsterdam & New York. 55-72.
- Notes: Covers relative weight of the test or cover, composition of the waxy materials, composition of body lipids, composition of the aqueous materials, and mode of secretion. Species mentioned include *Aonidiella aurantii*, *Asterococcus muratae*, *Callococcus acaciae*, *Chrysomphalus aonidum*, *Ceroplastes albolineatus*, *C. ceriferus*, *C. destructor*, *C. japonicus*, *C. rubens*, *C. pseudoceriferus*, *Dactylopius coccus*, *D. confusus*, *Drosicha corpulenta*, *Ericerus pela*, *Eulecanium cerasorum*, *Icerya purchasi*, *Kermes ilicis*, *Kerria lacca*, *Lecanodiaspis quercus*, *Parthenolecanium corni*, *Pseudaulacaspis pentagona*, *Pseudococcus comstocki*, *Pulvinaria horii*, *Unaspis eunonymi*, *U. yanonensis* and *Tachardina theae*.
- Tawfik, M.H. & Ghabbour, M.W.** 1998. Monitoring the sweet potato whitefly and the California red scale and its parasitoids by using yellow sticky traps. Page 36 in VIIIth International Symposium on Scale Insect Studies. 41 pp.
- Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Yellow sticky traps, used for monitoring the dispersal of sweet potato whitefly (*Bemisia tabaci*) within and between cotton fields and citrus orchards, also trapped male California Red Scale (*Aonidiella aurantii*) and its parasitoid, *Aphytis* sp. Cotton fields and three citrus orchards (representing different varieties and maturity of host plant) were used in these experiments. It was found that the populations of *A. aurantii* and its parasitoid were affected by the variety and maturity of the host plant.
- Tian, M.Y. & Bunalski, M.** 1997. [Data on the occurrence of *Cybocephalus politus* (Gyllenhal, 1813) and *Cybocephalus fodori* Endrody-Younga, 1965 (Coleoptera: Cybocephalidae) in Poznan.] (In Polish.) *Wiadomosci Entomologiczne* 16: 230.
- Notes: Original title: Informacje o wystepowaniu w Poznaniu *Cybocephalus politus* (Gyllenhal, 1813) i *Cybocephalus fodori* Endrody-Younga, 1965 (Coleoptera: Cybocephalidae). Host: *Lepidosaphes ulmi*.
- Tindo, M. & Dejean, A.** 1998. Rhythm of activity and feeding behavior of *Belonogaster juncea juncea* (Hymenoptera: Vespidae). *Sociobiology* 32: 101-107.
- Notes: A study of the feeding behavior of *B. juncea juncea*. Liquid matter is comprised mainly of floral and extra-floral nectar from several plant species, and the honeydew collected from leaves or by tending Homoptera (Aphididae, Coccidae, Margarodidae, Stictococcidae) and Tettigometridae).
- Tomkins, A.R., Allison, P.A., Thomson, C. & Wilson, D.J.** 1997. Development of a model to predict the phenology of oleander scale (*Aspidiotus nerii*) infesting kiwifruit. *Acta Horticulturae* 444: 791-795.
- Notes: Proceedings of the third international symposium on kiwifruit, Thessaloniki, Greece, 19-22 September 1995. The development of a simulation model to predict the phenology of a uniparental strain of *Aspidiotus nerii* in kiwifruits in New Zealand is described. The rates of development of *A. nerii* at different temperatures (12-25 deg C) were used as model parameters. The model gave a good fit compared with actual phenology data from a 6-year-old orchard (cv. Hayward).
- Tremblay, E. & Ponzi, R.** 1998. Observations on the symbiont degeneration in the male line of *Pseudaulacaspis pentagona* (Targioni-Tozzetti). Pages 36-37 in VIIIth International Symposium on Scale Insect Studies. 41 pp.
- Notes: [Conference held at Wye College, University of London, Aug. 31st -

Sept. 6th, 1998.] Abstract only. The regression of mouthparts, which is typical of the development of juvenile instars of male scale insects towards the adult stage, is paralleled by the degeneration of the bacteroid symbiont microorganisms inhabiting the bacteriocytes (micetocytes). This degenerative process has been followed in the white peach scale, *Pseudaulacaspis pentagona*, male line.

Trjapitzin, V.A. & Ruiz Cancino, E. 1997. *Diversinervus elegans* Silvestri (Hymenoptera: Chalcidoidea: Encyrtidae), a parasitoid of coccids (Homoptera: Coccoidea: Coccidae) in Mexico. (In Spanish with summary in English.) CEIBA 38: 151-155.

Notes: [Original title: *Diversinervus elegans* Silvestri (Hymenoptera: Chalcidoidea: Encyrtidae), un parasitoide de coccidos (Homoptera: Coccoidea: Coccidae) en Mexico.] *D. elegans* was collected on *Ficus benjamina* in Cuernavaca, Morelos, Mexico. The morphology, biology, geographical distribution, host plants and its use as a biological control agent of Coccidae are described.

Trouve, C., Deloncourty, N., Marro, J.P., Brun, J. & Dubrul, A. 1998. Pages 95-96. in: [Biological control trials against the scale *Pulvinaria regalis* in ornamental trees in the town of Calais.] Service Regional de la Protection des Vegetaux, Nord Pas-De-Calais, Loos-en-Gohelle.

Notes: Original title: Essais de controle biologique de la cochenille, *Pulvinaria regalis*, sur des arbres d'ornement de la ville de Calais. First transnational workshop on biological, integrated and reasoned control: status and perspectives with regard to regional and European experiences, Lille, France, 21-23 January 1998. Following difficulties in the control of the horse chestnut scale, *Pulvinaria regalis*, in urban trees, the open space department of the city of Calais decided to put an end to chemical control methods. Releases of the scale-eating ladybird *Cryptolaemus montrouzieri* were carried out on trees heavily infested by the scale. The bad weather conditions at the time of release have made it difficult to assess the efficacy of the biological control agent.

Trueman, H.E. 1998. Phylogeny of the Margarodidae (Hemiptera: Coccoidea) using molecular sequences. Page 37 in VIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. In the past, the taxonomy of the Margarodidae has been based solely on morphological features, mainly those of adult females. However, the reduction and loss of structures makes it difficult for evolutionary relationships to be estimated from morphology alone. Morrison (1927) characterised the margarodids by their possession of abdominal spiracles in all stages and compound eyes in the adult males, two features that are clearly not shared derived features (synapomorphies) (Miller, 1984). The characters upon which the family is based are ancestral features (plesiomorphies) that margarodids share with other hemipterans. Thus, the Margarodidae may be a paraphyletic grouping of species that could not be placed in other families (Schee, 1969), rather than a monophyletic group. With the use of molecular sequences and cladistic methodology, a re-construction of margarodid phylogeny, addressing the question of monophyly, is presented.

Tumminelli, R., Saraceno, F. & Conti, D. 1997. [Ants in citrus groves.] Le formiche nell'agrumeto. (In Italian.) Informatore Agrario 53: 11, 57-60.

Notes: The chemical control of ants has been recommended for several years in Sicilian citrus groves because of their predatory activity on natural beneficial insects and their help in protecting honeydew-producing insect pests. The efficacy of chlorpyrifos-ethyl [chlorpyrifos] applied to the trunks of the trees to protect against ants was compared with that of insecticidal gum containing hexane, and pyrethrum in an orange grove (cv. Navelina) in Sicily in 1994-96. The encyrtid *Leptomastix dactylopii* was released in 1994-95 to control cottony scale [the pseudococcid *Planococcus citri*], and the aphelinid *Aphytis melinus* was released in 1996 to control

citrus red scale insect [the diaspidid *Aonidiella aurantii*]. Chlorpyrifos gave the best control and was the least costly. The study verified the negative effects on the crop caused by the presence of *L. humile*. It is concluded that in integrated control programmes, the best time to treat ants and release beneficial insects is between April and September.

United States Department of Agriculture. Animal and Plant Health Inspection Service. 1997. Look out for the pink hibiscus mealybug. Program Aid No. 1606: 11 pp.

Notes: *Maconellicoccus hirsutus* is serious threat on more than 200 plants; distribution; brief field description; description of damage; biological control and natural enemies.

United States Department of Agriculture. Animal and Plant Health Inspection Service. 1997a. Pink hibiscus mealybug. *Maconellicoccus hirsutus* (Green). Program Aid No. 1605: 2pp.

Notes: Warning and photos.

Umesha, K., Thyagaraj, N.E. & Chandrappa, H.M. 1998. New record of the yellow scale of cotton, *Cerococcus hibisci* Green (Homoptera: Cerococcidae) on patchouli *Pogostemon cablin* (Blanco) Benth. Pest Management in Horticultural Ecosystems 4: 51.

Notes: *Cerococcus hibisci* is reported from Mudigere, Karnataka, India, from patchouli.

Van Driesche, R. 1998. Effect of euonymus scale (Homoptera: Diaspididae) on *Euonymus* spp. survival in southern New England, with estimates of economic costs of pest damage. Environmental Entomology 27(2): 217-220.

Notes: A field experiment on the ability of a Chinese strain of *Chilocorus kuwanae* (Silvestri) (Coleoptera: Coccinellidae) to suppress densities of euonymi scale (*Unaspis euonymi* [Comstock]) (Homoptera: Diaspididae) on *Euonymus* spp. in southern New England was conducted from 1991 to 1995. Observations were made at three spatial scales: (1) a set of 27 sites, 14 of which received *C. kuwanae* releases and 13 served as checks, (2) a single apartment complex, with approximately 110 euonymus shrubs dispersed over 32 ha, at which a single release was made, and (3) the statewide Massachusetts residential and commercial landscape as a whole. *Chilocorus kuwanae* suppressed *U. euonymi* at 9 of 14 release sites. The beetle failed to establish large populations at three sites, and at two other sites the experiment was ended prematurely by shrub removal by owners. Of 13 check sites, nine were invaded by *C. kuwanae* over the course of the experiment and the beetle became abundant at three. Of the 10 check sites where *C. kuwanae* remained absent or rare, scale numbers increased at four locations, decreased at four, and were unchanged at two. At the 32-ha apartment site, *C. kuwanae* spread to 64% of all euonymus plants within 4 months and the proportion of plants with heavy euonymus scale infestations decreased from 46 to 13% within 1 year. At the statewide (MA) landscape level, by 1994 no significant change had yet occurred in the proportion of plants with heavy euonymus scale infestations.

Van Driesche, R.G., Idoine, K., Rose, M. & Bryan, M. 1998. Release, establishment and spread of Asian natural enemies of *Euonymus* scale (Homoptera: Diaspididae) in New England. (In English with summary in Spanish.) Florida Entomologist 81: 1-9.

Notes: *Unaspis euonymi* feeds on foliage and stems of woody landscape plants in the US; 5 species of natural enemies recorded: *Chilocorus kuwanae*, *Cybocephalus* sp. nr. *nipponicus*, *Coccobius* sp. nr. *fulvus*, *Encarsia* sp. nr. *diaspidicola* and *Aphytis* sp.

Van Driesche, R., Idoine, K., Rose, M. & Bryan, M. 1998a. Evaluation of the effectiveness of *Chilocorus kuwanae* (Coleoptera: Coccinellidae) in suppressing euonymus scale (Homoptera: Diaspididae). Biological Control 12: 1, 56-65.

Notes: To assess the effectiveness of *Chilocorus kuwanae* in reducing *Unaspis euonymi* populations on infested euonymus shrubs, 27 sites with one or more moderately-densely infested euonymus shrubs (mostly *Euonymus*

*fortunei*) were chosen as study sites in southern New England (USA), during 1991-95. *C. kuwanae* was released repeatedly at 14 sites until a breeding population was established. No releases were made at the other 13 sites (controls). The beetle failed to establish large populations at 3 of the release sites, and shrub removal prematurely ended the study at 2 other sites. Nine of the 13 control sites were invaded by *C. kuwanae* and it became abundant at 3. Of the 10 control sites where *C. kuwanae* was absent or only present in low numbers, scale numbers increased at 4, remained unchanged at 2 and decreased at 4. Following a single release of *C. kuwanae* in a single apartment complex, with 110 euonymus shrubs dispersed over 32 ha, the beetle spread to 64% of all euonymus plants within 4 months and the percentage of plants with heavy euonymus scale infection decreased from 46 to 13 within 1 year. A statewide study in Massachusetts revealed no significant change in the proportion of euonymus plants heavily infected with scale by 1994.

Van Driesche, R.G., Kingsley, P., Rose, M. & Bryan, M. 1998. Effect of euonymus scale (Homoptera: Diaspididae) on *Euonymus* spp. survival in southern New England, with estimates of economic costs of pest damage. *Environmental Entomology* 7: 217-220.

Notes: In the landscape in southern New England, *Euonymus fortunei*-tagged plants heavily infested with euonymus scale, *Unaspis euonymi*, suffered 12.1% mortality annually, a 4-fold increase compared to uninfested or less infested plants.

Veeranna, G. 1997. Biochemical changes of tukra leaves of mulberry and its effect on economic characters of mulberry silkworm, *Bombyx mori* L. *Entomon* 22: 129-133.

Notes: Pink mealybug, *Maconellicoccus hirsutus* (Green) affected mulberry leaves were bioassayed to determine the supporting ability for development of growth of silkworm, *Bombyx mori* L. compared to healthy ones. It was found that economical characteristics such as weight of ten larvae, effective rate of rearing (ERR), single cocoon weight, shell weight, shell percent, filament length, etc, were significantly high in silkworm fed with tukra leaves compared to larvae fed with healthy leaves. Some biochemical constituents such as moisture content, total lipids and fatty acids, soluble carbohydrates and proteins were analysed. Percentage of moisture, total lipids, total proteins and soluble carbohydrates were found high in tukra leaves compared to healthy ones.

Verghese, A. & Ramachander, P.R. 1998. Inter-specific association among prey, *Chloropulvinaria psidii* (Maskell) predator, *Cryptolaemus montrouzieri* Mulsant and ant, *Camponotus compressus* Fabricius in a guava ecosystem. *Pest Management in Horticultural Ecosystems* 4: 21-24.

Notes: A study was conducted in an unsprayed guava ecosystem in Bangalore, Karnataka, India, to determine inter-specific associations among *Chloropulvinaria psidii* (*Pulvinaria psidii*), *Cryptolaemus montrouzieri*, *Camponotus compressus*, a prey, predator and ant, respectively. Analysis showed a positive significant association between prey-predator only at a higher predator-prey ratio. This has a bearing on suppression in biocontrol releases. A positive association between predator and ant was seen only when the mean prey population was lower, implying competition. At higher mean prey number, the predator and ant showed positive association implying coexistence. The implication of the study in biological control is discussed.

Visser, M.E. & Rosenheim, J.A. 1998. The influence of competition between foragers on clutch size decisions in insect parasitoids. *Biological Control* 11: 169-174.

Notes: *Aonidiella aurantii* were provided as hosts for this study of parasitoids *Aphaereta minuta* and *Comperiella bifasciata*.

Wakgari, W.M. & Giliomee, J.H. 1998. Observations on the white wax scale, *Ceroplastes destructor* Newstead (Hemiptera: Coccidae), a pest of citrus in South Africa. Page 41 in VIIIth International Symposium on Scale Insect

Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *C. destructor* has recently reached pest status in South Africa in citrus growing regions, and especially on easy-peel citrus (*Citrus reticulata*) groves. This study investigates its morphology, biology and population dynamics with the view of providing a more informed basis for control programs. Morphometric characteristics useful for the separation of the different life stages were described from field-collected and slide-mounted specimens. The fecundity, fertility, phenology and dispersion of *C. destructor* were investigated both on-farm (by regular field sampling) and on-station (by artificially infesting seedlings with crawlers). The temporal and spatial dynamics of population densities and levels, and the factors responsible for the changes are being studied through regular sampling from a group of easy-peel citrus groves representing varying altitudinal ranges in the Cape Province. Studies are also in progress to assess the underlying reasons for the upsurge of this species, and to determine the effect of scale density on its fecundity and fertility and on the growth and physiology of infested trees.

Wakgari, W.M. & Giliomee, J.H. 1998a. Description of the stages of the white wax-scale, *Ceroplastes destructor* Newstead (Homoptera: Coccidae). African Entomology 6(2): 303-316.

Notes: *Ceroplastes destructor* has recently increased in numbers and distribution in some Easy-peel (*Citrus reticulata*) orchards in the Western Cape Province of South Africa. Characteristics of the immature and adult females are described and illustrated from field-collected and slide-mounted specimens. A key to the different stages is provided. The biology and morphometric characteristics useful for separating the stages are discussed.

Waterhouse, D.F. 1998. Biological control of insect pests: Southeast Asian prospects. Australian Centre for International Agricultural Research (ACIAR), Canberra; Australia. vii + 548 pp.

Notes: This book describes the rating, origin, distribution, biology, host plants, damage, natural enemies (principally parasitoids) and attempts at biological control of the major exotic insect pests of Southeast Asia. Target insect pests covered include: *Dysmicoccus brevipes* and *Planococcus citri*.

Weber, M.G., Haim, A. & Ne'eman, G. 1997. Special issue - Mt. Carmel Fire, Israel. International Journal of Wildland Fire 7: p.iii + 227-352.

Notes: Eight papers are presented in this journal issue on the wildfire that occurred in September 1989 on Mt. Carmel, Israel. Over 100 ha of natural E. Mediterranean Aleppo pine (*Pinus halepensis*) forest was burnt in an area highly valued for recreation. A special study was set up to examine the possibilities for ecosystem restoration and future management. Topics considered included the repercussions of the fire on nature conservation, soil erosion and forestry management after wildfire, regeneration, spatial and temporal heterogeneity of species diversity after fire, arthropod species diversity, Aleppo pine seedling mortality and attack by *Matsucoccus josephi*, effects of management after fire on bird community succession, and the management implications of the project.

Whiting, D.C. & Hoy, L.E. 1998. High-pressure washing treatments to remove obscure mealybug (Homoptera: Pseudococcidae) and lightbrown apple moth (Lepidoptera: Tortricidae) from harvested apples. Journal of Economic Entomology 91(6): 1458-1463.

Notes: Mixed life stages of obscure mealybug, *Pseudococcus viburni* and late 1st-instar or early 2nd-instar lightbrown apple moth, *Epiphyas postvittana* on 'Royal Gala' apples (*Malus domestica*) were exposed to standard packhouse processing with and without addition of high-pressure apple washer treatments. Insect removal and mortality were assessed. After standard packhouse processing about 60% of *P. viburni* remained on their

- host apples. High-pressure apple washer removal by location decreased in the following order: calyx cavity outside the sepals > cheek about equal to stem cavity which is greater or equal to calyx beneath sepals. About half of the *E. postvittana* larvae infesting apples was removed by standard packhouse processing. Removal rates were similar for all locations on open-calyxed apples. However, no removal occurred from the calyx beneath the sepals if the apple calyx was closed. The persistence of insects on the apple cheek reflects the high proportion of larvae inside tunnels in this location compared with other apple locations.
- Wijk, L. van, Balkhoven, H. & Zuidam, C.** 1997. [New formulation of vbc is effective against scales.] Nieuwe formulering vbc werkt op gewone doppluis. (In Dutch, Flemish.) *Fruittelt* (Den Haag) 87: 20-21.  
Notes: A field study was carried out during 1996 in the Netherlands to investigate the efficacy of a new formulation of an insecticide (of unknown composition) (6 litres/94 litres water) in red currants (cv. Rovada and Rolan) severely infested with scale (Coccidae).
- Williams, D.J.** 1997. Obituary of Joseph Raymond Mamet. *The Scale* 21: 2-4.
- Williams, D.J.** 1998. Mealybugs of the genera *Eumyrmococcus* Silvestri and *Xenococcus* Silvestri associated with the ant genus *Acropyga* Roger and a review of the subfamily Rhizoecinae (Hemiptera, Coccoidea, Pseudococcidae). *Bulletin of the Natural History Museum. Entomology Series* (London) 67: 1-64.  
Notes: Descriptions or redescriptions of 17 species of *Eumyrmococcus* are presented and illustrated, including *E. falciculosus*, *E. kolombangarae*, *E. kruiensis*, *E. kusiacus*, *E. lamondicus*, *E. lanuginosus*, *E. maninjauensis*, *E. neoguineensis*, *E. nipponensis*, *E. queenslandicus*, *E. recalvus*, *E. sarawakensis*, *E. scorpioides*, *E. smithii*, *E. sulawesicus* and *E. taylori*, *Xenococcus acropygae*, new sp., and *X. annandalei*.
- Williams, M.** 1998. Scale insect diversity in central America, with emphasis on the soft scales (Hemiptera: Coccoidea: Coccidae). Pages 39-40 in VIIIth International Symposium on Scale Insect Studies. 41 pp.  
Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. Summary of the geological and climatic history of Central America, one of the highest diversities of insect species on earth. Review of the current understanding of scale insect diversity and distribution for these seven countries, with particular emphasis on Coccidae (currently 20 genera and 45 species).
- Williams, D.J. & Pellizzari-Scaltriti, G.** 1997. Two species of mealybugs (Homoptera Pseudococcidae) on the roots of Aloaceae in greenhouses in England and Italy. (In English with summaries in English & Italian) *Bollettino di Zoologia Agraria e Bachicoltura*. Milano Ser. II, 29: 157-166.  
Notes: *Ripersia speciosa* is now described as *Trochiscococcus speciosus*, new gen., new sp.; *Rhizoecus aloes*, new sp. also described.
- Wu, R., Liang, X.D., Li, M. & Yang, M.D.** 1998. Spatial distribution and sampling techniques of *Ceroplastes rubens minor* Maskell. (In Chinese with summary in English.) *Journal of Zhejiang Forestry Science and Technology* 18: 32-36.  
Notes: Ten trees of *Pinus massoniana* damaged by *Ceroplastes rubens minor* were examined for insect number and branch length in the east, west, south and north aspects and at the top of the tree crowns. Insect number and branch length were significantly different. The effects of the spatial distribution on sampling needs was considered.
- Wu, J.L., Pan, Y.Z., Zhao, Q. & Su, J.X.** 1998. [Studies on the control threshold of the silk tree scale (*Aonidiella sotetsu*) (Takahashi).] (In Chinese with summary in English.) *Scientia Silvae Sinicae* 34: 2, 51-57.  
Notes: Regression relationships were analysed between various characteristics of the silk tree scale *Aonidiella sotetsu*, the damage it causes to the silk tree (*Leucaena glauca* [*L. leucocephala*]), and various tree/stand/site characteristics, in Fu Lukou, Ningnan County, [Sichuan Province], China, in the period 1990-93.
- Wu, S. & Tang, F.** 1997. A new genus and a new species of Pseudococcidae

(Homoptera: Coccoidea). (In Chinese with summary in English.) Acta Zootaxonomica Sinica 22: 282-285.

Notes: Descriptions and illustrations of *Heteroheliococcus* new gen., *H. mirabilis* and *H. innermongolicus*.

Wysoki, M. 1997. Present status of arthropod fauna in mango orchards in Israel. Acta Horticulturae No. 455: 805-811.

Notes: [Proceedings of the 5th international mango symposium, Tel Aviv, Israel, 1-6 September 1996, Volume 2. Editors Lavi, U.; Degani, C.; Gazit, S.; Lahav, E.; Pesis, E.; Prusky, D.; Tomer, E. & Wysoki, M.] A summary of the insect and arthropod fauna in Israeli mango orchards is presented. Of 56 species from 20 families found in a survey, 7 species were considered to be economically important pests including scale species *Aonidiella orientalis*. Notes on pest control, lists of natural enemies, and pollinators of mango in Israel.

Xia, X.N., Liu, D.X. & Zhou, L.Q. 1997. A study of the spatial distribution of *Ceroplastes rubens* Maskell on *Ilex cornuta* Lindl. by projection pursuit regression method. (In Chinese with summary in English.) Entomological Knowledge 34: 272-276.

Notes: Spatial distribution shown to be related to orientations and levels; inner data structure is analyzed and described objectively by projection pursuit regression in order to provide a reliable basis for comprehensive management.

Xie, G.L., Pan, W.Y., Tang Z.Y., Ding, D.C. & Lian, J.H. 1997. Evaluation on the effective and stable control of *Hemiberlesia pitysophila* Takagi with *Coccobius azumai* Tachikawa. (In Chinese with summary in English.) Acta Entomologica Sinica 40: 135-144.

Notes: The aphelinid *Coccobius azumai*, introduced from Okinawa, Japan, was first released and successfully established in Huidong County, Guangdong Province, China, in 1989. Systematic observations and investigations made since the initial release showed that a year later the parasitism rate of *C. azumai* on *Hemiberlesia pitysophila* reached 55.8-64.2% within 50 m of the release site, and the density of female *H. pitysophila* was reduced from 3.41 to 0.64 per needle. Two years later, the effective control radius had increased to about 300 m. The parasitism rate ranged from 20.8 to 32.9%. The density of female *H. pitysophila* was further reduced to 0.6 per needle. Both *C. azumai* and *H. pitysophila* stabilized at a low density, whereas in areas where no *C. azumai* were released, the density of female *H. pitysophila* increased from 3.4 to 4.22 per needle, which was 6-10 times higher than that observed in the release area. It was concluded that hyperparasitism of *C. azumai* by *Marietta carnesi* was only 3.1-5.3%, and had little influence on the control efficacy of *C. azumai*.

Xie, Y.P. 1998. The Scale Insects of the Forest and Fruit Trees in Shanxi of China. China Forestry Publishing House. 147 pp.

Notes: 122 species reviewed, 14 new to science; discussions of natural conditions, resources of forest and fruit trees and fauna; origin, distribution, morphology, biology, population dynamics, destruction and control techniques given for 71 important species from 35 genera and 5 families; illustrated.

Xie, Y., Ji, W., Liu, H., Zhao, J., Li, Y., Zhang, H. & Zhang, Y. 1998. The biology of *Phenacoccus azaleae* (Pseudococcidae) in the forest of Bunge Prickly Ash, northern China. Page 40 in VIIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. *P. azaleae* is a new major pest in this part of northern China, causing the host trees to die if they are attacked by the mealybug in two successive years. Biology and natural enemies discussed.

Xie, Y.P., Liu, H.S., Miao, Z.W., Zhao, J.L., Sun, F.Q., Zhang, H.J., Wang, R.H. & Li, Y.F. 1998. The outbreak of a mealybug, *Phenacoccus azaleae* Kuwana and its control in forest of Bunge Pricklyash (Homoptera: Coccoidea:

Pseudococcidae). Pages 420-423 in Resource technology 1997: Beijing International Symposium Proceedings China Forestry Publishing House, Beijing, China.

Notes: Study of distribution, life history, biology characteristics, population dynamics and control of *P. azaleae*; host *Zanthoxylum bungeanum*.

Xie, Y., Xue, J., Liu, H. & Liu, X. 1998. A study on the accumulations of urban air pollutions SO<sub>2</sub> and Pb in the body of *Eulecanium gigantea* (S.) (Coccidae) and their host-plant *Sophora japonica*. (In Chinese with summary in English.) *Scientia Silvae Sinicae* 34: 45-49.

Notes: Results indicate that scale insect population density is positively correlated with the number of cars driving in the area; the contents of sulphur and lead in the body of the scale insects and their host plant are much higher in the polluted districts than that in the relatively clear districts; these species can absorb and tolerate pollutants.

Xu, Z.H. 1997. A taxonomic study of the ant genus *Pseudolasius* Emery in China (Hymenoptera: Formicidae). (In English with summary in Chinese.) *Zoological Research* 18: 1-6.

Notes: Associated with *Rhizoecus terrestris*.

Xu, Z.H. & He, J.H. 1997a. Notes on four new species of *Homalotylus* Mayr (Hym.: Encyrtidae). (In Chinese with summary in English.) *Wuyi Science Journal* 13: 85-93.

Notes: *Nipaecoccus vastator* mentioned as host of *Homalotylus zhaoi* on citrus.

Xu, Z.H., He, J.H. & Lou, J.X. 1997. Note on two new species of *Discodes* Foerster (Hymenoptera: Encyrtidae). (In English with summary in Chinese.) *Entomotaxonomia* 19: 217-221.

Notes: *Eriopeltis araxis* is host of *Discodes eriopeltis*.

Xu, Z.H., He, J.H., Xu, Z.H. & He, J.H. 1997. [Two new species of the genus *Anicetus* from China (Hymenoptera: Encyrtidae).] (In Chinese with summary in English.) *Acta Zootaxonomica Sinica* 22: 1, 90-94.

Notes: *Anicetus rubensi* sp. nov. is described, from specimens reared from the host *Ceroplastes rubens* from China. *Anicetus rarisetus* sp. nov. is described from *C. rubens*, *C. japonicus* and *C. ceriferus* from China.

Xu, T.R., Liu, C.G. & Wu C.B. 1997. The ultrastructure of Malpighian tubules of white wax scale. (In Chinese with summary in English.) *Acta Entomologica Sinica* 40: 283-287.

Notes: The ultrastructure of Malpighian tubules of the white wax scale, *Ericerus pela*, was studied and is described.

Xu, T., Liu, C. & Wu, C. 1997a. Studies on intracellular concretion in malpighian tubules of white wax scale. (In Chinese with summary in English.) *Journal of Sichuan University (Natural Science Edition)* No. 116: 229-234.

Notes: *Ericerus pela*.

Yang, J.S. & Sadof, C.S. 1997. Variation in the life history of the citrus mealybug parasitoid *Leptomastix dactylopii* (Hymenoptera: Encyrtidae) on three varieties of *Coleus blumei*. *Environmental Entomology* 26(4): 978-982.

Notes: Red-, yellow-variegated, and green-leafed plants of *Coleus blumei* (Benth) were studied to determine host plant effects on the size of the citrus mealybug, *Planococcus citri* (Risso), and the life-history of its parasitoid *Leptomastix dactylopii* (Howard). Same-aged 4th-instar citrus mealybugs were significantly larger on red-variegated and green plants than on yellow-variegated plants. Body size of citrus mealybugs at parasitization was correlated positively with body size of emerging adult parasitoid females. Number of eggs within parasitoid adult females 24 h after adult emergence was correlated positively with parasitoid body size. Average fecundity of parasitoid females was significantly higher on red-variegated and green plants than on yellow-variegated plants. Survivorship of *L. dactylopii* was also higher on red-variegated and green plants. Overall, population growth rates (rm) of the parasitoid were higher on red-variegated and green plants than on yellow-variegated plants. When differences among the population growth rates reported for citrus

mealybugs on these plants are considered, the potential for biological control seems greatest on green plants. Thus, despite the positive relation between parasitoid size and host size, *L. dactylopii* is unlikely to adequately compensate for plant-mediated increases in host population growth.

Yang, S.L. 1997. Insect pests and harmful animals of *Phalaenopsis* and their infestation habits. (In Chinese.) Report of the Taiwan Sugar Research Institute no. 156: 49-68.

Notes: There are numerous kinds of insect pests attacking *Phalaenopsis* including scale insects such as *Saissetia coffeae*, *Parlatoria proteus* and *Pseudococcus longispinus*.

Yang, S.L., Chen, H.Z., Shen, Y.L. & Zhao, R.Y. 1998. Note on insects of Coccoidea suborder in Lishui of Zhejiang Province. (In Chinese with summary in English.) Journal of Zhejiang Forestry Science and Technology 18: 16-22.

Notes: A list of forest insects from a survey in 1980 and complementary investigation in later years is presented, showing the presence of nearly 70 species of Coccoidea in Lishui, Zhejiang, China. Chinese name, latin name, collection site, host, damage, life cycle, and additional biological features of the insects are listed.

Yang, X.L., Shen, M.Q., Guo, Z.Z. & Xiong, J.W. 1997. Predation of the ladybeetle *Chilocorus kuwanae* on the scale *Unaspis yanonensis*. Entomologia Sinica. Shensi 4: 249-258.

Notes: The consumption of *Unaspis yanonensis* by ovipositing adult females of *Chilocorus kuwanae* was significantly greater than that of adult males. At 25 deg C, one adult female, on average, consumed 42.7 *U. yanonensis* per day, whereas one adult male consumed 22.3 *U. yanonensis* per day. However, after being deprived of prey for 48 h, this difference was eliminated. Females of *C. kuwanae* required 15 *U. yanonensis* per adult in order to oviposit eggs. The functional responses of adults to densities of different prey stages followed the Holling type I curve. The functional response to adult females indicated that the maximum prey consumption increased with an increase in temperature from 16 to 35 deg C, and dropped sharply at 37 deg C. However, temperature did not alter the type of functional response. Based on predation by *C. kuwanae* on adults of *U. yanonensis*, the minimum critical, optimum and maximum critical temperatures for predation were 10.6, 31.5 and 38.2 deg C, respectively. A decrease in predator abundance or an increased predator density resulted in a reduction in the attack rate. *C. kuwanae* adults preferred male pupae to other stages of *U. yanonensis* and their preference for various life stages of prey was in order of male pupae, 2nd-instar male nymphs, 2nd-instar female nymphs, adult females and 1st-instar nymphs.

Yasnosh, V.A. 1998. Observations of some mealybugs (Pseudococcidae) and their natural enemies on woody plants in Georgia. Page 40 in: VIIth International Symposium on Scale Insect Studies. 41 pp.

Notes: [Conference held at Wye College, University of London, Aug. 31st - Sept. 6th, 1998.] Abstract only. 22 species of mealybug are associated with tree species in Georgia, 50% of them immigrants, distributed mostly in the subtropical zone of the Black Sea. *Pseudococcus comstocki* and *Planococcus ficus* are widespread. *P. ficus* is the main pest species, found on grapevine and other hosts. Discussion of natural enemies. Revised check list of Georgian mealybugs and their parasitoids.

Yasnosh, V.A. & Tabatadze, E.S. 1997. Fungi of the genus *Aschersonia* (Deuteromycetes) - a new entomopathogen of armoured scale insect in the Republic of Georgia. (In Russian with summary in English.) Mikologiya i Fitopatologiya 31: 59-63.

Notes: Data are given for *Aschersonia* species pathogenic to *Lopholeucaspis japonica* (Homoptera: Coccinea: Diaspididae), a pest of citrus, tea and other plants of the Caucasian coast of the Black sea (predominantly in the Republic of Georgia). This is the first record of *Aschersonia* as a scale insects pathogen in this region. The fungus was observed in many orchards

- and found to parasitize up to 36% of the *L. japonica* population on citrus trees.
- Yasuda, H. & Takuma, K. 1997. Numerical simulation of the effect of natural enemies. *Journal of the Faculty of Agriculture, Tottori University* 33 7-13.
- Notes: Computer simulation was used to investigate the population dynamics of natural enemies. Fisher's model was transferred to a 2-step difference scheme and fitted with an analytical solution to verify the accuracy. The fit was almost 100% for single species situations. The simulation model was also used for *Rodolia cardinalis* as a natural enemy of *Icerya purchasi*, and the results correlate well with field data.
- Zhang, X.J., Li, Y.Z., Su, X., Lu, C.C. & Zhang, B. 1997. Effects of *Oracella acuta* (Homoptera: Pseudococcidae) on the growth of *Pinus elliottii*. (In Chinese with summary in English.) *Journal of South China Agricultural University* 18: 40-45.
- Notes: Field experiments were conducted in Guangdong, China, to study the influence of the loblolly mealybug, *Oracella acuta*, on the growth of slash pine, *Pinus elliottii*. The results showed that growth and tree height, and lateral shoots were reduced by 23.7 and 25.8%, respectively, in heavily damaged stands. Growth height and diameter, growth at breast height, fresh weight of one-year-old needles, and the volume growth of severely damaged trees was reduced by 26.8, 30.3, 47.6 and 33.5%, respectively. The total volume of timber lost in damaged stands was 3.96 m<sup>3</sup> per hectare during a 5 year infestation period.
- Zhao, S.X., Fan Q.H. & Guo, D.W. 1997. Chemical control of white peach scale *Pseudaulacaspis pentagona* living on nane tree. (In Chinese with summary in English.) *Wuyi Science Journal* 13 193-197.
- Notes: Seven insecticides were tested for their efficacy against white peach scale, *Pseudaulacaspis pentagona*, a pest of nane trees (*Prunus salicina* var. *cordata*, nai plums) in Fujian, China. In laboratory studies, insecticidal efficacy against nymphs ranged from 79.6 to 90.2% (adult efficacy ranged from 15.4 to 41.8%). In field studies, insecticidal efficacy against nymphs ranged from 71.3 to 88.8% (adult efficacy ranged from 8.4 to 40.5%).
- Zhao, S.X., Wei, H. & Chen, Q. 1997. *Pseudaulacaspis pentagona* and its predator *Cybocephalus nipponicus* on nane trees. (In Chinese with summary in English.) *Journal of Fujian Agricultural University* 26: 182-186.
- Notes: The life cycle, development form and stages, sex ratio, fecundity and egg hatching rate of *Pseudaulacaspis pentagona* on nane trees (a species in *Prunus*) were studied in laboratory and fields in Fujian, China. The insect produces 3 generation annually. The female adults of the overwintered generation begin to lay eggs in late March, with the laying peak in mid-April to early May. The peak occurrences of nymphs of the 1st, 2nd and 3rd generations were in early to late May, middle-late July, and middle September to early October, respectively; and the peak occurrence of adults was in early to middle June, early to middle August, and October, respectively. The predator *Cybocephalus nipponicus* also had population peaks in mid-May, late June, early and late July, early August, and mid-September, coinciding with all occurring peaks of the prey population. The adults of *C. nipponicus* had a daily predation rate of 53-121 eggs (average of 100 eggs), 15-35 (average of 20) 2nd-instar nymph or 2-3 (average of 1.5) adults.
- Zhong, Z.T. 1998. Control experiment of citrus arrowhead scales by spraying Supracide. (In Chinese.) *China Fruits* No. 1: 54.
- Notes: A field study was carried out in 16- to 18-year-old Citrus trees in China to investigate chemical control of *Unapris yanonensis* (*Unaspis yanonensis*).
- Zhou, L., Xie, X.L. & Luo, E.H. 1997. Biology of *Aulacaspis* (*Aulacaspis*) *rosarum* Borchsenius and its control. (In Chinese.) *Entomological Knowledge* 34: 22-222.
- Zimmerman, H.G. 1997. A case for the reintroduction of the cochineal

*Dactylopius opuntiae*. Page 143. in: Robertson, H.G., Ed., Insects in African Economy and Environment. Entomological Society of Southern Africa, Pretoria, South Africa. 143 pp.

Notes: Joint Congress of the Entomological Society of Southern Africa (11th Congress) and the African Association of Insect Scientists (12th Congress).