Eva Crane Trust

ECTD_208

TITLE: *Selective annotated bibliography of the Varroa mite and its control in honeybee colonies*

SOURCE: Eva Crane: Bibliography, IBRA, No. 37

DATE: 1985

CONTENTS

INTRODUCTION

Varroa jacobsoni has been spread across Europe and to many other parts of the world since 1970, and much has been published about the mite and its effects on honeybees.

This Bibliography has been compiled by photocopying 255 entries selected from *Apicultural Abstracts*, including some general reports on the spread of the mite, but concentrating especially on research into the biology of *Varroa* and of bees infested with it, and new experimental work on methods of controlling it in honeybee colonies. Altogether 88 publications on biology are included, 104 on chemical treatments of infested colonies and 23 on non-chemical treatments. Out-of-date publications on methods of treatment are in general omitted. An index is provided to substances used for *Varroa* control.

In response to an invitation from institutes in Turkey, where *Varroa* has been present since 1977, the British Council arranged for the author to visit that country in May 1985, and the Bibliography was compiled for this occasion. As a result of discussions during the visit, Section 7 on residues of chemicals in honey was incorporated. A few recent entries have also been added elsewhere, those in Section 6 having an entry number with a or b, as necessary.

Two members of IBRA staff have co-operated in the work. David Lowe, Editor of *Apicultural Abstracts*, provided typed entries for publications not yet abstracted in the journal, and Penelope Walker organized the photographic masters used for printing.

October 1985

1. GENERAL

1.1 BOOKS

1043/79 ALPATOV, V. V. (AND 6 OTHERS, EDITORS) [*Varroa* infestation of honeybees.] Moscow, USSR; Izdatel'stvo Nauka. (1977) 117 pp. [Ru, B, Price 0.60r]

This book contains 29 chapters by various authors, as follows:

pp. 5-9 Poltev, V. I.: Epizootics of *Varroa* disease.

pp. 9-12 Alpatov, V. V.: *Varroa jacobsoni* in other countries.

pp. 13-16 Lange, A. B.; Natskiĭ, K. B.; Tatsiĭ, V. M.: On some peculiarities of the biology of *Varroa jacobsoni*, a parasite of bees.

pp. 16-18 Sal'chenko, V. L.: The biology of the cause of *Varroa* disease, the mite *Varroa jacobsoni*, and an investigation into means of combating it.

pp. 19-23 Alpatov, V. V.; Lange, A. B.; Natskiĭ, K. B.; Tatsiĭ, V. M.: Work on the testing and application of treatments against *Varroa*.

pp. 23-31 Grobov, O. F.: Pharmacological preparations for combating *Varroa*.

pp. 31-33 Stolbov, H. M.: The elaboration of measures against *Varroa* disease.

pp. 33-36 Alpatov, V. V.: Towards a method of developing therapeutic preparations and evaluating their effectiveness against *Varroa*.

pp. 36-37 Gaponova, V. S.; Mel'nik, V. N.: Some data on *Varroa* disease and its treatment.

pp. 37-43 Pankova, S. V.: Haemolymph of the honeybee.

pp. 44-48 Simetskiĭ, M. A.; Smirnov, A. M.; Kudryavtsev, E. A.: The application of "Varroatin" as an aerosol treatment against *Varroa*.

pp. 48-54 Koptev, V. S.: The treatment of *Varroa* disease with naphthalene.

pp. 54-58 Chebotarev, I. I.: The effectiveness of complex treatments for *Varroa* disease.

pp. 58-60 Lange, A. B.; Natskiĭ, K. B.; Stolbov, N. M.; Tatsiĭ, V. M.: The arrangement of trials for treatments against *Varroa*.

pp. 61-66 Alpatov, V. V.; Lange, A. B.; Tatsiĭ, V. M.; Natskiĭ, K. B.; Chernov, K. S.: The selection and development of substances for use against *Varroa*.

pp. 66-71 Likhotin, A. K.: The application of acaricides against *Varroa*.

pp. 71-75 Stolbov, N. M.; Vas'kov, N. A.: Measures against *Varroa jacobsoni* in apiaries in the Tyumansk region.

pp. 75-76 Gavrilov, B. N.: Epizootology of *Varroa* disease in honeybees.

pp. 76-80 Chanyshev, Z. G.: *Varroa* in Bashkiria.

pp. 80-82 Vyazovskiĭ, E. N.: Late autumn and early spring treatment against *Varroa*.

pp. 82-85 Grobov, O. F.: A study of material from the alighting boards of hives infested with *Varroa*.

pp. 85-86 Mikityuk, V. V.; Sedin, I. F.; Fomenkov, A. P.: Studies of acaricides for *Varroa* disease.

pp. 87-92 Ankinovich, G. A.; Khazbievich, L. M.: Management of honeybee colonies infested with *Varroa* in the Moscow area.

pp. 93-95 Khazbievich, L. M.: A *sanpropusknik* [cage for treating bees] in an apiary infested with *Varroa*.

pp. 95-98 Khazbievich, L. M.: An electrothermal device for introducing aerosol treatments into a hive.

pp. 98-101 Petrov, S. G.: Protein food for colonies with *Varroa* disease.

pp. 102-103 Ilbyushenkov, M. S.: The biology of *Varroa jacobsoni*.

pp. 104-106 Tatsiĭ, V. M.: The wintering of bees with *Varroa* disease.

pp. 107-114 Khazbievich, L. M.: Short communications [on *Varroa*].

274/84 ANKINOVICH, G. B.; GROBOV, O. F.; PETROV, S. G.; POCHINIKIN, V. I.; KHAZBIEVICH, L. M. (EDITORS) **[Varroa disease of honeybees.]** Varroatoz pchel. Moscow, USSR; Moskovskoe Obshchestvo Ispytatelei Prirody (1981) 80 pp. [Ru, B, Price 0.60r]

This is a collection of short papers on various aspects of varroa disease, published by the Moscow Society of Naturalists. Topics discussed include: biological characteristics of *Varroa jacobsoni*; effects of *V. jacobsoni* on the honeybee colony; control methods, especially heat treatment and the use of sulphur, endosulfan and Neoron; experimental methods. D. Galton.

948/78 APIMONDIA **Varroasis, a honeybee disease.** Bucharest, Romania, Apimondia Publishing House. (1977) 92 pp. [En, B]

This is a collection of excerpts from various journals and from an Apimondia Symposium in Sofia, Bulgaria, in 1976. The one long paper is by O.F. Grobov (p. 46–70), and pages 71–84 carry photographs and drawings. There is a combined list of 163 references. E. E. Crane

1266/84 CAVALLORO, R. (EDITOR) ***Varroa jacobsoni* Oud. affecting honey bees: present status and needs.** Rotterdam, Netherlands; A.A. Balkema for the Commission of the European Communities (1983) ix + 107 pp. + 9 pl. ISBN 90-6191-524-4 [En, B] Commission of the European Communities, Joint Res. Centre, Ispra, Italy.

This book contains the proceedings of a meeting of the European Communities Experts' Group in Wageningen, on 7–9 February 1983. The 4 main sessions covered: extent of *Varroa* infestations and effects; existing rules and regulations (Denmark, Netherlands, Ireland); biology; control. D.A. Griffiths et al. presented 'The view of the acarologists', and a session on present and futur research included contributions by J. Louveaux (France) and J. Beetsma (Netherlands). Most of the papers are abstracted or listed separately in *Apicultural Abstracts*. Final discussions, conclusions and recommendations of the meeting are summarized on pp. 91-96. There is a bibliography of recent literature, and a list of participants. The book was printed from typed camera-ready copy in order to achieve rapid publication.

D.G. Lowe.

ÖZBEK, H.; ECEVİT, O. [The varroa mite affecting the honeybee.] **Bal arisi (Apis mellifera L.) 'da varroa akari, Varroa jacobsoni (Oudemans) (Acarina: Varroidae).** Ankara, Turkey; Zirai Mücadele ve Zirai Karantina Genel Müdürlüğü (1984) iii + 35 pp. [Tr, B]

RADEMACHER, E.; GEISELER, E. **Die Varroatose der Bienen: Geschichte, Diagnose, Therapie.** Berlin, German Federal Republic; Schelzky & Jeep (1984) 104 pp. [De, B]

TUTKUN, E.; İNCİ, A. [Varroa mite parasitic on honeybees: identification, distribution, biology and control.] **Bal arisinda zarar yapan ari akari (Varroa jacobsoni Oudemans) 'nin taninmasi, yayilişi, biyolojisi ve mücadelesi.** Ankara, Turkey; Yenigün Matbaasi (1985) iii + 88 pp. [Tr, en, B]

1.2 BIBLIOGRAPHIES

1279L/84 BEETSMA, J. **Recent bibliography on *Varroa jacobsoni* Oud.** In *Varroa jacobsoni Oud. affecting honey bees: present- status and needs [edited by Cavalloro, R.].* Rotterdam, Netherlands; A.A. Balkema for the Commission of the European Communities (1983) 99-103 [En, B]

1352L/80 DE JONG, D.; MORSE, R. A. (INTERNATIONAL BEE RESEARCH ASSOCIATION) **Annotated bibliography on *Varroa jacobsoni, Tropilaelaps clareae* and *Euvarroa sinhai.*** *Bibliography, International Bee Research Association* (1979) No. 15, 36 pp. ISBN 0-86098-084-7 [En, B, Price £5, $11.50] Revision of *AA* 987L/77; with 249 additional references.

1.3 MISCELLANEOUS PUBLICATIONS

1009/81 ALLGEMEINE DEUTSCHE IMKERZEITUNG [[Special number on] **Varroa disease of honeybees. Its spread in Europe – diagnosis – treatment. The position in March 1980.**] Die Varroatose der Honigbiene. Ausbreitung in Europa – Diagnose – Behandlung. Stand März 1980. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 129-167 [De, B]

This issue of *Allgemeine Deutsche Imkerzeitung* consists of 11 reports and discussions of all the studies on *Varroa jacobsoni* made at the Institut für Bienenkunde, Oberursel, in the last 3 years; these are separately abstracted. An outlook for the future and a list of relevant publications are also given. P. Walker

1302/78 CHAMOUX, H.-M.-L. **[Varroasis, a new and dangerous parasitic disease of honeybees (*Varroa jacobsoni*).]** La varroase, une nouvelle et dangereuse parasitose des abeilles (*Varroa jacobsoni* Oudemans, 1904). *Thèse pour le Doctorat Veterinaire, École Nationale Veterinaire d'Alfort, France.* (1977) iii + 78 pp [Fr, B] Route du Col du Rousset, 21650 Dic, France.

Information in 67 publications, covering the anatomy and biology of the parasite, and the symptoms, diagnosis, incidence, prophylaxis and treatment of the disease is reviewed. Commercially available chemicals used for treatment of the disease are described, with notes on methods of application, efficiency and disadvantages. C. Courant

FRITZSCH, W.; BREMER, R. **Varroatose (Varroose).** In Bienengesundheitsdienst. Jena, German Democratic Republic; Gustav Fischer (1984) Ed. 2, 46-67 [De, B]

1281/83 KOROMYSLOV, G. F. **[Research on *Varroa jacobsoni* infestation of bees, conducted at the All-Union Institute for Experimental Veterinary Science, Moscow.]** *Byulleten Vsesoyuznogo Instituta Eksperimental'noi Veterinarii* (1981) No. 41, 59-78 [Ru]

The topics described include: mixed infections (*Varroa jacobsoni* and *Aspergillus*); effects of some physical factors on bees and *V. jacobsoni*; effects of some chemosterilants on bees and *V. jacobsoni*; acaricidal activity of some synthetic scents and their toxicity to bees (particularly elenol and ionone); acaricidal effects and toxicity to bees of substances fed to bees for the control of *V. jacobsoni* (e.g. chlordimeform); effects of various acaricides on *V. jacobsoni* (particularly chloropropylate and chlorobenzilate); effect of chloropropylate on biochemical properties of honeybee blood; use of biological agents (derived from *Bacillus thuringiensis*) against *V. jacobsoni*.

PFEFFERLE, K. **Die neue Aussenmilbe (Varroa jacobsoni).** In Imkern mit dem Magazin. Münstertal/Schwarzwald, German Federal Republic; K. Pfefferle (1984) Ed. 6, 140-181 [De, B]

590/82 RITTER, W. Varroa disease of the honeybee *Apis mellifera*. *Bee World* (1981) 62 (4) 141-153 [En, B] Tierhygienisches Inst. Freiburg, Am Moosweiher 6, 7800 Freiburg, German Federal Republic.

In this review, with 46 references, the author describes the biology and epidemiology of *Varroa jacobsoni*, gives methods for diagnosing its presence, and lists various sprays, powders, fumigants and systemic agents that have been used for its control. Biological control methods, i.e. brood removal and heat treatment, are also described. Measures for minimizing the further spread of the mite are discussed. [Available as *IBRA Reprint* M106, price £0.95 or $2.30]. D. G. Lowe

1.3 continued

RITTER, W. Neuester Stand der diagnostischen und therapeutischen Massnahmen zur Bekämpfung der Varroatose. Tierärtzliche Umschau (1984) 39 (2) 122-124, 127 [De, en, B]

632/81 SLOVENSKI ČEBELAR [[Special issue on *Varroa*].] *Slovenski Čebelar* (1980) 82 (2) 41-136 + 8 pl. [Sn, B]

This special issue contains the following articles on various aspects of varroa disease:

pp. 43-45 Klun, L.: Varrooza na Japonskem [Varroa disease in Japan].

pp. 46-64 Mencej, M.: Varrooza v Sovjetski zvezi [Varroa disease in the USSR].

pp. 65-87 Klun, L: Varrooza v LR Bolgariji [Varroa disease in Bulgaria].

pp. 88-99 Senegačnik, E.: Varrooza v Zvezni Republiki Nemčiji in Nemški Demokratični Republiki [Varroa disease in the German Federal Republic and German Democratic Republic].

pp. 100-114 Miheličč, J: Varrooza v SFR Jugoslaviji [Varroa disease in Yugoslavia].

pp. 115-128 Klun, L: Uničevanje klopov *Varroa* s toploto [Heating apparatus for destroying *Varroa*].

pp. 129-132 Kopitar, M.: Republiški ukrepi za preprečevanje vdora, širjenja ter zatiranja varrooze v Sloveniji [Regulations for preventing the spread of varroa disease in Slovenia].

pp. 133-135 Klun, L.: Technologija čebelarjenja in zatiranje varroe [Beekeeping technology and varroa disease].

The 8 pages of colour photographs show *Varroa jacobsoni* parasitizing bee brood and adults, the appearance of parasitized colonies, and treatment of colonies with chemicals. D. G. Lowe

576L/80 SMIRNOV, A. M. Research results obtained in USSR concerning aetiology, pathogenesis, epizootiology, diagnosis and control of *Varroa* disease in bees. *Apiacta* (1978) 13 (4) 149-162 [En, B] Review.

1016/81 SMIRNOV, A. M.; VORONKOV, I. M. [Prevention and control of *Varroa jacobsoni* infestations of honeybees.] *Veterinariya, Moscow, USSR* (1979) No. 10, 87-89 [Ru, B]

This is a report of an international conference held in Bucharest, Romania. Papers were presented on: the life history of the *Varroa* mite; its method of feeding; means of control; the possibility of producing strains of bees resistant to infestation; new acaricides to kill mites that have developed resistance to the commoner ones used; physical means of control; biological control with micro-organisms (so far unsuccessful).

583/85 SMIRNOV, A. M.; POPOV, E. T. [**Prophylaxis of *Varroa jacobsoni* infestations of honeybees: a review.**] *Vestnik Sel'skokhozyaĭstvennoĭ Nauki* (1983) No. 4, 112-115 [Ru, en, B]

This a brief survey of some recent Russian work on *Varroa jacobsoni*, including its morphology and reproduction. It is also reported that the mite does not survive on wasps, bumble bees and flies, and that *Varroa* probably transports pathogens of certain honeybee diseases between colonies. Of the many products and methods tested for controlling *Varroa*, several chemicals have been found initially to be reasonably effective, but resistant strains of the mite have eventually developed. In USSR beekeepers are beginning to use hives designed to make treatments for *Varroa* more effective.

P. Walker.

ZANDER, E.; BÖTTCHER, F.K. **Der Varroatose.** In Krankheiten der Biene. Stuttgart, German Federal Republic; Eugen Ulmer (1984) 212-229 [De, B]

2. HISTORY OF THE SPREAD OF VARROA JACOBSONI

817/75 AKRATANAKUL, P.; BURGETT, M. *Varroa jacobsoni*: A prospective pest of honeybees in many parts of the world. *Bee World* (1975) 56 (3) 119-120 [En, B] Dept. Entomology, Oregon State Univ., Corvallis, OR, USA.

The life history and distribution of the tropical mite *V. jacobsoni* are described, and reports of its occurrence on *Apis mellifera* and *A. cerana* in 13 countries are listed in chronological order. The mite is reported from Thailand for the first time.

It is considered that the ability of *V. jacobsoni* to overwinter in hives in temperate regions is due to the relatively high temperature of the honeybee winter cluster. The mite could become a serious problem in Europe, Africa, Australia and the Western Hemisphere, and further work on its biology and control are needed.

D. G. Lowe

559/77 ALPATOV, V. V. [A fatal error in determining a race of honeybee.] *Priroda, USSR* (1976) No. 5, 72-73 [Ru, EB] 123376 Moscow, Druzhinnikovskaya ul 11/2, kv. 19, USSR.

There is no indigenous *Apis mellifera* in Primor'e region of USSR, only *Apis cerana*. The population of the "Far Eastern bee" there is descended from (largely Ukrainian) bees taken by settlers in or before the early part of the century. These bees give very high honey yields, largely because of the lime forests; the 10-year average in the experimental apiary was 102 kg per hive. The bees have been mistakenly imported into other parts of USSR and elsewhere, as good honey producers; they have brought with them *Varroa jacobsoni* that is parasitic on *Apis cerana* in wild colonies (and now on *A. mellifera*) in Primor'e.

A map shows the distribution of honeybee races in USSR. E.E. Crane

1044/79 ALPATOV, V. V. [*Varroa jacobsoni* in other countries.] In *Varroa* infestation of honeybees [edited by Alpatov, V. V. and 6 others]. Moscow, USSR; Izdatel'stvo Nauka. (1977) 9-12 [Ru, E1552, B]

The author briefly reviews present knowledge about the distribution of this mite, and suggests that parasitism by it arose 15–70 million years ago, on *Apis cerana* and *A. dorsata*. Over the years a balanced relationship evolved and the bees developed an immunity. Recent introductions of *A. mellifera* (without immunity) into territory occupied by the Asian *Apis* species has led to serious outbreaks of disease and to the spread of the mite. K. Donaldson

1040/79 CRANE, E. **The *Varroa* mite.** *Bee World* (1978) **59** (4) 164-167 [En, B] International Bee Research Association, Hill House, Gerrards Cross, Bucks. SL9 0NR, UK.

This review (reprinted as *IBRA Research News* No.16) summarizes known and postulated routes by which this mite, parasitic on honeybees, has been distributed. *Varroa* first spread through much of Asia, and was more recently imported (on bees) to many European countries, via European USSR, and to South America from Japan. The present distribution is ascertained, and, to prevent further spread, beekeepers are advised not to import bees or queens from infested areas.

The damage to colonies caused by the mite, and methods of confirmation of infestation, are summarized. Further information is contained in *Bee World* (1979) 60(1) : 8.

P. Walker

591/82 GRIFFITHS, D. A.; BOWMAN, C. E. **World distribution of the mite *Varroa jacobsoni*, a parasite of honeybees.** *Bee World* (1981) **62** (4) 154-163 [En, B] Min. Agric., Fisheries and Food, Slough Lab., Slough, Berks. SL3 7HJ, UK.

The results are given of a world survey by acarologists. A table lists the 83 countries to which questionnaires were sent, with the replies received (negative, positive, no reply). The information acquired has been incorporated into a distribution map which shows countries in which the presence of *V. jacobsoni* is established or suspected, and in which it is absent (in February 1981). The results indicate that *V. jacobsoni* is absent from Australasia and the Pacific islands, present in at least 14 countries in Asia and the Middle East, absent from Africa apart from Tunisia and Algeria, present in only Brazil and Paraguay in Central and South America, absent from North America, and present in 10 European countries, including the USSR. In June 1981 *Varroa* was also discovered in Gonizia, Italy, near the border with Yugoslavia.

The survey shows that the usual ways for the mite to enter a country are: (1) importation of honeybee colonies; (2) crossing of a national frontier through local trading, movement of swarms, and drifting of individual bees. Only from Paraguay has there been direct evidence that queen importation was responsible for the initial outbreak.

D. G. Lowe

1267/84 RUTTNER, F. **Varroatosis in honeybees: extent of infestation and effects.** In *Varroa jacobsoni Oud. affecting honey bees: present status and needs [edited by Cavalloro, R.]*. Rotterdam, Netherlands; A.A. Balkema for the Commission of the European Communities (1983) 7-13 [En, B] Inst. Bienenkunde, Oberursel, German Federal Republic.

The distribution of *Varroa jacobsoni* in Europe is described, the main emphasis being on ways in which the mite is spread — by honeybee imports from one country to another, by migratory beekeeping, and 'on the wing'. It is concluded that *V. jacobsoni* will continue to spread to the west and south of Europe.

D. G. Lowe.

3. BIOLOGY OF VARROA JACOBSONI

3.1 GENERAL

1289/83 BREM, S.; KOPP, H.; MEYER, P. [The natural winter losses of *Varroa jacobsoni* in comparison with the whole mite population of the honeybee colony: an investigation of six colonies.] Der natürliche Wintertotenfall von *Varroa jacobsoni* im Vergleich zur gesamten Milbenpopulation im Bienenvolk Untersuchungen an sechs Bienenvölkern. *Tierärztliche Umschau* (1983) **38** (1) 16, 18, 21 [De, en, B] Landesuntersuchungsamt für das Gesundheitswesen Südbayern, Veterinärstr. 2, D-8042 Oberschleissheim, German Federal Republic.

Winter debris and samples of bees from each colony were examined by the flotation method. Colonies 1—4 had totals of 4, 7, 20 and 23 mites; the numbers in the debris of each colony were 1, 1, 6 and 1. In colony 5, a total of 959 mites were found, with only 5 in the debris, but in this colony the bees had access to the debris and so could remove it from the hive. In colony 6 only 1 mite was found in the debris, probably indicating a new infestation. It is concluded that low levels of infestation can be detected by examination of winter debris. Author

240/82 BRETSCHKO, J. [*Varroa* infestation from a biological viewpoint.] Varroatose aus biologischer Sicht. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (12) 365-368 [De, B] Dominikanergasse 20, 8047 Graz-Ragnitz, Austria.

Hive populations and incidence of varroa disease were recorded from October until the following July at several apiaries in Tunisia. During the beginning of the spring build-up of colony population, there were fewer mites in colonies with queens 0–1 yr old than in colonies with older queens. Colonies with fewer mites increased their size more rapidly. It is concluded that in strong colonies a 10–20% level of infestation was not harmful. P. Walker

592/82 DE JONG, D. Effect of queen cell construction on the rate of invasion of honeybee brood cells by *Varroa jacobsoni*. *Journal of Apicultural Research* (1981) 20 (4) 254-257 [En, B] Dept. Entomology, Cornell Univ., Ithaca, NY 14853, USA.

In 6 honeybee colonies, the number of *Varroa jacobsoni* mites leaving adult bees and entering brood cells increased after queen cell construction. The number of mites per cell was greater on comb sides with queen cells than in other parts of the brood nest. Author

236L/79 LANGE, A. B.; NATSKII, K. V.; TATSII, V. M. [Biology of *Varroa*.] *Veterinariya, Moscow, USSR* (1976) No.7, 74-77 [Ru, B]

1299/77 LO KANG-CHEN; CHAO ROU-SU [Preliminary investigations on bee mites in Taiwan.] *Journal of Agricultural Research of China* (1975) **24** (1/2) 50-56 [Ch, en, B] Taiwan Agric. Res. Inst., Taipei, Taiwan.

Neocypholaelaps indica was the most common mite associated with both *Apis cerana* and *A. mellifera*. It is not a parasitic mite but a phoretic form which may utilize honeybees as a means of dispersal. It was also numerous on the flowers of loquat in spring in central Taiwan. A species of macrochelid mite, probably also phoretic, was very rare.

Varroa jacobsoni was the most important parasitic mite on *A. mellifera*. It was seen on bees' bodies between thorax and abdomen on the upper side, and between the first 3 abdominal segments at the side. There were up to 12 female mites on worker pupae (mean 3.56), 14 on drone pupae (mean 5.77). The male was not found. Development of juveniles into adult mites took 8–9 days at 30°C. The morphology of the various stages is described and illustrated. Author

630/81 POLTEV, V. I. [Characteristics of the course of varroa disease of honeybees.] *Sbornik Nauchnykh Trudov, Moskovskaya Veterinarnaya Akademiya* (1978) **99**, 123-124 [Ru, B] Dept. Bee Biology and Pathology, Moscow Veterinary Acad., Moscow Zh-378, USSR.

In the USSR *Varroa* infestations are most severe in southern regions where the winter is short and the mite multiplies almost without interruption. In the north, where the bees produce no brood during the winter, the mite ceases to multiply and most die, but some females survive a winter of 5–8 months. In the central regions *Varroa* begins to multiply as soon as brood appears in the hive, and the population builds up rapidly to a maximum in the autumn. As the quantity of brood in the hive declines, the mites feed more on the haemolymph of adults. During the first and sometimes the second year that *Varroa* exists in an apiary it does comparatively little damage. Mortalities among the bees are not conspicuous, a reasonable honey crop is gained, and the colonies may winter well. In the third and fourth years, when mite populations have built up, losses become serious. Colonies build up poorly in the spring, little honey is produced, and many colonies die in the autumn.
J. P. Harding

3.1 continued

245/85 ROMANIUK, K.; DUK, S. **[Seasonal dynamics of *Varroa jacobsoni* development in untreated honeybee colonies.]** Sezonowa dynamika rozwoju *Varroa jacobsoni* w nie leczonych rodzinach pszczelich. *Medycyna Weterynaryjna* (1983) 39 (12) 725-727 [Pl, en, ru, B] Klinika Chorób Inxazyjnych Wydziału Weterynaryjnego AR-T, 10-710 Olsztyn, Poland.

Observations were carried out in a 60-hive apiary at 1-month intervals from April to September 1982. Live workers and sealed brood were taken for examination from the same 16 colonies. These examinations preceded the analysis of debris from wintering colonies. It was found that the quantity of debris was inversely related to the strength of the wintering colony and directly related to the number of female mites found on the bottom board. Examination of live workers showed that the number of live *V. jacobsoni* females per 100 bees was low in the period from April to July (3.2–7.7); in August this number increased to 15.9, in September to 23. The number of female mites per 100 worker larvae was 7.5 in May, 8.1 in June, 14.9 in July, 29.7 in August and 134.7 in September. The highest number of parasites occurred on drone brood — 7.5 female mites per 100 larvae in May, 104.1 in June, 131 in July and 143 in August

Author.

1272/84 RUIJTER, A. DE; PAPPAS, N. **Karyotype and sex determination of *Varroa jacobsoni* Oud.** In *Varroa jacobsoni Oud. affecting honey bees: present status and needs [edited by Cavalloro, R.]*. Rotterdam, Netherlands; A.A. Balkema for the Commission of the European Communities (1983) 41-44 [En, B] Exp. Bee Farm Ambrosiushoeve, Hilvarenbeek, Netherlands.

Marked worker cells, capped 2–4 h before, were opened with a needle and one old (*A*) or young (*B*) female *Varroa* mite was introduced into each. After 10 days the cells were re-opened and the eggs, larvae, nymphs and adult mites counted. The experiment was repeated using old (*C*) or young (*D*) mites which had been kept on caged honeybees for a week. Cells with *A* contained eggs/larvae and male and female nymphs; with *B*, eggs/larvae and young nymphs (sex not determined); with *C*, eggs/larvae and male and female nymphs, and one cell with one (male) adult; with *D*, eggs/larvae, male nymphs and male adults. It is thus concluded that *V. jacobsoni* is arrhenotokous i.e. unfertilized eggs produce only males. Chromosome studies of eggs stained with aceto-orcein confirmed that *V. jacobsoni* is haplo-diploid; n = 7 in males, 2n = 14 in females.

278/84 STEINER, J.; POMPOLO, S. DAS G.; TAKAHASHI, C. S.; GONÇALVES, L. S. **Cytogenetics of the acarid *Varroa jacobsoni*.** *Revista Brasileira de Genética* (1982) 5 (4) 841-844 [En, B] Dept. Genética, Fac. Medicina, Univ. São Paulo, 14100 Ribeirão Prêto, SP, Brazil.

The chromosome number of *V. jacobsoni* was determined by examining embryos dissected from adult females taken from recently sealed *Apis mellifera* brood cells; only 2 chromosome complements (7 and 14, representing haploid male and diploid female embryos respectively) were found. A figure shows 3 submetacentric and 4 acrocentric chromosomes in metaphase. The sex determination mechanism of *V. jacobsoni* is thus of the haplo-diploid or arrhenotokous type.

P. Walker.

3.2 ANATOMY AND MORPHOLOGY

967L/80 BUZA, L. **[Morphology and biology of *Varroa jacobsoni*.]** Az ázsiai nagy méhatka (*Varroa jacobsoni* Oudemans) morfológiája és biológiája. *Magyar Állatorvosok Lapja* (1979) **34** (6) 363-365 [Hu, en, de, ru, B] ,

582/85 DELFINADO-BAKER, M. **The nymphal stages and male of *Varroa jacobsoni* Oudemans a parasite of honey bees.** *International Journal of Acarology* (1984) **10** (2) 75-80 [En, B] Dept. Entomology, Univ. Maryland, College Park, MD 20705, USA.

The nymphal stages (protonymph and deutonymph) of *Varroa jacobsoni* are described for the first time and the adult male is redescribed. Morphological characters for accurate recognition of these developmental stages are figured and discussed as well as significant features found in the nymphal stages that provide further support for assigning *V. jacobsoni* separate family status.

Author.

1413/81 GROBOV, O. F.; PULENETZ, N. M.; SOFRONOV, G. L. **Geographical variability of the size of the dorsal scutellum in females of *Varroa jacobsoni* Oudemans.** In *Proceedings of the XXVIIth International Congress of Apiculture, Athens, 1979.* Bucharest, Romania; Apimondia Publishing House. (1980) 346-350 [En, B] Vsesoyuznyĭ Inst. Eksperimental'noi veterinariĭ, Moscow ZH-472, USSR.

Results for 1571 females from 17 regions of the USSR showed wide variability; the average length of the dorsal scutellum ranged from 997 to 1147 μm and the average width from 1542 to 1688 μm. The average shape index (SI, which is the ratio of length to width) ranged from 0.54 to 0.68. A statistical analysis of the SI values and results from other countries indicated 4 groupings of mites; mites from places as far apart as Moscow, Japan, Leningrad and the German Federal Republic were all rather round in shape, with an SI of 0.64. Mites from the Amur area have an elongated body (SI 0.68), significantly different from all others.

P. Walker

938L/82 HIRSCHMANN, W. **[First descriptions of the protonymph, deutonymph and males, and redescription of females, of *Varroa jacobsoni*.]** Erstbeschreibung der Protonymphe, Deutonymphe und des Männchens sowie Wiederbeschreibung des Weibchens von *Varroa jacobsoni* Oudemans 1904. *Acarologie* (1980) **27**, 60-66 [De, B] The descriptions are illustrated by drawings and scanning electromicrographs.

233/85 KAAS, J. P. [***Varroa* under the knife: a histological—anatomical investigation of the internal structure of *Varroa jacobsoni*.**] *Varroa* onder het mes: een histologisch—anatomische verkenning van het inwendige van *Varroa jacobsoni* Oudemans 1904. *Doctoraalverslag, Rijksuniversiteit te Leiden, Netherlands.*(1983) 41 pp. [Nl, B] Karel Lotsylaan 25, Amsterdam, Netherlands.

The following are described, with photographs: digestive system, excretory organs, musculature, nerve tissue, glands and genitalia.

P. Walker.

614/83 LIU, T. P. **A scanning electron microscope study on the female mite *Varroa jacobsoni* (Oudemans, 1904).** *American Bee Journal* (1982) 122 (6) 413-415 [En, B] Bee Diseases Res. Lab., Agriculture Canada, Beaverlodge, Alta. T0H 0C0, Canada.

The idiosoma of the female *V. jacobsoni* is highly sclerotized; the body is oval and dorsoventrally flattened. The legs are short and stout, with the pretarsus developed into a strong sucker. Long, stiff setae cover the legs, especially the tarsal segments. The dorsal shield is covered with numerous branched setae, and has a row of thick, short and curved setae at its lateral edges. The significance of these morphological features in relation to the phoretic behaviour of the female mite is discussed.

Author

621/84 OKU, K.; HARA, N.; SANO, H. **[The occurrence of wing abnormalities in honeybees.]** *Honeybee Science* (1983) 4 (3) 109-110 [Ja, en, B] Chubu Livestock Hygiene Serv. Center, 1-2-45 Aoba-cho, Fujieda-shi, Shizuoka-ken, 426 Japan.

In an inspection of 1861 colonies in 81 apiaries in Shizuoka Prefecture, central Japan, workers with distorted wings were found in 80% of apiaries (46% of colonies). Laboratory experiments suggest that such deformation results from infestation with *Varroa jacobsoni*.

Author.

1273/84 RUIJTER, A. DE; KAAS, J. P. **The anatomy of the *Varroa*-mite.** In *Varroa jacobsoni Oud. affecting honey bees: present status and needs [edited by Cavalloro, R.].* Rotterdam, Netherlands; A.A. Balkema for the Commission of the European Communities (1983) 45-47 [En, B] Exp. Bee Farm Ambrosiushoeve, Hilvarenbeek, Netherlands.

Male and female mites were studied by dissection and by examination of Giemsa-stained sections. Details of the internal anatomy and histology are illustrated by means of photographs and drawings. A detailed description of the female reproductive system is given. Some photographs show stages of spermatogenesis in males and maturation of spermatozoa within females.

D.G. Lowe.

3.2 continued

638L/81 SADOV, A. V. [The pretarsus – a vulnerable part of the *Varroa* mite.] *Pchelovodstvo* (1979) No. 11, 18-20 [Ru, B]

637/81 SADOV, A. V.; POLTEV, V. I.; CHUMAKOV, V. P.; GROBOV, O. F. [The pretarsus of the female *Varroa* and mechanism of its action.] *Veterinariya, Moscow, USSR* (1980) No. 2, 36-39 [Ru, B] Moscow Veterinary Academy, Moscow, USSR.

The pretarsus of the 2nd and 4th pairs of legs consists of a complex arrangement of soft connective tissue membranes for over two-thirds of its length. The dorsal side has a weakly chitinized transparent hood. Internally there are muscular fibrillae. Vertically there are 3 small apertures to the exterior and a large funnel-shaped extension. The whole serves as a suction apparatus for attaching to the substratum as an aid to locomotion. The pretarsus is not adapted for movement over a wet or dusty surface, and the mite is unable to move over a horizontal surface if this is covered with particles smaller than the diameter of the funnel-shaped extension of the pretarsus; on a sloping surface the mite falls off.

1337/82 SADOV, A. V. [The respiratory apparatus of the female *Varroa jacobsoni* mite.] *Veterinariya, Moscow, USSR* (1980) No. 11, 43-47 [Ru] Moscow Veterinary Academy, Moscow, USSR.

The newly-hatched larva of *V. jacobsoni* has no tracheae, and respiration is cuticular; the tracheae begin to form after the first moult. In the protonymph of the female, the respiratory system is already formed; a stigma is present, with a relatively short tongue-like peritreme extending from it. In the deutonymph, the peritremal tube lengthens to 280 μm, and in the adult, to 319 μm. The respiratory apparatus is located on the ventral surface of the body; its detailed structure is described and illustrated. The unattached end of the peritreme is able to dilate in response to environmental conditions, and together with its associated structures can govern the admission of air through the respiratory orifice. The capacity of the end of the peritreme of the respiratory apparatus to change its shape is closely associated with the vital activities of the female mite, and the shape is determined by atmospheric composition, temperature, humidity and pressure. The mite is capable of withstanding a wide range of unfavourable environmental conditions, and this must be taken into account when treating hives with a phenothiazine aerosol. The bottom of the hive should be covered with a layer of waxed paper smeared with vaseline, or sprinkled with dry talc powder, to trap mites. In the absence of a trap of this type, 20–50% of mites which drop to the bottom of the hive recover and re-attach themselves to their hosts.

1272/83 SADOV, A. V. **[Morphology of the mouthparts of the adult *Varroa jacobsoni* mite.]** *Sbornik Nauchnykh Trudov Moskovskaya Veterinarnaya Akedemiya* (1980) **116**, 76-84 [Ru, B]

The structure of the oral apparatus, including the claws and setae of the individual segments of the chelicerae and other appendages, are described in great detail. Internal parts, such as the salivary ducts and the sphincter and dilatory muscles of the gullet, are also described. The possible functions of the various structures in the mite's method of feeding are discussed. Attention is also drawn to the possibility that *V. jacobsoni* may act as a vector of bacterial and viral diseases of the honeybee. J. P. Harding

3.3 PHYSIOLOGY, BEHAVIOUR, LIFE CYCLE AND SURVIVAL

981L/80 AVDEEVA, O. I. **[Life cycle of the *Varroa* mite in laboratory conditions.]** *Pchelovodstvo* (1978) No.10, 16-17 [Ru, B]

666/74 CHOI, S. Y.; WOO, K. S. **[Studies on the bionomics of bee mite, *Varroa jacobsoni* Oudemans, and its chemical control (I).]** *Research Reports of the Office of Rural Development, Suwon, Korea* (1973) **15** (Livestock), 35-43 [Ko, en, B] Coll. Agric., Seoul National Univ., Suwon, Korea.

Varroa jacobsoni has been found in honeybee colonies in Korea since 1968. A study of its biology showed that development from egg to adult took 10 days for females and 6 days for males. The adult females entered the honeybee brood cells just before capping and each laid about 5 eggs, which hatched with the young bees; 1-3 mites were found on adult workers and 1-8 on drones. "Hyang-Su", a mixture extracted from several plants (using 2 ml/comb) gave more effective control than Folbex or Neobex. A.S. Attwood

949/84 DE JONG, D.; DE JONG, P. H. **Longevity of Africanized honey bees (Hymenoptera: Apidae) infested by *Varroa jacobsoni* (Parasitiformes: Varroidae).** *Journal of Economic Entomology* (1983) **76** (4) 766-768 [En, B] Dept. Entomology, Cornell Univ., Ithaca, NY 14853, USA.

In Brazil, uninfested Africanized honeybees lived for an average of 27.6 days;bees infested by *V. jacobsoni* during pupal development lived on average for only 13.6 days. Bees infested with 2 or more mites lived for 9 days. The number of mites per bee was negatively correlated with length of life and weight of the bee at emergence. There was no significant correlation between weight at emergence and length of life in either infested or uninfested bees, therefore the shorter lifespan of infested bees was not merely a secondary result of reduced adult weight.

J.M. Gedye.

960/85 GLINSKI, Z.; JAROSZ, J. **Alterations in haemolymph proteins of drone honey bee larvae parasitized by *Varroa jacobsoni*.** *Apidologie* (1984) **15** (3) 329-337 [En, de, fr, B] Bee Diseases Lab., Inst. Infectious and Invasive Diseases, Agric. Univ., Lublin, Poland.

Protein fractions in healthy drone brood and in drone brood parasitized by *V.jacobsoni* were compared by electrophoresis. In parasitized brood the total protein content was lower and was related to the numbers of *Varroa*. Electrophoretic patterns and densities of proteins were also altered, especially those of the low mol wt cathodal fractions. It is suggested that the changes could be due to protein depletion in the host larvae, but that they may be the result of biochemical changes following the release of toxic substances by the mite into the host's blood.

P. Walker.

277/84 GROMYKO, G. I. **[Survival of *Varroa* mites outside the hive.]** *Pchelovodstvo* (1982) No. 5, 16-17 [Ru, B] Nauchno-Issledovatel'skii Institut Veterinarnoi Sanitarii, Moscow, USSR.

Live *Varroa jacobsoni* may be removed from the hive in debris, or they may fall from foraging bees onto flowers. An investigation showed that mites can survive on flowers of white clover (*Trifolium repens*) and dandelion (*Taraxacum officinale*) for up to 5 days at 20–28°C and RH 70–75%. The female mite can survive for 5–6 days without food. D. Galton.

972/85 IFANTIDIS, M. D. **Parameters of the population dynamics of the *Varroa* mite on honeybees.** *Journal of Apicultural Research* (1984) **23** (4) 227-233 [En, B] Lab. Sericulture and Apiculture, School Agric., Aristotle Univ., Thessaloniki, Greece.

The population dynamics of the mite *V.jacobsoni* were studied in summer 1981 and 1983 in colonies of *Apis mellifera cecropia* in the region of Thessaloniki, Greece. The reproductive rate of the mite was estimated by examining the progeny of 364 females in worker cells and 131 in drone cells containing pupae with dark eyes and light brown thorax (i.e. 9 days after the worker cells and 10 days after the drone cells were sealed). The proportions of non-egg-laying mites on worker and drone brood were about 19% and 4% respectively. The reproductive rate was 2.92 for mites in worker cells (total progeny 1066) and 3.66 for mites in drone cells (total progeny 480). The rate for female progeny reaching adulthood from each original female mite, for a single passage through the brood cells, was 0.71 for mites in worker cells and 1.70 for mites in drone cells.

243/85 MORITZ, R. F. A.; HÄNEL, H. **Restricted development of the parasitic mite *Varroa jacobsoni* Oud. in the Cape honeybee *Apis mellifera capensis* Esch.** *Zeitschrift für Angewandte Entomologie* (1984) **97** (1) 91-95 [En, de, B] Inst. Bienenkunde, J.W. Goethe-Univ., 6000 Frankfurt am Main, German Federal Republic.

Laying queens of *A.m.carnica* and *A.m.capensis* were kept in small nuclei in a flight room. The brood combs were examined every 6 h and the sealed cells marked on a transparent foil; after *c.* 100 cells had been marked the comb was kept in an incubator at 35°C. When the bees emerged each cell was marked again on the foil and the length of the post-capping stage determined. In a second experiment, a *V.jacobsoni* female was added to each of 25 cells through an opening in the capping, which was then re-closed. The mean length of the post-capping stage was 9.6 days in *A.m.capensis*, 12.0 days in *A.m.carnica*. The introduction of mites into the cells did not affect the duration of the post-capping stage. When the bees emerged none of the 25 *A.m.capensis* cells with an adult mite contained offspring capable of parasitizing a bee, whereas 7 of the 25 mite-containing *A.m.carnica* cells did so.

1271/83 MURAVSKAYA, A. I. **[The effect of lowered temperature on the mite *Varroa jacobsoni*.]** *Sbornik Nauchnykh Trudov Moskovskaya Veterinarnaya Akedemiya* (1980) **116**, 87-90 [Ru, B]

The optimal temperature for the development of *V. jacobsoni* is 34°C. Lowering the temperature to 30° for the first few days after placing nymphs in a controlled environment at an RH of 70-80% prevented further development, and the nymphs died. J. P. Harding

3.3 continued

28/83 NEPOMNYASHCHIKH, V. A. **[Behaviour of *Varroa jacobsoni* under stress.]** *Zhurnal Obshchei Biologii* (1980) **41** (6) 873-878 [Ru, en, B] Kafedra Entomologii, Moskovskiĭ Gosudarstvennyĭ Univ., Moscow, USSR.

A laboratory study of female *Varroa jacobsoni* isolated from their honeybee hosts and exposed to temperatures higher or lower than under natural conditions revealed conflicting behaviour patterns which were intensified under abnormal temperatures and during oviposition. As a result, new stereotyped behaviour patterns were formed. Author

1274/83 NEPOMNYASHCHIKH, V. A. **[The interaction of motivation and rhythms in the temporal regulation of behaviour patterns in *Varroa jacobsoni*.]** *Doklady Akademii Nauk SSR* (1981) **258** (6) 1508-1510 [Ru, B] Kafedra Entomologii, Moskovskiĭ Gosudarstvennyĭ Univ., Moscow, USSR.

Honeybee pupae with *V. jacobsoni* attached to them were removed from combs and a total of 34 mites were studied continuously under a microscope for periods of 3–8 h. The rhythms studied were two phases of the mite's feeding behaviour, a searching phase when the mite makes repeated attempts to penetrate the host cuticle with its chelicerae, and a feeding phase recognizable by the movements of the intestine visible through the mite's integument. Feeding lasted from 0.1 to 15 min and the intervals between successive attempts to feed varied from 4 min to 3 h in the same mite. It is suggested that there is an underlying 'oscillator' with a regular rhythm of feeding behaviour, but that there is a threshold for the appearance of the searching phase. A rise in the level of feeding motivation leads to a fall in the threshold, but when the searching phase culminates in feeding the threshold rises temporarily and several rhythmic periods of the 'oscillator' are missed. J. P. Harding

950/84 PETROVA, A. D.; BYZOVA, YU. B.; TATSII, V. M.; EMEL'YANOVA, O. YU. **Metabolic expenditures of *Varroa jacobsoni* Oudemans, 1904 (Mesostigmata, Varroidae) — an ectoparasite of the honeybee.** *Doklady Biological Sciences* (1982) **262** (1-6) 115-118 [En, B] A.N. Severtsov Inst. Evolutionary Morphology and Animal Ecology, Acad. Sci. USSR, Moscow, USSR.

V. jacobsoni adults and nymphs were removed from honeybee brood or adult bees and their oxygen uptake was measured by open manometry. The effects of temperature, seasonal changes, and food deprivation, were determined. The total metabolic expenditure of *V. jacobsoni* during its development into an adult was estimated to be 57.6 mm^3 oxygen, or 0.28 cal. On average, the daily oxygen consumption by an adult female mite at 33°C was 18.6 mm^3; at 22° and 4° it was 5.1 and 2.5 mm^3, respectively. If the lifespan of a wintering female is taken to be 150 days (at 4–22°), then total winter oxygen consumption will be 811 mm^3, or 3.9 cal. The energy value of 1 μl of blood from a wintering bee is 0.7 cal, therefore each mite needs to ingest 5.5 μl of honeybee blood during this period. [Original paper published in Russian, in *Doklady Akademii Nauk SSR* (1982) 262(2) : 499-502.]

D.G. Lowe.

966L/85 ROBAUX, P. **[Biology and behaviour of *Varroa jacobsoni*.]** Biologie et comportement de *Varroa jacobsoni*. *Bulletin Technique Apicole* (1984) **11** (2) 101-115 [Fr, B]

961/85 RUTTNER, F.; MARX, H.; MARX, G. **[Observations on a possible adaptation of *Varroa jacobsoni* to *Apis mellifera* in Uruguay.]** Beobachtungen über eine mögliche Anpassung von *Varroa jacobsoni* an *Apis mellifera* L. in Uruguay. *Apidologie* (1984) **15** (1) 43-62 [De, en, fr, B] Inst. Bienenkunde, Univ. Frankfurt, Im Rothkopf 5, 6370 Oberursel/Ts., German Federal Republic.

Nine honeybee colonies at an experimental station in Uruguay were monitored for 2 years. The initial *Varroa* infestation is described as 'moderate to heavy'; mites were present in 2–34% of capped brood cells (mean 18.4%). The colonies were not treated, but after 2 years the mean infestation level had decreased to 5.5% (ranging from 0 to 13%). This result is explained by the low reproductive rate of female mites in worker cells; 60–90% of these females did not produce offspring. This is in marked contrast to the figure of 20% found in studies in Europe. *Varroa* reproduction in drone cells in colonies in Uruguay was similar to that in colonies in Europe. In Uruguay generally, *Varroa*-infested colonies are not treated by beekeepers and they do not seem to be greatly weakened by the presence of the mites.

P. Walker.

1299/78 SADOV, A. V. **[A study of the female *Varroa* mite.]** *Pchelovodstvo* (1976) No.8, 15-16 [Ru, B] Inst. Exp. Veterinary Sci., Moscow, USSR.

With Yu. Ya. Mikhailov, the author showed (by feeding ^{90}Sr in food given to bees) that female *Varroa* mites feed exclusively on bee haemolymph, particularly from the intersegmental regions of the abdomen. They can survive 2–3 days away from the host. Haemolymph represented 50.7% of the *Varroa* body weight in autumn, 43.7% in summer and 44.6% in spring. The body weight of parasitized larvae is reduced, and the proportion that is protein is reduced by 15–20%. The life span of parasitized bees is reduced by up to 50%. D. Galton

1412/81 SADOV, A. V. **[Survival ability of *Varroa* under various conditions.]** *Pchelovodstvo* (1980) No. 1, 17-18 [Ru, B] Moscow Veterinary Acad., Moscow, USSR.

A study of the effect of various external factors on the female *Varroa* mite showed that the respiratory system was vulnerable to various factors. The survival of the mite in various liquids was studied, and the effect of exposure of mites to temperatures of 22, 34 or 40°C is reported. At 40°C all mites were killed in less than 1 day. D. Galton

3.3 continued

1015/81 SAKAI, T.; TAKEUCHI, K.; HARA, A. **[Studies on the life history of a honeybee mite, *Varroa jacobsoni* Oudemans, in laboratory rearing.]** *Bulletin of the Faculty of Agriculture, Tamagawa University* (1979) No. 19, 95-103 [Ja, en, B] Lab. Entomology, Fac. Agric., Tamagawa Univ., Machida-shi, Tokyo 194, Japan.

To obtain the maximum number of eggs for laboratory rearing, female mites were collected from honeybee larvae after cocoon spinning, and reared on pre-cocoon larvae at 35°C and RH 85%. Oviposition occurred once daily. In the laboratory, the development proceeded as follows: egg 1–2 days, protonymph 2–3 days, deutonymph 2 days, deutochrysalis 2 days. The protochrysalis stage could not be determined; the total period was 8–11 days. The egg was found to contain a larva with 3 pairs of legs suggesting that the mite enters the larval stage within the egg shell, and that the protonymph hatches directly from the egg. Author

977L/80 SMIRNOV, V. M. **[The length of life of winter generations of the *Varroa* mite.]** *Pchelovodstvo* (1978) No. 12, 14-15 [Ru, B]

1049/82 ZOTOV, V. A.; NEPOMNYASHCHIKH, V. A. **[Disturbances in biological rhythms as a result of conflict between incompatible motivations.]** *Zhurnal Obshcheĭ Biologii* (1981) 42 (4) 622-627 [Ru, en, B] Kafedra Entomologii, Moskovskii Gosudarstvennyi Univ., Moscow, USSR.

It has been assumed that an organism possesses various mechanisms each controlling different movements or other aspects of behaviour. If stimuli are received which cause separate acts of behaviour with different rhythms, this can result in conflict and a disturbance of total activity. For example, the rhythm of cleaning the forelegs in female *Varroa jacobsoni* is affected under conditions of stress so that the rhythm of alternate cleaning of left and right legs is disturbed.

P. Walker

3.4 FEEDING, NUTRITION AND DIGESTION

979L/80 AVDEEVA, O. I. [**The biology of nutrition of the *Varroa* mite under laboratory conditions.**] *Pchelovodstvo* (1979) No. 8, 18-19 [Ru, B] Female mites must feed on the haemolymph of worker or drone brood in open cells before they are able to lay eggs.

244/85 BARABANOVA, V. V. [**Digestive enzymes of *Varroa jacobsoni*.**] *Vestnik Zoologii* (1983) No. 3, 81-83 [Ru, B] Inst. Zoologii I.I. Shmal'gauzena, Kiev, Ukrainian SSR, USSR.

Adult *V. jacobsoni* were collected from worker honeybees in February and September and also from the final (bee) brood and were analysed for 9 enzyme activities. The invertase activity was 2.5-fold as great as the amylase activity in February and September specimens but was similar to the amylase activity in mites taken from brood. The amylase activity was moderately high in all mites. Protease activity was highest in the mites from bee brood and lowest in the winter mites. Cellulase and especially exoglucanase activities were observed. Chitinase activity was higher in the winter than in the autumn mites. Lipase and alkaline and acid phosphatase activities were also detected; the acid phosphatase activity was 4 times as high in autumn as in winter mites. The differences in enzyme activities may be related to seasonal and developmental differences in the protein and carbohydrate composition of bee blood. [*Chem. Abstr.* 99: 155715e (1983).]

F.B. Wells.

BARABANOVA, V.V. [Proteolytic activity in the intestines of female mites, Varroa jacobsoni.] Vestnik Zoologii (1984) (1) 69-72 [Ru, B]

628/81 SADOV, A. V.; GORBATOV, V. A.; GROBOV, O. F. [**Auto-radiography as a means of determining the amount of honeybee haemolymph in the diet of female *Varroa* mites.**] *Byulleten' Vsesoyuznogo Instituta Eksperimental'noi Veterinarii* (1979) No. 34, 56-59 [Ru, B]

Bees were fed a 0.001% solution of ^{3}H-timidin in syrup (timidin is a complex with 4 nucleosides, a precursor of DNA). Each bee carried 1-3 *Varroa jacobsoni*. Autoradiographs were made of the haemolymph and other tissues of both bees and mites, using smears and sections made 24, 48, 72 and 96 h after feeding. Radioactivity was detected in the midgut, Malpighian tubules and muscles of the *Varroa* after 24 h, and in the cuticle of the mite after 48 h. After 96 h the marker was accumulating in the tissues of the mite, especially in the cuticle and fatty tissues.

J. P. Harding

3.4 continued

973/83 TEWARSON, N. C.; ENGELS, W. **Undigested uptake of non-host proteins by *Varroa jacobsoni*.** *Journal of Apicultural Research* (1982) **21** (4) 222-225 [En, B] Univ. Tübingen, Auf der Morgenstelle 28, 74 Tübingen 1, German Federal Republic.

The nutrition of *V. jacobsoni* involves the macromolecular resorption of proteins [Tewarson, N.C., 1981]. Immuno-techniques confirmed the presence of undegraded *Apis mellifera* proteins in the blood of adult female *V. jacobsoni* and protonymphs taken from infested laboratory colonies of *A. m. carnica*. Undegraded proteins were also present in newly laid eggs. Bovine serum albumin injected into adult worker honeybees was also subsequently detected in the haemocoel of female mites which had fed on the injected bees for 12—48 h. It is suggested that the *V. jacobsoni* digestive tract lacks the proteolytic enzymes necessary for breakdown of ingested proteins.

D. G. Lowe

1280/83 TEWARSON, N. C.; JANY, K.-D. **Determination of proteolytic activity in *Varroa jacobsoni*, an ectoparasitic hemophagous mite of honey bees (*Apis* sp.).** *Apidologie* (1982) **13** (4) 383-389 [En, de, fr, B] Inst. Biologie III, Univ. Tübingen, Auf der Morgenstelle 28, 7400 Tübingen, German Federal Republic.

In previous studies [Tewarson, 1981] it was shown by immunotechniques that female *Varroa jacobsoni* feeding on honeybees resorb the honeybee's blood proteins without digesting them. The same proteins can also be detected in the mite's eggs. In order to check this undegraded resorption of host proteins, a study of proteolytic activity in *V. jacobsoni* was carried out using homogenates of whole female mites in Tris-HCl buffer (pH 8.2). Low proteolytic activity could be detected only by means of very sensitive methods using synthetic substrates, and there were also indications that *Apis* blood contains a protease inhibitory factor. The possible significance of macromolecular resorption of proteins in the life cycle of *V. jacobsoni* is discussed.

D. G. Lowe

627/84 TEWARSON, N. C. **Nutrition and reproduction in the ectoparasitic honey bee (*Apis* sp.) mite, *Varroa jacobsoni*.** *Dissertation zur Erlangung des Grades eines Doktors der Naturwissenschaften, Eberhard-Karls-Universität Tübingen, German Federal Republic* (1983) ix + 71 pp. + lxvi [En, B] Fak. Biologie, Eberhard-Karls-Univ. Tübingen, Tübingen, German Federal Republic.

The volume of larval *Apis mellifera* blood ingested by young mites varied from 0.86 µl in 1.5 h to 1.50 µl in 48 h, but an increase in feeding time was not significantly correlated with an increased meal volume. Using immunological and electrophoretic methods, it was shown that honeybee blood proteins passed into the mite's blood as whole macromolecular proteins, without any significant digestive degradation. These proteins were later detected in oocytes developing in mites, and in freshly laid eggs. In the latter, 7 proteins from honeybee blood, and one other protein, were identified as vitellogenins. Enzyme assays of the *Varroa* midgut revealed only a very weak proteolytic activity; the only enzyme identified was exocarboxypeptidase-A. Experimentally offered vertebrate protein (bovine serum albumin) was also found intact in the mite's blood. The results indicate that this particular host—parasite relationship is highly specialized.

D.G. Lowe.

3.5 REPRODUCTION

1281/84 GROBOV, O. F.; MIKITYUK, V. V. **[Effects of some chemosterilants on female *Varroa* mites and on honeybees.]** *Byulleten' Vsesoyuznogo Instituta Eksperimental'noi Veterinarii* (1981) **41**, 62-65 [Ru, B] Vsesoyuznyi Inst. Eksperimental'noi Veterinarii, Moscow, USSR.

In laboratory experiments various chemosterilants (alkylryls, homologues of alkyl compounds, and cytotoxic antibiotics) were effective in sterilizing *Varroa* females. However, they were also toxic to honeybees. Thus, hexamethyltriphosphamide (HMPA) topically applied to the integuments of both mites and bees had a high sterilizing and somatic activity. Doses of 0.1×10^{-3} mg HMPA decreased egg laying by *Varroa* by 55%, doses of 2×10^{-3} mg and 100×10^{-3} mg per mite decreased lifespan by 36.8% and 86%, respectively. A residual effect of HMPA was also observed. A high efficacy of thiophosphamide-triethylene and of PA18 and PA25 was also observed, but all these preparations were toxic to bees.

F.B. Wells.

944/84 HÄNEL, H. **Effect of JH_{III} on the reproduction of *Varroa jacobsoni*.** *Apidologie* (1983) **14** (2) 137-142 [En, de, fr, B] Inst. Bienenkunde, Univ. Frankfurt, Karl-von-Frisch-Weg 2, 6370 Oberursel, German Federal Republic.

JH_{III} was tested on mites in sealed cells containing honeybee larvae and pupae; when sealed fifth instar larvae were treated topically with the hormone there was a significant increase in the number of *Varroa* offspring compared with controls. In a further test, JH_{III} was applied to sealed cells into which a *Varroa* mite was then introduced; these mites produced significantly more offspring than untreated controls. Toxicity of JH_{III} to honeybees was tested by spraying solutions of it onto groups of caged workers; mortality in these groups was not significantly different from that of groups sprayed with water or solvent.

P. Walker.

614/84 IFANTIDIS, M. D. **Ontogenesis of the mite *Varroa jacobsoni* in worker and drone honeybee brood cells.** *Journal of Apicultural Research.* (1983) **22** (3) 200-206 [En, B] Lab. Apiculture, Fac. Agric., Univ. Thessaloniki, Thessaloniki, Greece.

Ontogenesis of the mite *Varroa jacobsoni* was observed at 4-h intervals in brood cells of the honeybee *Apis mellifera cecropia*. Between July and November 1981, in the region of Thessaloniki, 241 worker and 107 drone cells infested with fertile mites were examined in the post-capping period. A macroscopic distinction between the sexes was recorded photographically as early as the first mobile phase of mite ontogenesis. In cells containing either worker or drone brood, egg-laying by the mite began about 60 h after the cell was capped and one egg was laid every 30 min. Normally the offspring included only one male, which developed from an egg laid about 96 h after capping. Ontogenesis lasted 7.5 days in the female *Varroa* and 5.5 days in the male. The mite can lay at most 7 eggs in a drone cell and 6 in a worker cell.

Author.

986L/80 MIKITYUK, V. V. [Reproductive capacity of female *Varroa* mites.] *Pchelovodstvo* (1979) No. 9, 21 [Ru, B]

238/83 MURAVSKAYA, A. I. [Assessment of the reproductive capacity of female *Varroa jacobsoni*.] *Veterinariya, Moscow, USSR* (1982) No. 2, 49-54 [Ru, B] Nauchno-issledovatel'skii, Inst. Pchelovodstva, Rybnoe, Ryazan, USSR.

Large numbers of cells of drone and worker brood of known age were examined at daily intervals. *Varroa* mites entered cells containing larvae and remained passive until the cells were sealed. The mites then began to move and to suck blood of the larvae. The first eggs were laid on about the 12th day on worker brood and on about the 14th day on drone brood. Each mite laid an egg each day for 5 days on worker brood, and for 6 days on drone brood. On bee brood 18 days old, the first mite eggs to be laid had developed into males and females of the next generation. J. P. Harding

572/85 RITTER, W.; DE JONG, D. Reproduction of *Varroa jacobsoni* O. in Europe, the Middle East and tropical South America. *Zeitschrift für Angewandte Entomologie* (1984) 98 (1) 55-57 [En, de, B] Tierhygienisches Inst., 7800 Freiburg, German Federal Republic.

In an examination of brood from a comparatively small number of infested colonies over a period of 4 years infestation by *V. jacobsoni* was higher in drone cells than in worker cells. In colonies in the German Federal Republic and in Turkey about a quarter of the infested worker cells contained no reproductive mites; in Brazil (Africanized bees) the figure was 57%. A similar result was found in one colony of *A.m.ligustica* in Brazil.

P. Walker.

SCHULZ, A.E. Reproduktion und Populationsentwicklung der parasitischen Milbe Varroa jacobsoni Oud. in Abhängigkeit vom Brutzyklus ihres Wirtes Apis mellifera L. (1. Teil). Apidologie (1984) 15 (4) 401-420 [De, en, fr, B]

1013/81 SHANIDZE, M. G. [Egg laying of the female *Varroa* mite.] *Pchelovodstvo* (1979) No.11, 20-21 [Ru, B] Beekeeping Res. Stn., Okrokana, Tbilisi, Georgian SSR, USSR.

Four types of egg were identified; the type which predominated from February to May was oval, white, 0.47 × 0.58 μm, with a larva forming within the membrane. From June to October the main type was yellowish-white, round, soft, 0.41 × 0.48 μm, with a yellow mass inside. Fewer eggs were laid in spring (2–5 eggs, sometimes 9/cell). D. Galton

TEWARSON, N.C. Fortpflanzungsphysiologische Untersuchungen an Varroa jacobsoni: Eiablage und Schlüpfen der Erstlarve. Allgemeine Deutsche Imkerzeitung (1983) 17 (9) 277-280 [De, B]

3.6 TAXONOMY

228/75 DELFINADO, M. D.; BAKER, E. W. **Varroidae, a new family of mites** on honey bees (Mesostigmata: Acarina). *Journal of the Washington Academy of Sciences* (1974) 64 (1) 4-10 [En, B] New York State Museum and Science Serv., Albany, NY 12224, USA.

An examination of the mite *Varroa jacobsoni* Oudemans (type-species of *Varroa*), infesting honeybees in SE Asia, showed that it possessed characteristics which did not fit the family Laelapidae to which it had been assigned. *Varroa jacobsoni* is redescribed with diagrams; *Euvarroa sinhai*, a new species from India and parasitic on honeybees, is also described. It is proposed that these mites should be placed in a separate family, Varroidae. J. M. Gedye

260L/77 SAMŠIŇÁK, K.; HARAGSIM, O. **The taxonomic placement of the genus *Varroa* Oudemans, 1904 (Acari, Dermanyssidae).** *Folia Parasitologica* (1975) 22, 189-191 [En, ru, B] A subfamily Varroinae has been erected within the family Dermanyssidae.

4. HONEYBEES INFESTED WITH VARROA

4.1 DIAGNOSIS

578L/85 ABEILLE DE FRANCE ET L'APICULTEUR [Diagnostic tests for varroa disease in Alsace.] Essai de depistage de la varroase en alsace. *Abeille de France et l'Apiculteur* (1983) No. 672, 225-226 [Fr, B]

953/85 BARBATTINI, R.; MARCHETTI, S.; D'AGARO, M. **[Comparative results of various methods for diagnosing varroa disease.]** Risultati comparativi di diverse metodiche diagnostiche della varroasi. In *Apicoltura sana — agricoltura produttiva. Atti del Convegno Internazionale dell'Apicoltura, Lazise, 29 settembre – 2 ottobre, 1983.* Milan, Italy; Studio Edizioni (1984) 68-77 [It, en, B] Istituto di Difesa delle piante, Univ. Udine, Udine, Italy.

The following methods for diagnosing *Varroa* infestations were compared using 25 healthy colonies and 15 infested ones: analysis of hive residues after winter, treatment with Folbex-VA [isopropyl dibromobenzilate], inspection of adult bees and drone brood. With heavy infestations all 4 methods gave good results, but inspecting hive residues was the cheapest. With a low level of infestation the most efficient method was to use Folbex-VA.

1008/81 BREM, S. **[Diagnosis of varroa disease.]** Beitrag zur Varroatosediagnostik. *Berliner und Münchener Tierärztliche Wochenschrift* (1980) **93** (6) 114-116 [De, en, B] Veterinärstr. 2, 8042 Oberschleissheim, German Federal Republic.

The biology of *Varroa jacobsoni* is described briefly. Early diagnosis by the inspection of hive debris is useful; a 2.8-mm wire mesh is inserted between the winter cluster and the hive floor. Some (10–20 g) of the small debris which is collected is then examined. Separation of mites can be achieved by flotation of the debris in ethanol – wax, pollen, propolis particles, etc. sink, while mites and chitin particles float. P. Walker

258L/80 CHERNEVSKII, P. **[A portable box for diagnosing varroa disease.]** *Pchelarstvo* (1978) 76 (9) 26-27 [Bg, B]

1279/83 DE JONG, D.; ROMA, D. DE A.; GONÇALVES, L. S. A comparative analysis of shaking solutions for the detection of *Varroa jacobsoni* on adult honeybees. *Apidologie* (1982) 13 (3) 297-303 [En, de, fr, B] Dept. Entomology, Cornell Univ., Ithaca, NY 14853, USA.

A plastic bottle with a constriction in the middle acts as a shaking container [*AA* 245L/82]; it contains a wire screen with holes 3 mm square. On shaking infested bees in a liquid in the container, the mites become detached and pass through the screen into the neck of the inverted bottle. Of the 7 liquids tested at various concentrations, the most effective, convenient and economic was a 25% aqueous solution of ethanol or of isopropyl alcohol. Hand shaking of infested bees in one of these solutions for 1 min removed on average 92% of the mites; mechanical shaking in a rotary shaker for 30 min was 100% effective. P. Walker

1290/83 HARTMANN, S. **[Results of the examination of winter [hive] debris for *Varroa jacobsoni* in the Stuttgart district.]** Ergebnisse der Wintergemüll-Untersuchung auf *Varroa jacobsoni* im Regierungsbezirk Stuttgart. *Bienenpflege* (1982) No. 11, 222-224 [De, B] Staatliches Tierärztliches Untersuchungsamt, Stuttgart, German Federal Republic.

In an examination of debris from 45 203 colonies, *Varroa* mites were found in samples from 921 colonies. The results were analysed by district (*Kreis*) though rather few samples were submitted from some. The percentage of infested colonies varied among the 12 districts; in central and eastern ones (where there is little migratory beekeeping) there was a very low infestation or none at all, but in parts of the north and west up to 8% of colonies examined were infested. However, the number of mites per sample was usually low, suggesting that most of the colonies were newly infested. P. Walker

1331/82 POLTEV, V. I.; SADOV, A. V.; MEL'NIK, V. N. **[Examination of honeybees for *Varroa*.]** *Veterinariya, Moscow, USSR* (1981) No. 2, 51-54 [Ru, B] Veterinary Academy, Moscow, USSR.

It is recommended that 50–100 bees per hive should be examined for the mites in the summer. The bees are transferred to a wire cage which is shaken in a vessel containing a 1% solution of soda, lye or washing powder at 60 C. The mites are dislodged and after straining through muslin may be counted. This is a more reliable method than searching the hive floor. It is claimed that if 20 mites are found on 100 bees, it means that the colony will decline, and 50 mites per 100 bees means that the colony will probably be killed. J. P. Harding

1028/81 RITTER, W.; RUTTNER, F. **[Methods of diagnosis [of *Varroa jacobsoni* infestations].]** Diagnoseverfahren. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 134-138 [De, B] Inst. Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

In winter, mites were found by immersing dried hive debris in alcohol; the mites and pieces of chitin floated, whilst wax and other detritus sank. Most mites fell to the hive floor in February and March. Mite mortality was significantly higher from the end of July to mid-September than in other summer months. In summer, diagnosis in moderately and strongly infested colonies was made by examination of drone brood cells at the edge of the frame.

For definite diagnosis in weakly infested colonies it is suggested that the mites be killed with a suitable acaricide (but preferably only in spring and autumn); samples of bees should be taken only from open brood comb. P. Walker

4.2 BIOLOGY

1285/84 BAARS, A. J.; DRIESSEN, O. M. J. **Aryl hydrocarbon hydroxylase and glutathione S-transferase activity in the *Varroa* mite and the honeybee.** *Journal of Apicultural Research* (1984) **23** (1) 37-39 [En, B] Sylvius Lab., Dept. Pharmacology, Univ. Leiden, 2300 RA Leiden, Netherlands.

Aryl hydrocarbon hydroxylase and glutathione S-transferase activity was determined in post-mitochondrial fractions of homogenates of the mite *Varroa jacobsoni* and the honeybee (*Apis mellifera*). Aryl hydrocarbon hydroxylase activity in the mite was about a third of that found in the honeybee, whereas the glutathione S-transferase activity was similar in the two. The results obtained may be relevant to the screening of acaricides to control the mite.

Author.

1286/84 BYZOVA, YU. B.; PETROVA, A. D.; TATSII, V. M.; EMEL'YANOVA, O. YU. **Respiration of honey bees (*Apis mellifera* L.) under the influence of varroatosis.** *Doklady Biological Sciences* (1982) **263** (1-6) 229-231 [En, B] A.N. Severtsov Inst. Animal Ecology and Evolutionary Morphology, Acad. Sci. USSR, Moscow, USSR.

Weight loss during honeybee metamorphosis was 19% of total weight in healthy bees, and 25% in bees parasitized by *Varroa*. During the second half of pupal development oxygen uptake increased considerably in parasitized bees (146.4 ml/g body weight, compared with 128.8 ml/g in controls). This is probably because of restlessness of the pupae, resulting also in damage to the integument. Infestation of wintering colonies produced a lowered (by c.25%) respiration rate and disrupted thermoregulation in the cluster. It is postulated that these affects accumulate from generation to generation, causing progressive deterioration of the colony. [Originally published in Russian in *Doklady Akademii Nauk SSR* (1982) 263 (1): 235-238.]

P. Walker.

839/76 CHOI, S. Y.; WOO, K. S. **[Studies on the bionomics of bee mite *Varroa jacobsoni* Oudemans and its chemical control. II.]** *Research Reports of the Office of Rural Development, Suwon, Korea (Livestock)* (1974) **16**, 69-76 [Ko, en, B] Coll. Agric., Seoul Natn. Univ., Suwon, Korea.

This paper continues work reported in *AA* 666/74. Infestation of honeybees by *V. jacobsoni* was greater in sealed brood than adult bees during the brood-rearing season, but infestation of adults increased thereafter. Pupal weight was greatly reduced by infestation; the presence of 6 mites on a pupa caused a 10% reduction.

Hyang-Su No.1, a mixture of plant origin for controlling mites on bees, applied at 2–3 ml per comb just before cells were sealed reduced pupal body weight by 5%. It is therefore not recommended for use during the main brood-rearing season.

J.M. Gedye

971/83 DE JONG, D.; DE JONG, P. H.; GONÇALVES, L. S. **Weight loss and other damage to developing worker honeybees from infestation with *Varroa jacobsoni*.** *Journal of Apicultural Research* (1982) **21** (3) 165-167 [En, B] Dept. Entomology, Cornell Univ., Ithaca, NY 14853, USA.

The type and degree of damage to adult workers of *Apis mellifera* from infestation with the parasitic mite *Varroa jacobsoni* during development was investigated. Mean weights of infested bees upon emergence as adults were from 6.3% to 25% less than for healthy bees. Mean % weight loss was correlated at a high level of significance with the number of mites in the cell. Only 6% of infested bees showed obvious physical deformation in the form of wing damage. Author

958L/85 DE JONG, D.; GONÇALVES, L. S.; MORSE, R. A. **Dependence on climate of the virulence of *Varroa jacobsoni*.** *Bee World* (1984) 65 (3) 117-121 [En, B] The effects of *V.jacobsoni* infestations have not been so severe in tropical climates as in temperate ones.

1415/81 DOLEJSKY, W.; SCHLEY, P. **[A mathematical simulation model to estimate population development in a honeybee colony after infestation with the mite *Varroa jacobsoni*.]** Ein mathematisches Simulationsmodell zur Abschätzung der Population-sentwicklung im Bienenvolk (*Apis mellifera* L.) nach Befall mit der Milbe *Varroa jacobsoni* Oud. *Zentralblatt für Veterinärmedizin, B* (1980) 27 (9-10) 798-805 [De, en, es, fr, B] Justus-Liebig-Univ. Giessen, Heinrich-Buff-Ring 44, Giessen, German Federal Republic.

The populations of bees and of *Varroa* mites were studied using a simulation model with time-dependent parameters. A Fortran program was used to obtain numerical solutions to two differential equations and one integro-differential equation describing the numbers of bees and of mites. Actual data fitted the model well, and results are presented graphically. Author

943/82 DOMATSKAYA, T. F. **[Protein and nitrogen contents of the blood of honeybees infested with *Varroa jacobsoni*.]** *Veterinariya, Moscow, USSR* (1980) No. 11, 47 [Ru]

The amounts of protein and residual nitrogen in the blood of healthy honeybees and of bees infested with *Varroa jacobsoni* were determined in each month between May and September. It is concluded that infestation by these mites impedes protein metabolism and leads to an increase in the level of non-protein nitrogen. Feeding infested colonies with a protein supplement is recommended.

620/83 GONÇALVES, L. S.; DE JONG, D.; NOGUEIRA, R. H. **Infestation of feral honey bee colonies in Brazil by *Varroa jacobsoni*.** *American Bee Journal* (1982) 122 (4) 249-251 [En, B] Dept. Biologia, Inst. Biociências, UNESP, 13.500 Rio Claro, SP, Brazil.

In an examination of 32 feral colonies in the state of São Paulo, 29 contained *V. jacobsoni*. Infestation levels of adult bees and of worker brood and drone brood are reported. In one area, the level of infestation was significantly lower than that of managed colonies.

In a congested group of feral colonies, the level of infestation was higher than in colonies which were further apart. P. Walker

965/85 PETROV, S. G.; KHAZBIEVICH, L. M. **[A biological trap as a method for controlling *Varroa* infestations of honeybees.]** *Doklady TSKhA* (1980) No. 266, 139-141 [Ru, B]

In a colony, after earlier replacement of the queen, the first comb of sealed brood appeared in July. Of 148 cells examined, 46% contained mites, whereas on neighbouring combs only 4% of cells contained mites. The first comb was removed to an incubator and 74% of the bees which emerged bore mites. The colony from which the comb had been removed subsequently developed well, and overwintered satisfactorily. J.P. Harding.

4.2 continued

574/82 NIKOL'SKII, O. R.; PRISMOTROVA, N. N.; KUZINA, N. I. [**Prognosis of the epizootological condition of honeybees affected by varroa disease.**] In *Bor'ba s boleznyami pchel na dal'nem vostoke.* Blagoveshchensk, USSR; Khabarovskoe Knizhnoe Izdatel'stvo. (1980) 13-17 [Ru, B] Primor'e Veterinary Res. Stn., USSR.

The number of *Varroa jacobsoni* mites in honeybee colonies was estimated by counting the number on 100 bees. Three categories of infestation were recognized: weakly infested, 1–10 mites; moderately infested, 11–20 mites; strongly infested, over 20 mites per 100 bees. For colonies killed by *Varroa* in the Primorskiĭ region, counts varied from 21 to 208; for colonies that had not succumbed, from 4 to 19 mites per 100 bees. The author suggests that if a colony has from 15 to 20 mites per 100 bees in August or September, considerable deaths can be expected in late autumn and winter. J. P. Harding

RITTER, W.; LECLERCQ, E.; KOCH, W. **Observations des populations d'abeilles et de Varroa dans les colonies à différents niveaux d'infestation.** Apidologie (1984) 15 (4) 389-400 [Fr, en, de, B]

964/80 SADOV, A. V. [**Effect of the mite *Varroa jacobsoni* on biochemical values of the honeybee.**] *Veterinariya, Moscow, USSR* (1978) No.9, 66-68 [Ru, B] Vsesoyuznyĭ Inst. eksperimental'noĭ veterinarii, USSR.

In workers and drones parasitized by females of *V. jacobsoni*, there is a rapid decrease in nucleic acid content of muscle tissue in comparison with unparasitized bees, and the total protein content of the haemolymph is 15-30% less. Such losses, which occur in bees of different ages, result from the consumption of haemolymph by the mites. Where bees are deficient in protein and its fractions, it is necessary to feed supplementary protein in spring and autumn.

245/81 SMIRNOV, A. M. [**Effect of varroatin on queen honeybees.**] *Veterinariya, Moscow, USSR* (1978) No.1, 68-71 [Ru, B]

In applications in hives to prevent *Varroa* infestations, 12 sprayings with an aerosol preparation of varroatin over the first 2 years of a queen's life did not affect her survival or egg-laying capacity. The sex ratio and development of the offspring remained unchanged. In contrast, phenothiazine applied as a smoke in 6 similar doses decreased the egg-laying capacity of queens and 8 doses killed one-third of queens. In colonies treated with varroatin, viable queens, workers and drones emerged from sealed brood. No larvae or pupae were removed by the workers. [*Chem. Abstr.* 88 : 116056u (1978).] F. B. Wells

622L/84 YONEMURA, H. [Wing abnormalities in honeybees caused by *Varroa*.] *Honeybee Science* (1983) 4 (3) 111-112 [Ja, B]

4.3 OCCURRENCE OF MICRO-ORGANISMS

931/84 BALL, B. V. [**The association of *Varroa jacobsoni* with virus diseases of honeybees.**] Der Zusammenhang zwischen *Varroa jacobsoni* und Viruserkrankungen der Honigbiene. *Biene* (1983) **119** (5) 200-201 [De, B, E1594] Rothamsted Exp. Stn., Harpenden, Herts. AL5 2JQ, UK.

Evidence from several sources suggests that infestations of honeybee colonies by *Varroa jacobsoni* may be associated with acute paralysis virus (APV), and possibly other viral infections. In honeybees in the UK, APV is present at low levels in apparently healthy adult bees and does not cause mortality. It is postulated that multiplication of the virus is normally supressed, but that the presence of *Varroa* in some way affects this mechanism so that virus replication occurs. [Published also in *Allgemeine Deutsche Imkerzeitung* (1983) 17(6):177-179.]

P. Walker.

240/85 CHERNOV, K. S. [Transmission of mycoses—an aspect of *Varroa* infestations.] *Byulleten' Vsesoyuznogo Instituta Eksperimental'noi Veterinarii* (1981) **41**, 59-60 [Ru, B]

V.jacobsoni kept in petri dishes containing *Aspergillus* or *Beauveria* cultures at 26°C for 1–2 weeks became infected by the fungi and died in 1–3 days as a result of the mechanical effects of the spores and mycelia. An experiment to study the possibility of the transference of aspergillosis by *Varroa* to honeybees is described, but no results are given.

J.P. Harding.

HORN, H. **Zur Zusammenhang zwischen Varroa jacobsoni und Bakteriosen bei der Honigbiene.** Allgemeine Deutsche Imkerzeitung (1984) 18 (10) 328-329 [De, B]

241/78 SALIMOV, R. M.; KUTSENKO, YU. M.; KUMKOV, V. T. [Bacteriological and virological investigations in an area badly infested with *Varroa.*] *Byulleten' Vsesoyuznogo Ordena Lenina Instituta Exsperimental'noĭ Veterinarii* (1975) No. 21, 61-62 [Ru, B]

Deaths of bees in some apiaries in the Primorskii region were thought to be due to a septic condition transmitted by *Varroa jacobsoni*. Tests of haemolymph from diseased bees and of suspensions made from *Varroa* taken from the affected apiaries indicated the presence of *Enterobacter hafnia*. Serological tests confirmed this diagnosis. Tests for viruses were negative. J. P. Harding

4.4 BEES OTHER THAN APIS MELLIFERA

4.41 APIS CERANA

817/83 DELFINADO-BAKER, M.; KNOX, D. Infestations of *Apis cerana indica* colonies by *Acarapis woodi* and *Varroa jacobsoni*. *American Bee Journal* (1982) 122 (8) 592 [En, B] Bioenvironmental Bee Lab., USDA-SEA, Beltsville, MD 20705, USA.

Samples of bees and brood collected from 2 apiaries in Pakistan [specific locality not known] in May 1982 were examined. Female mites of *V. jacobsoni* were found in the brood cells. *Acarapis woodi* was identified in the tracheae of adult bees. This mite was also identified in a sample of bees collected at Rawalpindi. This is the first report of acarine disease in Pakistan. P. Walker

1349/80 HARA, A. [*Varroa jacobsoni* – an ectoparasitic mite of the honeybee.] *Honeybee Science* (1980) 1 (1) 17-20 [Ja, en, B] Fac. Agric., Tamagawa Univ., Machida-shi, Tokyo 194, Japan.

Colonies of *Apis cerana japonica* were examined for the presence of *V. jacobsoni* in the Tsushima islands, Japan, where there are no *A. mellifera*; only one mite (on a drone) was found during examination of 573 bees. In an infested *A. cerana* colony in Tokyo, 2% of bees had *Varroa* mites compared with 20% in a nearby *A. mellifera* colony.

Mites were reared in the laboratory (35°C, RH 85%); egg laying was observed, and 2 nymphal stages lasted 8-11 days. P. Walker

620/84 KITAOKA, S. [Notes on previous *Varroa* infestations and the recent occurrence of deformed honeybees in Japan.] *Honeybee Science* (1983) 4 (3) 105-108 [Ja, en, B] Natn. Inst. Animal Health, Tsukuba, Ibaraki-ken, 305 Japan.

V. jacobsoni has probably been a parasite of *Apis cerana* for a long time, and on this bee species the effects of the parasitism are not severe. However, when this mite first infested *A. mellifera* in Japan in about 1950, this species of honeybee had no defence mechanism. Severe damage to colonies in Japan resulted. In 1982 there was a high incidence of deformed workers in colonies in many apiaries, and this was correlated with the size of *V. jacobsoni* infestations in those colonies.

Author.

72/82 KOENIGER, N.; KOENIGER, G.; WIJAYAGUNASEKARA, N. H. P. **[Observations on the adaptation of *Varroa jacobsoni* to its natural host *Apis cerana* in Sri Lanka.]** Beobachtungen über die Anpassung von *Varroa jacobsoni* an ihren natürlichen Wirt *Apis cerana* in Sri Lanka. *Apidologie* (1981) **12** (1) 37-40 [De, en, fr, B] Dep. Environmental Biology, Univ. Guelph, Ont. N1G 2W1, Canada.

Seven colonies were examined by opening capped brood cells; *V. jacobsoni* was found in all colonies. All of the 66 adult mites found on drone pupae had produced nymphs and young females, whereas no nymphs or eggs were found on worker pupae. If this is true in general for *A. cerana*, it may be one of the reasons why the mite is less harmful to *A. cerana* than to *A. mellifera*, where *Varroa* reproduces on worker as well as on drone brood. P. Walker

4.42 WILD BEES

242/82 MIKITYUK, V. V.; SEDIN, I. F. **[Spread of *Varroa jacobsoni* in an area with a high population of wild bees (Apoidea).]** *Trudy Vsesoyuznogo Instituta Eksperimental'noĭ Veterinarii* (1980) **52**, 101-103 [Ru, B]

Thirty species of wild bees were captured on plants near hives of honeybees known to be infested with *Varroa*; none of them were carrying *Varroa*, and no mites at all were found on 28 of the species. The mite *Tortania harstia* was found on *Halictus quadricinetus* and *H. scabiosa*. The results suggest that it is unlikely that wild bees contribute to the spread of *Varroa*. J. P. Harding

5. NON-CHEMICAL TREATMENT OF INFESTED COLONIES

5.1 BIOLOGICAL TREATMENT (COLONY MANAGEMENT)

636/81 ABAKUMOV, A. M. [Treatment of frames during varroa disease.] *Veterinariya, Moscow, USSR* (1980) No.2, 40 [Ru, B] Krasnodarsk NIVS, USSR.

Varroa mites are 4–9 times as numerous in drone comb as in worker comb; they are also more than twice as numerous in the lower parts of combs as in the upper. Therefore the building of drone comb was encouraged in the lower parts of frames, then the comb was cut out, so that the total number of mites to be treated by other means was reduced. D. Galton

942/84 BRETSCHKO, J. [Varroa disease is also a problem of bee management.] Varroatose auch ein Problem der Bienenpflege. *Bienenvater* (1983) **104** (2) 48-50, 52-54 [De, B] Dominikanergasse 20, 8047 Graz-Ragnitz, Austria.

Levels of infestation were recorded in colonies, with or without treatment, in Tunisia and in Yugoslavia. The author thinks that control of the mite should not be entirely dependent on the use of chemicals; it is important to detect the presence of *Varroa* early. If infested drone brood is removed, mite populations are reduced. Tobacco smoke is also effective; any chemical treatment should not be carried out until the autumn. During the summer it is important to ensure that colonies have sufficient food, though a strong colony is not immune from attack. P. Walker.

574L/85 GATINEAU, M. [Preventing egg-laying, a control measure against *Varroa*?] Le blocage de la ponte, lutte contre le *Varroa*? *Abeille de France et l'Apiculteur* (1984) No. 681, 119-120 [Fr, B]

235/82 KOENIGER, N.; SCHULZ, A. [Experiments on a biological treatment of varroa disease by the control of all newly emerged bees.] Versuche zur biologischen Therapie der Varroatose durch eine Kontrolle der frischgeschlüpften Bienen. *Apidologie* (1980) **11** (2) 105-112 [De, en, fr, B] Inst. Bienenkunde, Im Rothkopf 5, 6370 Oberursel/Ts., German Federal Republic.

Four honeybee colonies were kept in hives that were divided into two. In one half the queen was confined on an empty comb for 6 days. The comb was then moved to the other part of the hive, whilst the queen was moved to another empty comb. This procedure was repeated every 6 days until 8 combs had been laid in. Each comb was kept in the colony until the cells were capped; it was then moved to an incubator. As the bees emerged they were examined, and only those that were free from *Varroa* were returned to the colony. A total of 5446 mites were found on 31 333 bees, and a further 176 dead mites were collected from paper on the hive floors. After 72 days from the start of the experiment, the colonies were killed and the bees were inspected for *Varroa* by washing them in benzine. One colony was free from mites, and in the others 2, 8 and 27 mites were found.

The results support work reported previously [*AA* 1010, 1011/81] that removal of infested brood effectively reduces the total *Varroa* population. D.G. Lowe

275/84 MAUNG MAUNG NYEIN; ZMARLICKI, C. **Control of mites in European bees in Burma.** *American Bee Journal* (1982) 122 (9) 638-639 [En, B] Bee House, United Nations Dev. Program, Rangoon, Burma.

In Burma the native host of *Varroa jacobsoni* is *Apis cerana*, and that of *Tropilaelaps clareae* is *A. dorsata*. Both mites were also found in all mature *A. mellifera* colonies examined. A treatment programme for 21 *A. mellifera* colonies involved: confinement of the queen in a cage for 21 days; uncapping of dead brood; feeding with sugar syrup (which stimulated hive cleaning); fumigation with phenothiazine. Six colonies which suffered queen failure during the following 7 months were lost, but in the other 15 colonies the populations of both mites were reduced. After release the queens began to lay rapidly, and all 15 colonies increased and produced surplus honey (average 35 kg). The best time to carry out such an annual treatment is when brood rearing is at its lowest level.

P. Walker.

1333/82 MEL'NIK, V. N.; MURAVSKAYA, A. I. [Drone brood combs and *Varroa jacobsoni* infestations.] *Veterinariya, Moscow, USSR* (1981) No. 4, 50-51 [Ru, B]

Drone comb or foundation is placed in the hive in spring and summer to attract *Varroa* mites. A total area of drone comb (on one or more frames) of 840–1680 cm^2 is sufficient for a single-chambered hive containing 12 frames, each 435 × 300 mm. The use of drone comb can be combined with phenothiazine treatment, but not with thymol or heat treatment, as this causes the bees to build worker comb. Drone combs may be used repeatedly providing the mites have been killed by immersing the combs in water at 55 C for 3 h. The combs are taken out, and with the cappings pierced, are returned to the hive. The bees eat the drone larvae and throw out the dead mites.

J. P. Harding

616/84 PFEFFERLE, K. **Application of the rotation principle in beekeeping and use of appropriate technical means for obtaining young, healthy colonies free of *Varroa* disease.** In *Proceedings of the XXVIIIth International Congress of Apiculture, Acapulco, 1981.* Bucharest, Romania; Apimondia Publishing House (1981) 347-354 [En, B] Rotenbuck 16, D-7816 Munstertal, German Federal Republic.

An outline is given of a management system based on the use of new colonies formed from 'surplus bees' at the start of the swarming season. Old, weak or queenless colonies are not strengthened and are eliminated if they do not meet requirements. A 3-frame nucleus hive incorporating a funnel, a queen excluder, and a bottom screen with a movable floorboard (used in *Varroa* control) is described.

D.G. Lowe.

PFEFFERLE, K. **Verschiedene Verfahren zur Erzeugung varroafreier Nachwuchskolonien und die laufende Erneuerung des Völkerbestandes durch das Rotationsprinzip.** Allgemeine Deutsche Imkerzeitung (1983) 17 (9) 281-287 [De, B]

5.1 continued

1332/82 RAIDCHENKO, A. K. [Experiences in the control of *Varroa jacobsoni* infestations.] *Veterinariya, Moscow, USSR* (1981) No. 4, 51-52 [Ru, B]

Treatment against *Varroa* in spring or autumn was ineffective; summer treatment was also of little benefit if the queen was present, but if infested colonies were kept queenless in the summer and treated with acaricides such as phenothiazine this was a reliable method of control. J. P. Harding

1010/81 RUTTNER, F.; KOENIGER, N. [A biological method for the elimination of *Varroa* mites from bee colonies.] Eine biologische Methode zur Eliminierung der Varroa-Milben aus Bienenvölkern. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (1) 11-12 [De, B] Inst. Bienenkunde, Univ. Frankfurt, Im Rothkopf 5, 6370 Oberursel/Ts., German Federal Republic.

In a colony infested with *Varroa jacobsoni*, if the queen's egg-laying area is restricted, the parasitized brood can be removed. In two series of tests reduction or elimination of mites was achieved by this method. [See also next abstract.]

P. Walker

1011/81 RUTTNER, F.; KOENIGER, N.; RITTER, W. [Restriction of brood rearing and removal of brood [in the treatment of *Varroa* infestations].] Brutstop und Brutentnahme. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 159-160 [De, B] Inst. Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

The method described by Ruttner and Koeniger [see previous abstract] is discussed. A simplified procedure is described for use in the field. P. Walker

1024/81 SHILOV, V. N. [Efficacy of zootechnical methods against varroa disease.] *Pchelovodstvo* (1980) No. 7, 19-21 [Ru, B] Beekeeping Res. Inst., Rybnoe, Ryazan Province, USSR.

Autumn treatment for *Varroa* infestation is considered unwise, because it weakens colonies just before wintering. For summer treatment four possible methods are suggested: (*a*) drone comb is periodically cut out; (*b*) all brood is removed except one comb with young larvae in the middle of the nest – all female mites move onto this comb which is removed when sealed; (*c*) nuclei without brood are made from young non-flying bees after treating them against the mites; (*d*) gauze is hung inside the hive above the floorboard when taking control measures so that mites falling from the combs can be caught and removed, thus preventing survivors from re-infesting the colony.

The combined use of methods (*a*) and (*d*) resulted in strong colonies ready for the flow or for overwintering; the honey yield was 12–14% higher in these colonies than in a control colony. D. Galton

VESELÝ, V.; PEROUTKA, M. Bewertung der Methode zur radikalen Eindämmung der varroatose. Apidologie (1984) 15 (4) 379-388 [De, en, fr, B]

5.2 HEAT TREATMENT

954L/85 CLÄERR, G. [Prospects for a biological control method to control varroa disease.] Prospettive per i metodi di lotta biologica alla varroasi. In *Apicoltura sana — agricoltura produttiva. Atti del Convegno Internazionale dell'Apicoltura, Lazise, 29 setembre – 2 ottobre, 1983.* Milan, Italy; Studio Edizioni (1984) 78-87 [It, en, B] *Varroa* mites are trapped on a small number of combs of sealed brood which are culled; this is repeated several times.

581/80 KARPOV, B.; ZABELIN, B. [Heat treatment for the control of *Varroa jacobsoni* infestation in bees.] *Veterinariya, Moscow, USSR* (1978) No. 5, 121-122 [Ru, B] Min. Agric., USSR.

Treatment should be carried out in autumn when there is little brood, and the ambient temperature is between 0° and 12 C. Combless package bees and swarms may be treated at the time of acquisition. Brood should be destroyed, and young bees 10–15 days old treated. Bees are brushed onto a cassette which consists of a metal frame with holes 4–5 mm in diameter; the bees rest on a net with 2.5 × 3 mm apertures. The cassette is placed horizontally in a heating chamber at 46–48 C for 12–15 min. The temperature must not exceed 48° and care should be taken to keep bees evenly spread on the cassette. The mites fall away.

Complete details of the cassette and the heating chamber are given. D. Galton

1342/80 KHRUST, I. I. [Heat treatment for varroa disease.] *Pchelovodstvo* (1978) No. 6, 5-8 [Ru, B] Nauchno-Issledovatel'skogo Inst. Pchelovodstva, Maikop, Krasnodar, USSR.

Honeybees infested with the mites are confined in a wire cage and heated for 15 min; at a temperature of 46–48°C the mite loses its grip on the bee's body and may fall off, or can be shaken off. Above 50°C the bees become overheated. [See also following abstract.] D. Galton

1343/80 KOMISSAR, A. D. [Heat treatment of bees.] *Pchelovodstvo* (1979) No. 6, 17-18 [Ru, B] Inst. Zoology, Acad. Sci., Kiev, Ukrainian SSR, USSR.

Treatment using the heat chamber described in the previous abstract is claimed to be up to 100% effective in destroying *Varroa* mites. Bees are said to survive exposure to a temperature of 46°C for 15–25 min if the density of bees is sufficiently high (1 kg or more in the chamber). Treatment of infested colonies is more effective in autumn than in spring, as the mites are then on the adult bees and not on brood. D. Galton

586L/85 NOVIKOV, V. S.; BARABANOVA, V. V. [Thermal treatment in combination with acaricide preparations for therapy of honeybees infested with *Varroa* mites.] *Sbornik Nauchnykh Rabot, Sibirskii Nauchno-Issledovatel'skii Veterinarnyi Institut* (1980) No. 38, 160-161 [Ru]

5.2 continued

947/84 SOLOV'EVA, L. F. [**Thermal treatment to control varroa disease of honeybees.**] *Pchelovodstvo* (1983) No. 1, 17-18 [Ru, B] Beekeeping Res. Inst., Rybnoe, Ryazan Province, USSR.

Various thermal and other treatments were compared using groups of 20 colonies. Thermal treatment in spring was more effective than treatment with phenothiazine or Sineakar, and it did not retard growth of colonies so much, but to repeat the treatment in a single-space heat chamber after an interval of only a month could retard and even kill a colony. The best results wwere obtained in autumn with a multi-space heat chamber.

D. Galton.

1273/83 VETLOVA, I. V. [**Comparative study of the effects of heat treatment and some acaricides in the treatment of honeybees infested by *Varroa jacobsoni*.**] *Sbornik Nauchnykh Trudov Moskovskaya Veterinarnaya Akedemiya* (1980) **116**, 84-87 [Ru, B]

Tests were made of the effectiveness of a number of chemicals including 'TM', folbex, menthol, ether sulphonate, naphthalene, sulphur and 'Sineacar', and also of the effects of temperature (37, 38 and 48°C). Tests were made in cages on honeybees infested with *Varroa*. At least 10 cages were used for each treatment with a queen and small retinue of workers in each. Counts of dead mites and of dead bees at stated times gave a measure of the effects of the treatments. 'TM' killed 100% of the mites in 10 mins, and no bees in this time. Folbex took nearly 20 mins to kill 100% of the mites, by which time 50% of the bees had died. Menthol, sulphur and 'Sineacar' and the temperatures 37 and 38° took 1–2 days to kill most of the mites, and less than 20% of the bees. The other chemicals and a temperature of 48° were too lethal to bees to be useful. J. P. Harding

5.3 OTHER PHYSICAL TREATMENTS

1344L/80 SCHLEY, P. [The use of gamma-rays on honeybee colonies infested with *Varroa*.] Zur Anwendung von Gammastrahlen bei varroatoseverseuchten Bienenvölkern. *Biene* (1979) **115** (10) 418-420 [De, B]

567/85 SYCHEV, M. M.; BUT, A. I.; KONDRAKOV, M. K. [Effects of some physical factors on honeybees and on [*Varroa jacobsoni*] mites.] *Byulleten' Vsesoyuznogo Instituta Eksperimental'noi Veterinarii* (1981) **41**, 60-62 [Ru, B]

No physical factors were found which were more effective against *Varroa jacobsoni* than they were harmful to bees. Ozone (produced by a high voltage discharge) at a concentration of 1−2 g/m^3 weakened and sometimes killed bees without any apparent effect on *Varroa*.

J.P. Harding.

5.4 BACTERIAL TREATMENT

573L/85 MIKITYUK, V. V.; KORZHOVA, L. N. [The use of bacterial insecticides/acaricides against varroa disease.] *Byulleten' Vsesoyuznogo Instituta Eksperimental'noi Veterinarii* (1981) **41**, 76-78 [Ru, B] A strain of *Bacillus thuringiensis*, in doses of 0.35 µg, was toxic to *Varroa* but practically harmless to bees.

6. CHEMICAL TREATMENT OF INFESTED COLONIES

The entries in this section are numbered, and are indexed under chemical and trade names at the end of the Section. Publications relating to the most commonly tested agents are entered first, under a familiar name (6.1-6.8), and then reports on other agents and general papers in a single sequence (6.9).

6.1 AMITRAZ (FUMILAT A, TAKTIC, TCL, VARRESCENS)

1 **1276L/84** COLIN, M. E.; FAUCON, J. P.; MORAND, M. **Utilisation of aerosol to treat bee-colonies against varroatosis (Varroase).** In *Varroa jacobsoni Oud. affecting honey bees: present status and needs [edited by Cavalloro, R.].* Rotterdam, Netherlands; A.A. Balkema for the Commission of the European Communities (1983) 71-72 [En, B] Preliminary report of an aerosol heated to more than 30°C, containing amitraz and a mite repellent e.g. 0.5% menthol.

1a **968/85** CSABA, G.; KÁVAI, A. **Varrescens fumigating strip for the control of varroa disease.** *Apiacta* (1984) **19** (2) 34-36 [En, B]

This fumigating strip (produced by Hungaronektár, Budapest) is impregnated with a low concentration of amitraz; it takes about 90 s to burn. About 10 000 colonies have been treated with the Varrescens strip, and no queen losses or other adverse effects on the colonies have been reported. Treatment of an infested colony in summer kills 85–90% of mites within 1 h, and the rest in 16 h; in autumn, mites take up to 24 h to die. No amitraz was found in honey harvested from treated colonies. In comparative tests, Varrescens was more effective than Folbex-VA or Varroatin. For best results, repeated treatment with Varrescens in September and October is recommended.

P. Walker.

1b DARGHOUTH, M.A.; KILANI, M. **Essai de l'utilisation de l'amitraz pour le traitement des ruches atteintes de varroase.** Maghreb vetérinaire (1984) 1 (5) 9-13 [Fr, en, ar]

2 **252/82** KILANI, M.; BUSSIERAS, J.; POPA, A.; SAKLI, A. **[A preliminary trial on the treatment of varroa disease with amitraz.]** Essai préliminaire de traitement de la varroase (à *Varroa jacobsoni*) de l'abeille domestique par l'amitraz. *Apidologie* (1981) **12** (1) 31-36 [Fr, en, de, B] École Natn. Médecine Vétérinaire, Sidi Thabet, Tunisia.

This acaricide is of the diamidide type. Groups of 160 bees from infested colonies were treated with an aqueous suspension of amitraz at concentrations from 0.001 to 0.1%; some groups were sprayed with 10 ml suspension, and in other groups it was allowed to disperse through the hive by evaporation.

Good results were obtained at a concentration of 0.001%, which killed 96.5% of *Varroa* mites and only 1.64% of the bees by the evaporation method, and 100% and 5.2% respectively by spraying. Bee mortality was higher when the amitraz concentration was increased.

P. Walker

2a MARCHETTI, S.; BARBATTINI, R. **Comparative effectiveness of treatments used to control Varroa jacobsoni Oud.** Apidologie (1984) 15 (4) 363-378 [En, de, fr, B]

3 **970/85** PEROUTKA, M.; VESELÝ, V. **The use of amitraz in Taktic - a preparation for the diagnosis and treatment of varroa disease in bees.** *Apiacta* (1984) **19** (2) 40 [En, B] Apicultural Res. Inst., Dol, Czechoslovakia.

Taktic, which contains 12.5% amitraz, was used as an aqueous emulsion spray at a concentration of 0.01% (by vol). In colonies treated in July, the infestation level decreased by 94% from 4.48 female mites/100 bees to 0.26 mites/100 bees. In colonies with sealed brood, mite mortality varied from 64.3% to 88.8%. In colonies treated in October almost all mites were killed. For diagnosis of varroa disease, Taktic is applied at the same rate, and hive debris is examined 12—16 h later. In an examination of debris from 651 colonies treated with Taktic in November—December, *Varroa* was present in 49 colonies. In 3 colonies *Varroa* was diagnosed using a washing method, although Taktic had not revealed the presence of the mites. The results indicate that the use of Taktic for diagnostic purposes is 94% successful.

P. Walker.

4 **257/82** ROMANIUK, K.; LIPIŃSKI, Z. **[Trials of a TCL preparation for the control of *Varroa jacobsoni* on honeybees.]** Próby zwalczania inwazji *Varroa jacobsoni* (Oudemans 1904) u pszczół przy pomocy preparatu TCL. *Medycyna Weterynaryjna* (1981) **37** (6) 342-344 [Pl, en, ru, B] Klinik Chorób Inwazyjnych Wydzialu Weterynaryjnego AR-T, Olsztyn, Poland.

An aqueous solution (200–250 ml) containing 0.00012% TCL [active constituent not named] was sprayed onto bees and brood in 130 *Varroa*-infested colonies; many of the mites were killed, and in 2 colonies no mites were found after treatment. Average mite mortality was 93%. TCL displayed no toxic effects on bees or brood during the 7 days after spraying. P. Walker

5 **1291/83** ROMANIUK, K.; LIPIŃSKI, Z. **[Effectiveness of TCL (amitraz) for the control of varroa disease in honeybees.]** Terenowa przydatność preparatu TCL (amitraza) do zwalczania warrozy u pszczoły miodnej. *Medycyna Weterynaryjna* (1982) **38** (8/9) 450–453 [Pl, en, ru, B] Klinika Chorób Inwazyjnych Wydziału Weterynaryjnego AR-T, 10-720 Olsztyn, Poland.

Samples of bees were examined for *V. jacobsoni* before treatment with amitraz, and again 6 days later. Amitraz was applied in 0.0001% aqueous solution at a dose of 250 ml/colony. No harmful effects on brood or workers or on queen oviposition were observed, but mites were seen to fall from their hosts. Six days after a single spray the number of infested bees was 89% less than before treatment, but effectiveness was increased to 92—100% if 2 applications of amitraz were made.

Author

6 **246/85** ROMANIUK, K. **[Fumilat-A for the control of *Varroa*.]** Fumilat A-skuteczny i łatwy w użyciu lek do zwalczania warrozy pszczół. *Medycyna Weterynaryjna* (1983) 39 (6) 340-343 [Pl, en, ru, B] Klinika Chorób Inwazyjnych Wydziału Weterynaryjnego AR-T, 10-720 Olsztyn, Poland.

Fumilat A is a fumigant strip containing amitraz. In colonies with honeybee brood, mortality of *V. jacobsoni* reached a maximum (93.5%) 3 h after treatment; in colonies without brood, mite mortality was 100% after 6 days. No harmful effects on adult bees or bee brood were observed.

P. Walker.

6.2 CHLORDIMEFORM (CHLORPHENAMIDINE, GALECRON)

CHLORDIMEFORM HYDROCHLORIDE (K-79)

1047/79 ALPATOV, V. V.; LANGE, A. B.; TAĬSII, V. M.; NATSKII, K. B. [The selection and development of substances for use against *Varroa*.] In *Varroa* infestation of honeybees [edited by Alpatov, V. V. and 6 others]. Moscow, USSR; Izdatel'stov Nauka. (1977) 61-66 [Ru, E1555, B]

Tests of 3 Japanese acaricidal smoke preparations, Varostan (*A*), Galekron (*B*) and Danikoroba (*C*), were made in 14 honeybee colonies in which the numbers of female *Varroa* were known. The number of female *Varroa* destroyed were: *A*, 3–50%; *B* 6%; *C* 4–18%; controls 1–2%. The wide variation in the results was thought to be due to the different degrees of brood development in the colonies.

It was noted that the number of mites on capped drone brood was 20 times as high as the number on capped worker brood, and it is suggested that patches of drone brood should be squashed with a hive tool. Other possible methods for controlling the disease and for testing acaricides are discussed. K. Donaldson

956L/85 CRANE, E. **Living with *Varroa* in Japan.** *Bee World* (1984) 65 (4) 149-150 [En, B]

Describes the use of amitraz, chlordimeform, chlorobenzilate, tedion or tetradifon (sold as Danikoropa) and phenothiazine.

585L/82 HARLANDER, B. **[Field trials with K-79 for the treatment of varroa disease in November/December 1980 in Hessen.]** Feldversuch mit K-79 zur Bekämpfung der Varroatose im November/Dezember 1980 in Hessen. *Allgemeine Deutsche Imkerzeitung* (1981) **15** (7) 202-204 [De, B]

HARLANDER, B.; RUTTNER, F. **Bekämpfung der varroatose; sytemisch wirkende Substanzen, integrierter Bienenschutz.** Mitteilungen der Deutschen Gesellschaft für Allgemeine und Angewandte Entomologie (1983) 4 (1/3) 26-28 [De, en]

615/83 MORITZ, R. F. A. [Drug distribution in systemic therapy of ectoparasitoses of *Apis mellifera*.] Präparatverteilung bei systemischer Therapie von Ektoparasitosen bei *Apis mellifera* L. *Apidologie* (1982) **13** (2) 127-141 [De, en, fr, B] Inst. Bienenkunde, Univ. Frankfurt, Im Rothkopf 5, 6370 Oberursel, German Federal Republic.

K-79 (chlordimeform hydrochloride) has been shown to kill *Varroa* mites [see e.g. *AA* 1039/81]; for effective treatment, a good distribution of the chemical throughout the affected colony is necessary. In a study of the distribution using (*A*) a radioactive tracer, and (*B*) methylene blue dye, it was found that Apirêve 80 S (a commercial sugar solution) was a suitable carrier for K-79. After identical applications (2 × 50 ml Apirêve with 0.07% K-79) the mean intake of K-79 was 5.4 and 10.2 µl per worker honeybee, in summer and winter, respectively.

Two treatments of 50 ml Apirêve containing 0.07% K-79 were more effective than single treatments of 50, 100 or 200 ml. In summer, the highest mite mortality was 94.5% and in winter 98.02%, results which agree well with those predicted by Wachendörfer et al. [*AA* 935/82]. A further disadvantage of summer treatment was that K-79 was found in about 75% of honey cells. P. Walker

11 **1038/81** RUTTNER, F. **[Testing of new methods for the treatment of varroa disease.]** Versuche mit neuen Verfahren zur Behandlung der Varroatose. *Biene* (1980) **116** (5) 198-201 [De, B] Inst. Bienenkunde, Univ. Frankfurt, Im Rothkopf 5, 6370 Oberursel/Ts., German Federal Republic.

In preliminary laboratory and field tests *Varroa*-infected bees were given food containing the acaricide K-79 (chlordimeform hydrochloride). Winter treatment of a brood-free colony gave best results, 99% of mites being killed. The acaricide acted systemically through the bees' haemolymph. [See also next abstract.] P. Walker

12 **1039/81** RUTTNER, F.; RITTER, W.; GÖTZ, W. **[Chemotherapeutic measures for controlling *Varroa jacobsoni* via the haemolymph of the honeybee.]** Chemotherapie der Varroatose über die Haemolymphe der Biene. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 160-165 [De, E 1569, B] Inst. Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

Preliminary results using K-79 (chlordimeform hydrochloride) were reported in the previous abstract. In further laboratory and field trials the colony was either fed with 35 mg K-79 in 50 ml water, or the solution was sprinkled onto the bees, which then licked it. In wintering colonies the solution was sprinkled onto bees at the top of the cluster. The chemical was absorbed into the bees' haemolymph and was thus ingested by mites feeding on the bees. The chemical was not harmful to the colony, but it killed almost 100% of mites feeding on adult bees. However, concentrations of K-79 in larval haemolymph were not sufficient to kill mites feeding on brood.

Analysis of honey samples from treated colonies showed levels of K-79 at or below the detectable limit of 0.01 ppm. P. Walker

13 **944/78** SMIRNOV, A. M.; CHERNOV, K. S. **[Beekeeping in Japan.]** *Pchelovodstvo* (1976) No. 2; 3; 4; 5, 27-28; 29-30; 36-38; 45-47 [Ru, B] Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Veterinarnoi Sanitarii, g. Moskva, USSR.

This series [the first 2 parts were *AA* 500L/77] includes a section on enemies and diseases of honeybees, and, in particular, *Varroa jacobsoni*. This mite was first found in Japan in 1955, had spread to most of the south by 1958, and was in all areas within 10 years. The usual treatment then was to burn infected stocks and sterilize hives with caustic soda. Nowadays hives are fumigated from above with preparations containing phenothiazine, tetradifon or Folbex; bees, including the queen, sometimes die, and it is not known how honey is affected. There are reports of mites that have developed resistance to these chemicals, so new preparations (chlordimeform, Vorostan, Danikoroba, Danikan, Perion) are being tried.

D. Galton

6.2 continued

14 **566/85** SOTNIKOV, A. N. **[Acaricidal effects and toxicity to honeybees of some preparations used against varroa disease.]** *Byulleten' Vsesoyuznogo Instituta Eksperimental'noĭ Veterinarii* (1981) **41**, 68-69 [Ru, B]

In laboratory tests, nilverm, dertil and benacil (anthelminthics) given in sugar syrup in doses of 200 μg/bee were toxic to bees and harmless to *Varroa*. The insecticide/acaricide Galecron (chlordimeform) in doses of 0.5–5 μg was not toxic to bees and caused 100% mortality of *Varroa* in 144 h; it is therefore recommended for field trials in apiaries.

J.P. Harding.

15 **623/84** TAKEUCHI, K.; HARADA, K. **[Control of *Varroa* with oxalic acid sprays.]** *Honeybee Science* (1983) **4** (3) 113-116 [Ja, en, B] Inst. Honeybee Sci., Tamagawa Univ., Machida-shi, Tokyo, 194 Japan.

Oxalic acid solution was sprayed directly onto combs of infested colonies at concentrations [expressed as % of oxalate] of 1.4, 2.0 and 2.8%; mite populations were reduced by 76, 5.6 and 23.8–90.3%, respectively, compared with untreated controls. At 0.7% concentration a small increase in *Varroa* numbers was recorded. Oxalic acid did not harm the bees:average dose per comb was estimated to be 275 mg or less, using the strongest solution. The effect of the treatment lasted for 3 days, but mite mortality was highest on the first day.

A spray containing chlorophenamidine killed 70.5% of mites, and Amitraz 28.5%, but the latter also killed some bees.

P. Walker.

16 **935/82** WACHENDÖRFER, G. (AND 8 OTHERS) **[Results with the acaricide K79 (chlordimeform hydrochloride) used in Hessen against varroa disease of the honeybee.]** Erfahrungen mit dem Akarizid K79 (Chlordimeformhydrochlorid) in Hessen zur Bekämpfung der Varroatose der Honigbiene. *Deutsche Tierärztliche Wochenschrift* (1981) **88** (5) 161-168 [De, en, B] Staatliches Veterinäruntersuchungsamt, Frankfurt am Main, German Federal Republic.

Following preliminary reports [*AA* 1038, 1039/81], results are now given for tests using K79 on 14 000 brood-free colonies (in November/December) in 1400 apiaries in Hessen; 66% of the colonies were infested by *Varroa*. Each colony received 2 applications, each of 35 mg K79, at an interval of 7–10 days; there were apparently no harmful effects on the bees. After treatment, 73 previously infested colonies were destroyed for examination; about half contained no mites. In the remaining colonies about 95% of mites had been killed. P. Walker

6.3 DICOFOL (KELTHANE)

1048/79 KHAZBIEVICH, L. M. [A *sanpropusknik* [cage for treating bees] in
17 **an apiary infested with *Varroa*.**] In *Varroa* infestation of honeybees [edited by Alpatov, V. V. and 6 others]. Moscow, USSR; Izdatel'stvo Nauka. (1977) 93-95 [Ru, B]

This device consists of a container, 450 × 400 × 350 mm, with a steel mesh base with 4 × 4 mm apertures under which there is a movable plastic tray. A thermostatically controlled electric heater keeps the temperature of the container at not less than 15 C. Bees from an infested colony are shaken into the container where they are exposed to a chemical which causes the mites to drop off and fall into the tray. Suitable fast-acting chemicals are naphthalene, Tedion [tetradifon], Folbex [chlorobenzilate], Kelthane [dicofol], or phenothiazine. J. P. Harding

1274/84 LAERE, O. VAN; IFANTIDIS, M. **Smoke production and treatment of**
18 **honeybees with dicofol for control of *Varroa jacobsoni*.** In *Varroa jacobsoni Oud. affecting honey bees: present status and needs [edited by Cavalloro, R.].* Rotterdam, Netherlands; A.A. Balkema for the Commission of the European Communities (1983) 57-61 [En, B] State Res. Stn. Nematology & Entomology, Merelbeke, Belgium.

The device described in *AA* 599/83 was used for burning strips containing 0.5 g dicofol. In laboratory tests the 24-h LD_{50} for *V. jacobsoni* was reached with 5 mg dicofol/dm^3 for 9 min. Using 10 mg/dm^3, all treatments for 4 min or longer gave 100% mortality after 24 h. The effects on honeybee mortality were insignificant.

D.G. Lowe.

563/85 LAERE, O. VAN; IFANTIDIS, M.; WAEL, L. DE [Dicofol fumigation of
19 **honeybees for the control of *Varroa jacobsoni*.**] Dicofol-Räuchern von Honigbienen zur Bekämpfung der Milbe *Varroa jacobsoni*. *Apidologie* (1983) 14 (3) 175-182 [De, en, fr, B] Stn. Nematologie en Entomologie, Van Gansberghelaan 96, 9220 Merelbeke, Belgium.

Paper wicks were each impregnated with 0.5 g of dicofol plus a small quantity of potassium nitrate. Small groups of *Varroa*-infested bees in cages were fumigated; treatment with 5 mg dicofol/dm^3 killed 50% of *Varroa* in *c.* 9 min. With 10mg/dm^3, all mites were killed in 4 min. At this dose, fumigation times of 2, 4, 8, 16 and 32 min appeared harmless to bees. The mites' reaction to the smoke was to leave the bees, thus exposing themselves to a greater concentration of smoke.

Author.

6.3 continued

1031/81 MAUL, V.; PETERSEN, N.; WISSEN, W. **[Field trials for the clinical testing of Kelthane and bromopropylate [against *Varroa jacobsoni*].]** Feldversuche zur klinischen Erprobung von Kelthane und Brompropylat. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 149-150 [De, B] Aussenstelle für Bienenzucht, Erlenstrasse 9, 3575 Kirchhain, German Federal Republic.

A 1.5% aqueous suspension of Kelthane was sprayed into the bee space of 56 heavily infested colonies at the end of July. The number of dead mites collected ranged from 0 to 517. After treatment of 35 weakly infested colonies in September with a 0.6% aqueous suspension of bromopropylate, from 0 to 19 dead mites were collected.

The average effectiveness of these acaricides was 40–50%; the widely varying results are attributed to the method of application. P. Walker

576/78 POLTEV, V. I.; LIKHOTIN, A. K. **[Diagnosis and treatment of *Varroa* disease in honeybees.]** *Veterinariya, Moscow, USSR* (1975) No.11, 60-61 [Ru] Dept. Bee Biology & Pathology, Moscow Acad. Veterinary Sci., Moscow, USSR.

Generation of smoke containing Kelthane [dicofol], Folbex [chlorobenzilate] or phenothiazine, controlled *Varroa jacobsoni* in hives and was not toxic to the bees. [*Chem. Abstr.* 84: 85561r (1976)]. F. B. Wells

1029/81 RITTER, W.; RUTTNER, F. **[Chemotherapy [of *Varroa jacobsoni* infestations].]** Chemotherapie. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 138-146 [De, B] Inst. Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Rederal Republic.

The toxicity of over 60 chemicals was tested in the laboratory, first on bees and then, within the range not toxic to bees, on *Varroa*. The best were subjected to field tests.

The most effective chemical was Kelthane. Varostan killed mites effectively but also 20% of bees; bromopropylate seemed promising and with improved formulations bee losses might be reduced. Mustard oil was effective in high or low concentrations, and 10% ethyl formate killed 80% of mites. Carbolineum killed over 90% of mites, and heat treatment of bees at 49 C killed 85% of mites. P. Walker

1030/81 RITTER, W. **[Tests with Kelthane [against *Varroa jacobsoni*] at the Oberursel Institute.]** Versuche mit Kelthane am Institut Oberursel. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 146-149 [De, B] Inst. Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

After laboratory testing, the acaricide Kelthane (dicofol) was subjected to field tests in over 4000 colonies. The standard method of application was to spray the bees in a colony with 200 ml of a 1.5% suspension of Kelthane in water. Although this was the most effective of all chemicals tested (see previous abstract), results were variable, and in colonies without brood it was only 55–65% effective. Combinations of Kelthane with other products were no better.

Honey from 7 colonies treated 3 times with Kelthane (during the flow) was analysed; the samples contained from 0.2 to 0.7 ppm of Kelthane. P. Walker

6.4 FOLBEX (CHLOROBENZILATE, AKAR-338)

983/80 ARTEMENKO, L. P.; SKRYPNIK, E. I.; SABADIN, B. M.; ZAICHIKOVA, V. A. [**Akar-338 for varroa disease.**] *Pchelovodstvo* (1978) No.7, 20-21 [Ru, B] Krymskaya Nauchno-Issledovatel'skaya, Veterinarnaya Stantsiya, Simferopol', Ukrainian SSR, USSR.

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The 5 acaricides tested in the laboratory were Rospin, melbex gelekron [Galecron ?] Neoron and Akar-338, in aerosol, fumigant or powder form. Akar-338 was very effective against *Varroa*. *Bull. Docum. Centre, Apimondia*

434/71 Laigo, F. M. & Morse, R. A., Univ. Philippines Coll. Agric., Los Banos, Philippines

25

Philipp. Ent. 1(2) : 144–148 (1969)

Control of the bee mites, *Varroa jacobsoni* Oudemans and *Tropilaelaps clareae* Delfinado and Baker with chlorobenzilate

Brood nests of *Apis mellifera* infested with *Varroa jacobsoni* were treated with one of two formulations of chlorobenzilate. Single treatments with a local chlorobenzilate formulation or Folbex strip yielded 18 and 24 mites per colony respectively. Further treatment after 2 months yielded 48 and 40 mites respectively. Weekly treatment for 12 weeks with Folbex caused a significant reduction in the mite population in the 4th week; further treatment reduced the population further but did not eradicate the mites. Results are not given for *Tropilaelaps clareae* because the incidence of infestation was low.

It is recommended that colonies should be treated 3 times at weekly intervals, and that each series of treatments should be repeated every 2–3 months.

J. M. GEDYE

1032/81 RENNINGHOFF, V.; RITTER, W. [**Results with the treatment of varroa disease in Tunisia.**] Erfahrungen mit der Varroatose-Therapie in Tunesien. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 150-151 [De, B] Inst. Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

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Varroa was first identified in Tunisia in 1978, though it may have been present before that. Laboratory and field tests gave unsatisfactory results for formic acid; but phenothiazine killed over 70% of mites, and Folbex over 90%. Bromopropylate gave the best results (over 96% mite mortality) in colonies with and without brood. Bee mortality in the laboratory tests was not high except for high concentrations of Folbex (38%) and formic acid (20%). P. Walker

27 **1280/84** SELIVANOVA, A. S.; GROBOV, O. F.; SEDOV, V. A.; CHIGAREVA, O. I.; ANTONOVA, I. A. **[Treatments for controlling *Varroa* infestations of honeybees.]** *Veterinariya, Moscow, USSR* (1982) No. 8, 55-58 [Ru, B]

The following treatments are described. (1) Phenothiazine applied as a smoke from a burning tablet or strip. This is blown from a smoker into the entrance of the hive which is then closed for 15–20 min. Treatments may be carried out in spring and autumn when the temperature is not below 15°C, and are said to be 40–96% effective according to how airtight the hive is. (2) Thymol, applied in doses of 10–15 g per hive in spring and autumn, is harmless to bees and 97% effective against *Varroa*. It may be sprinkled on the top bars of the brood chamber. (3) Naphthalene is effective against *Varroa* but kills bee brood, therefore 2–3 g may be applied in autumn when there is no brood present. A special 'incandescence chamber' is used to apply it as a smoke. (4) Varroatin (dicresyl ether methyl carbaminic acid) is applied as an aerosol in the summer, but care must be taken as the dosage is critical and too much will kill the bees. (5) Formic acid can be used in hives as bees can survive a concentration 80 times as high as that which is lethal to *Varroa*, but it must be used with care. (6) Folbex may be used if the hive is without brood. The strips are incinerated and the hive is hermetically sealed for 25–30 min. The treatment is 50% effective in spring, 90% in the autumn, and 98% in broodless nuclei.

J.P. Harding.

28 **568L/85** SHABLII, M. YA. **[Studies on the effects of various acaricides on *Varroa jacobsoni*.]** *Byulleten' Vsesoyuznogo Instituta Eksperimental'noĭ Veterinarii* (1981) **41**, 70-71 [Ru, B] The most effective of the preparations tested were Akar-338 and thymol.

29 **964/85** TITOV, V. F.; VAS'KOV, N. A.; STOLBOV, N. M.; GROBOV, O. F.; POPOV, E. T. **[Folbex for *Varroa* infestations.]** *Veterinariya, Moscow, USSR* (1984) No. 5, 46-47 [Ru, B] Vzesoyuznyĭ Nauchno-Issledovatel'skiĭ Inst. Veterinarnoĭ Entomologii i Arakhnologii, Tyumen', Kazakh SSR, USSR.

The use of smouldering strips of Folbex for the fumigation of colonies is described. The hive should be hermetically sealed for 25–30 min and provided the air temperature is not below 12°C the treatment may be performed in summer or autumn and repeated once after 24 h. The procedure is said to be 97% effective in killing *Varroa*. In autumn there is some danger that the queen may be killed; this can be avoided by feeding with sugar syrup, or by temporarily caging the queen.

J.P. Harding.

30 **1022L/81** VAS'KOV, N. A.; TITOV, V. F.; DAUROVA, E. G.; TIKHOMIROV, S. M. **[Chlorobenzilate for treating varroa disease.]** *Pchelovodstvo* (1979) No. 12, 19 [Ru, B] Folbex (chlorobenzilate) was 97–98% effective in killing *Varroa jacobsoni*; it is recommended for use in honeybee colonies in spring before brood rearing begins.

6.5 FOLBEX-VA (FOLBEX-VA-NEU, FOLBEX-FORTE, ISOPROPYL-4,4'-DIBROMOBENZILATE, BROMOPROPYLATE, NEORON)

570L/85 ABEILLE DE FRANCE ET L'APICULTEUR [Coping with varroa disease
31 (method used with success in China).] Face à la varroase (méthode utilisée avec succès en Chine). *Abeille de France et l'Apiculteur* (1984) No. 682, 179 [Fr, B] Using artificial swarming and treatment with Folbex-VA or another acaricide.

943/84 KLEPSCH, A.; MAUL, V.; PETERSEN, N.; KOENIGER, N.; GÖTZ, W. **[Field**
32 **test of the treatment of varroa disease with Folbex VA Neu.]** Feldversuch zur Varroatosebekämpfung mit Folbex VA Neu. *Biene* (1983) **119** (2) 54-57 [De, B] Abteilung für Bienenzucht, Kirchhain, German Federal Republic.

In these trials, in which a total of 320 colonies were treated, adverse effects on the bees were minimal. In 34 of the colonies the percentage of mites killed by each of 4 applications was assessed and the number of surviving mites counted. The mean total kill after 4 applications was 82%. P. Walker.

274/83 MALININ, O. A.; YAROSHENKO, V. I.; ALEKSEENKO, F. M.
32a **[Determination of neoron in honey.]** *Veterinariya, Moscow, USSR* (1981) No. 9, 68-69 [Ru, B] Ukrainskiĭ NII Eksperimental'noĭ Veterinarii, USSR.

Neoron is described as a mildly toxic substance used as a treatment against *Varroa* infestations. The oral LD_{50} in rats is 5000 mg/kg. In the concentrations used against *Varroa* (0.5 g per hive) it is harmless to bees.

A method of detecting residues in honey using gas chromatography is described. After 2–3 applications to hives, residues in honey stored for 6–7 months were 0.028-0.035 mg/kg. With 3–8 applications the quantity found in extracted (centrifuged) and comb honey varied from 0.07 to 0.52 mg/kg. No harmful effects to bees were observed.

After storing for 6 months the content of neoron in honey decreased by 30–60%. This was independent of temperature. J. P. Harding

RADEMACHER, E.; BÖTTCHER, H. **Die Behandlung von Naturschwärmen**
33 **gegen Varroatose mit dem Präparat 'Folbex VA Neu'.** Allgemeine Deutsche Imkerzeitung (1984) 18 (6) 194-198 [De, B]

600/83 RITTER, W. [Possible methods for treating honeybee colonies against
34 *Varroa* and acarine disease.] Möglichkeiten der Behandlung von Bienenvölkern gegen die Varroatose und Milbenseuche. In *Tagung der Fachgruppe Tierseuchenrecht. Giessen, vom 18-19 März, 1982.* Giessen, German Federal Republic; Deutsche Veterinärmedizinische Gesellschaft e.v. (1982) 70-83 [De, B]

Folbex-VA-Neu is applied as a smoke to kill parasitic mites. It was used on a total of 2600 honeybee colonies without harming adult bees or brood. For treatment of acarine disease, a colony should be smoked with the substance 6 times within 7 days in early spring. Colonies infested with *Varroa* are best treated by 4 applications on consecutive days in the autumn.

P. Walker

35 **280/84** RITTER, W.; PERSCHIL, F.; CZARNECKI, J. M. **Treatment of bee colonies with isopropyl-4,4-dibromo-benzilate against varroa disease and acarine disease.** *Zentralblatt für Veterinärmedizin, B* (1983) **30**, 266-273 [En, de, es, fr, B] Tierhygienisches Inst. Freiburg, Am Moosweiher 2, D-7800 Freiburg i. Br., German Federal Republic.

In field trials, fumigant strips containing isopropyl-4,4-dibromobenzilate (Folbex-VA) were burned in test hives (total 2600 hives) in the evening when foragers had returned. Bee mortality (workers and queens), behaviour and brood rearing were normal. *A. woodi* infestations were eliminated completely in spring by 6 applications of one fumigant strip per colony at intervals of 7 days. *V. jacobsoni* infestations were reduced by 97% in autumn with 4 applications of one strip per colony at intervals of 4 days. In laboratory tests Folbex-VA was significantly more toxic to *V. jacobsoni*, but less toxic to *A. woodi*, than chlorobenzilate (Folbex); it was also much less toxic to honeybees. It is recommended that Folbex-VA should be burned in an empty upper chamber (provided to allow the bees more space during the treatment). Food should be available e.g. uncapped honey or syrup, and the external temperature should be above freezing, but below 10°C.

D.G. Lowe.

36 **929/84** RITTER, W.; PERSCHIL, F. **[Effects of Folbex-VA (isopropyl-4,4'-dibromobenzilate) on *Varroa* mites, and its tolerance by honeybees.]** Prüfung der Wirkung von Folbex-VA (isopropyl-4,4'-dibrombenzilat) auf Varroamilben und der Verträglichkeit für Bienen. *Apidologie* (1983) **14** (1) 9-27 [De, en, fr, B] Tierhygienisches Inst. Freiburg, 7800 Freiburg, German Federal Republic.

Two applications of Folbex-VA fumigant strips (with an interval of 4 days) were sufficient to detect *V. jacobsoni* infestations of more than 5 mites/colony. In spring, in colonies with sealed brood, 4 applications of the fumigant strip killed 59% of the mites present; in autumn, 75% of mites were killed in colonies with brood, and 97% in colonies without brood.

Artificial swarms were successfully treated (98% of mites killed) with 2 applications 24 h apart. No adverse effects on adult bees or on brood were observed in any of the tests.

P. Walker.

37 **969/85** RITTER, W.; DELAÎTRE, N.; IFANTIDIS, M. **Use of Folbex-VA in smoker to control varroa disease.** *Apiacta* (1984) **19** (2) 37-39 [En, B] Inst. Bienenkunde, Univ. Frankfurt, Im Rothkopf 5, 6370 Oberursel/Ts., German Federal Republic.

By burning several Folbex-VA strips in a smoker, several colonies can be treated in turn. The aperture of the smoker is lengthened so that it can be pushed through a slit in the plastic with which the hive entrance is closed. The strips burn for about 8 min, whatever the number of strips. The most satisfactory procedure is to burn 8 strips together in the smoker, treating 8 colonies by giving each 8 puffs of smoke at 5-s intervals. This was almost as effective as burning a single strip inside the hive.

P. Walker.

38 **1283/84** TEMIZ, A. I. **[Effectiveness of Folbex-VA against the parasite *Varroa* [*jacobsoni*] in comparison with other preparations.]** Folbex-VA ilacinin *Varroa* parazitine karşi etkinliğinin saptanmasi üzerine araştirmalar. *Ege Bölge Zirai Araştirma Enstitüsü Yayinlari* (1983) No. 35, iv + 36 pp. [Tr, en, B]

In comparative tests, Folbex-VA (isopropyl-4,4-dibromobenzilate) was found to be more effective in reducing *Varroa* infestations than naphthalene, GLO (paradichlorobenzene), formic acid, tobacco smoke, smoke of pine needles, and a formulation of malathion dust. Honeybee mortality was slighly increased by the formic acid treatment, but none of the treatments affected brood mortality.

Author.

6.6 FORMIC ACID

1035/81 KOENIGER, N.; RAU, C. [Field trials with formic acid [against
39 *Varroa jacobsoni*] in Hochtaunuskreis 1979/1980.] Feldversuch 1979/1980 mit Ameisensäure im Hochtaunuskreis. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 157-159 [De, B] Inst. Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

Over 2000 colonies in 235 apiaries were treated with formic acid for 3 weeks in September; nearly all the colonies were without brood. Counts of dead mites were made; also a sample of colonies was killed, and the mites were shaken out and counted.

Varroa was found in 679 colonies at 95 apiaries; formic acid was shown to be an effective acaricide, and no harmful effects were observed in overwintering bees during the 6 months following treatment.

P. Walker

258L/82 KRÄMER, K. [*Varroa* control with formic acid.] Varroabekämpfung
40 mit Ameisensäure. *Biene* (1980) **116** (8) 340-343 [De, B]

259L/82 KRÄMER, K. [Further information on the control of the *Varroa*
41 mite with formic acid.] Nachlese zur Bekämpfung der *Varroa*-Milbe mit Ameisensäure. *Biene* (1980) **116** (8) 343-344 [De, B] See previous item and *AA* 1033-1036L/80.

1346/80 KUNZLER, K.; MOOK, H.; BRESLAUER, H. [Study of the
42 effectiveness of formic acid on the control of the bee mite *Varroa jacobsoni*.] Untersuchung über die Wirksamkeit der Ameisensäure bei der Bekämpfung der Bienenmilbe *Varroa jacobsoni*. *Biene* (1979) **115** (9) 372-373 [De, B] Eisenbahnstr. 139, 6072 Dreieich, German Federal Republic.

At least 3 plastic (bee-proof) dishes containing formic acid were put in different parts of the hive. Rate of evaporation was controlled by altering the level of acid or the size of the dish; the resulting concentration of acid in the hive atmosphere was measured. A concentration of 50 µg formic acid/l air was lethal for *V. jacobsoni*, but did not harm the bees.

P. Walker

1036L/81 MAUL, V.; KRAMER, K. [Formic acid for the treatment of varroa
43 disease.] Ameisensäure in der Bekämpfung der Varroatose. *Biene* (1980) 116, 292-295; 340-343; 343-344 [De, B]

44 **1034/81** MAUL, V.; PETERSEN, N.; WISSEN, W. **[Field trials with formic acid for the treatment of varroa disease.]** Feldversuche zur Varroatosetherapie mit Ameisensäure. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 155-157 [De, B] Aussenstelle für Bienenzucht, Erlenstrasse 9, 3575 Kirchhain, German Federal Republic.

Colonies rearing brood were treated with 98% formic acid for at least 3 weeks; in those without capped brood, treatment was for 1 week. Altogether 569 colonies were treated using 2 evaporation methods. The daily target dose of 20–30 ml formic acid/colony was not achieved, levels reaching only 6–8 ml/day on average. Consequently mite mortality, though high in many colonies,, was variable. It also seems possible that there may be a seasonal factor in the effectiveness of the treatment.

P. Walker

45 **1033/81** RITTER, W.; RUTTNER, F. **[New methods for the treatment of varroa disease. Formic acid – laboratory and field tests.]** Neue Wege in der Behandlung der Varroatose. Ameisensäure – labor- und Freilandversuche. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 151-153 [De, B] Inst Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

In laboratory tests, 98% formic acid showed low toxicity to bees and high toxicity to *Varroa*. Field trials of formic acid at 25% and 70% concentrations gave poor results, but high mite mortality was achieved when colonies with or without brood were treated in summer with 98% acid. The acid was introduced as a vapour by means of a wick dipping into a flask containing the acid; an improved method of application is needed. Winter treatment was successful in some colonies, but results varied.

Of 6 honey samples from treated colonies, formic acid was not detectable in 2; in 2 others the allowed limit of 40 ppm was exceeded (47 and 64 ppm).

P. Walker

46 **618/84** SULIMANOVIĆ, D.; PECHHACKER, H.; HÜTTINGER, E. **New method for the control of *Varroa* disease during winter.** In *Proceedings of the XXVIIIth International Congress of Apiculture, Acapulco, 1981.* Bucharest, Romania: Apimondia Publishing House (1981) 366-370 [En, B] Heinzelova 55, 41001 Zagreb, Yugoslavia.

Methyl formate, ethyl formate, methyl acetate, and the same substances mixed with formic acid, were used in November–January in Yugoslavia, to fumigate honeybee colonies infested with *Varroa jacobsoni*. The substances were each placed in a 100-ml flask fitted with a glasswool wick. After 5–6 weeks K-79 (chlordimeform hydrochloride) was used to kill remaining mites as a check. Compared with K-79, methyl formate was 58% effective, ethyl formate 25%, and methyl acetate and the 3 mixtures were comparatively uneffective. Adequate ventilation of hives was necessary in order to prevent harm to the bees.

D.G. Lowe.

46a WACHENDÖRFER, G.; KAISER, E.; KRÄMER, K.; SEINSCHE, D. **Labor- und Feldversuche mit einem von KRÄMER modifizierten Ameisensäure-Dämmplatten-Verfahren zur Varroatosebekämpfung.** Allgemeine Deutsche Imkerzeitung (1983) 17 (11) 339-344 [De, B]

46b WACHENDÖRFER, G.; KAISER, E.; KOENIGER, N.; KLEPSCH, A.; MAUL, V. **Derzeitiger Stand der Untersuchungen zur Wirksamkeit und Verträglichkeit mit einem von Krämer modifizierter Ameisensäure-Dämmplatten-Verfahren zur Varroatosebekämpfung.** Deutsche Tierärtzliche Wochenschrift (1984) 91 (5) 189-193 [De, en, B]

6.7 PHENOTHIAZINE (THIODIPHENYLAMINE, KRKA, VARITAN) VAROASIN (PHENOTHIAZINE + PARAFORMALDEHYDE) VARROATIN (PHENOTHIAZINE + 2,4,6-TRIMETHYL-1,3,5-TRIOXANE)

241L/85 BLAŽEVIĆ, R.; SULIMANOVIĆ, D. **["Krka" preparations against varroa disease.]** Lijekovi "Krke" protiv varooze. *Veterinarski Arhiv* (1983) 53 (Supplement) S21-S22 [Sh, en, B] Varitan (phenothiazine) and Varvapin (phenothiazine plus malathion) smoke preparations.

47

1026/81 BULGARIA, SYMPOSIUM ON VAROASIN **Varoasin and Control of Varroatosis [varroa disease] in Bees, Symposium, 28-29 March 1980, Sofia, Bulgaria.** (1980) 42 pp. [En, Bg, Ru, Fr, B]

48

Summaries are given (in English, Bulgarian, Russian and French) of 4 papers describing the use of a Bulgarian preparation, Varoasin fumigation tablets. The tablets contain phenothiazine and paraformaldehyde, and it is claimed that their use in spring and autumn reduces *Varroa jacobsoni* infestations to a 'bearable' level.

D. G. Lowe

943L/78 DANIELYAN, S. G.; MARKOSYAN, A. A.; NALBANDYAN, K. M.; AKOPYAN, N. M. **[Gas smoke generator for treating bees.]** *Veterinariya, Moscow, USSR* (1975) No.8, 67 [Ru, B] Describes a smoker modified to use phenothiazine, for bees infested with *Braula* or *Varroa*.

49

615/84 ESPINOZA CAMARENA, J.; MEZA PECH, I.; LINERA, D. R. **Winter combined method of control of *Varroa jacobsoni* Oud.** In *Proceedings of the XXVIIIth International Congress of Apiculture, Acapulco, 1981.* Bucharest, Romania; Apimondia Publishing House (1981) 329-332 [En, B] Dept. Granja, Dirección Agric., Calle 13 esq. 32, La Plata (1900), Argentina.

50

In mid-August 1980, in Argentina, 12 colonies with various infestations of *Varroa jacobsoni* were fumigated with phenothiazine daily until no more mites were found. All sealed and unsealed brood was then removed and destroyed, and the frames were replaced by sterilized shallow framed combs from which honey had been extracted. Two more treatments with phenothiazine at 3-day intervals were made as a precaution. The 10 colonies which survived the treatment developed normally and yielded a mean of 36 kg honey; one colony became re-infected in the following autumn.

D.G.Lowe.

51 **962/80** GLEBOVA, N. A.; NENILINA, T. V.; BARABANOVA, V. V. **[Comparison of the acaricidal action of chemicals used in *Varroa* disease of honeybees.]** *Sbornik Nauchnykh Trudov. Sib. NIIVI* (1977) No.31, 86-91 [Ru, B] Veterinary Res. Inst., Novosibirsk, USSR.

Phenothiazine was 93% effective, varroatin 71.5% and sulphur 51%. Even a three-fold application of phenothiazine did not free the bees completely of the mites.

J. P. Harding

52 **974/80** MEL'NIK, V. N. **[Effectiveness of some ways of attacking varroa disease in honeybees.]** *Pchelovodstvo* (1979) No. 1, 12-14 [Ru, B] Beekeeping Res. Inst., Rybnoe, Ryazan Province, USSR.

Heat treatment, and treatment with phenothiazine, Sineacar and Varroatin were compared. None was completely effective. The best time for treatment is May; in infested colonies all brood should be removed and destroyed. D. Galton

52a MUSIENKO, V.N. [Effectiveness of phenothiazine strips against honeybee varroose.] Visnik Sil's'kogospodars'koi Nauki (1983) (11) 52-53 [Uk]

53 **1038/79** RAKHMATULIN, R. G. **[Effectiveness of preparations [for treatment of] varroa disease.]** *Pchelovodstvo* (1978) No. 2, 12-13 [Ru, B] Glavnyi Veterinarnyi, MSKh, RSFSR, USSR.

Varroatin can be 70–90% effective. It should be used at temperatures between 20° and 25°C, and with frames spaced 2.5–3 cm apart. The aerosol should be aimed at an angle of 45° between the frames for 1–1.5 s, and applied in the evening or early in the morning, in early spring and early autumn; the preparation must reach open cells with larvae. Varroatin has no adverse effect on workers, queen, brood, quality of honey, nor on the operator, two of whom can treat 100 hives in 1.5 h

Sulphur treatment was less effective and reduced productivity, especially in weak stocks. It was given 2 or 3 times in spring and in autumn at intervals of 8-9 days in a dose of 0.2 g per chamber. Dead mites were found up to 5 days after treatment.

Phenothiazine was not as effective against the mites, and it killed 20% of queens as well as reducing the lives of workers. Use of naphthalene is forbidden in the USSR because of its effect on honey. D. Galton

54 **965/80** RAKHMATULIN, R. G. **[Trials of preparations for control of *Varroa* infestation of honeybees.]** *Veterinariya, Moscow, USSR* (1978) No.3, 71-73 [Ru, B] Glavnoe upravlenie veterinarii, MSKh, RSFSR, USSR.

Large-scale tests carried out on more than 500 000 colonies during 1975 to 1976 in 30 districts of the RSFSR showed that Varroatin [a mixture of phenothiazine and 2,4,6-trimethyl-1,3,5-trioxane] was more effective in controlling *Varroa* infestation of honeybees than sulphur. It was non-toxic to honeybees and did not affect the quality of honey, or queen-rearing, reproductive or honey-collecting activities. Its efficiency ranged from 70 to 96%. Phenothiazine gave good results in some tests.

6.7 continued

958/80 REZINKIN, G. S. **[Acaracide treatment of honeybees infested with *Varroa*.]** *Veterinariya, Moscow, USSR* (1978) No.3, 75-76 [Ru, B] Primorskiĭ Opornyĭ Punkt po Pchelovodstvu, USSR.

Treatment of infested honeybee colonies with phenothiazine aerosol (dose not stated) effectively controlled *Varroa jacobsoni*. The fumigant Acarotox (ether sulphonate), applied in the spring at a rate of 1 tablet per 12-frame hive, 7 times in 48 h, was also effective, but Varroatin did not give good results. It is stated that in early spring and late autumn all sealed brood should be removed before colonies are treated, and in summer it is best to treat colonies after the main honey flow, when there is least brood.

1301L/78 SIMETSKII, M. A.; SMIRNOV, A. M.; KUDRYAVTSEV, E. A. **[How best to apply Varroatin.]** *Pchelovodstvo* (1976) No.7, 16-18 [Ru, B] For destroying *Varroa* mites.

1030/79 SIMETSKII, M. A.; SMIRNOV, A. M.; KUDRYAVTSEV, E. A. **[Control of the mite *Varroa jacobsoni* on honeybees.]** *Veterinariya, Moscow, USSR* (1977) No. 4, 78-80 [Ru, B]

A formula was elaborated for a mixture of unspecified composition termed Varroatin, applied as an aerosol to the combs, and in a series of tests this gave up to 99.6% mortality of mites. For the best results, colonies should be treated when no brood is present – in April and May, or in September and October, after the brood has emerged. Varroatin should be applied 4 times at 24-h intervals.

1037/79 SMIRNOVA, O. I.; MAKHNO, P. M.; SIMETSKII, M. A.; SMIRNOV, A. M.; KUDRYAVTSEV, E. A. **[Mechanism of the action of Varroatin on the *Varroa* mite.]** *Pchelovodstvo* (1978) No. 2, 8-11 [Ru, B] Vsesoyuznyi Nauchno-Issledovatel'skiĭ Institut Veterinarnoĭ Sanitarii, Moskva, USSR.

Photographs show various parts of the mite, including cuticle, fatty tissues, nerve ganglia, muscles, ovary, oviduct, accessory gland and vagina. Photographs of these parts after treatment with Varroatin show signs of degeneration such as vacuolization of the cytoplasm, rupture of muscular tissues and epithelial disintegration. D. Galton

990L/71 Tsiviley, I. V.
Pchelovodstvo 88(6) : 17 only (1968) *In Russian*
Phenothiazine for controlling *Varroa* and the bee louse

1340/82 ZUJIĆ, N.; DELAK, M.; SULIMANOVIĆ, D. **[Effect of phenothiazine fumigation on *Varroa jacobsoni*.]** Djelovanje dima fenotijazina na parazite *Varroa jacobsoni*. *Veterinarski Arhiv* (1981) **51** (Supplement) 134-137 [Sh, en, B] Veterinarska stanica Starigrad, 58460 Starigrad, Yugoslavia.

The fumigants tested were phenothiazine preparations containing oxygen donors to improve burning. They were less effective than a commercial preparation from Japan (Danikoropa). Satisfactory results were obtained by using 2 g phenothiazine per colony. The phenothiazine should be put onto strongly glowing coal. Author

6.8 SULPHUR

631/81 ELISEEV, V. K. **[Control of varroa disease of honeybees with sulphur.]** *Sbornik Nauchnykh Trudov, Moskovskaya Veterinarnaya Akademiya* (1978) **99**, 128-129 [Ru, B]

61 Powdered sulphur (1 g per hive) was evenly scattered over the top-bars of the brood chamber. When repeated twice, at 10-day intervals, colonies in early stages of infestation by *Varroa* were cleared of the mite. J. P. Harding

575/80 GROBOV, O. F.; MIKITYUK, V. V.; LIKHOTIN, A. K. **[Use of purified sulphur against varroa disease of honeybees.]** *Veterinariya, Moscow, USSR* (1978) No.1, 71-73 [Ru, B] All-Union Inst. Exp. Veterinary Sci., Moscow, USSR.

62 Honeybees kept in a cage 11 × 8 × 8 cm containing 100 mg sulphur were only slightly affected, but *Varroa* mites were killed. Field experiments also gave positive results. It was concluded that purified sulphur can be used in hives, at 0.1 g per frame for prophylaxis, and at 0.2 g for therapy, with an interval of 12–14 days between applications, at a time when the bees are flying well. It should not be applied when the ambient air temperature exceeds 30–33 C. A single treatment with sulphur may be given in early spring. The maximum permissible dose of purified sulphur per hive in the USSR is 3 g (southern regions) or 5 g (central and northern regions). The sulphur is distributed uniformly on the top-bars of the frames. After treatment it is essential to place the bees on clean combs, uncontaminated with sulphur. D. Galton

1032/79 MIKITYUK, V. V.; SEDIN, I. F. **[Use of ground sulphur against *Varroa* disease of honeybees.]** *Veterinariya, Moscow, USSR* (1977) No.5, 69-70 [Ru, B] Belgorodskii Otdel VIEV, USSR.

63 When applied as a dust at 0.1 g/1440cm³, ground sulphur killed all the mites, doses of 500, 100, 50 and 10 mg on 5 × 5 cm of uncovered brood caused complete brood mortality in 48 h. When sulphur was mixed with an emulsifying agent, diluted 1 : 100 000, and applied at doses of 110 or 130 µg, mite mortality was 79.9–75.6%. Worker bees appeared unaffected.

When sulphur was used as a fumigant at 0.1 g/1440 cm³ at 35 C and 86% RH, mite mortality was 100%, and bee mortality 11.6%. Mite mortality decreased with decreasing temperature.

When refined sulphur was given to worker bees at a concentration of 0.1% in 1 : 1 sugar syrup, average life-span was reduced from 23.6 days (control) to 0.9 days.

241/82 MIKITYUK, V. V. **[The application of sulphur in the treatment of *Varroa* infestations under the conditions of the central black-earth zones.]** *Trudy Vsesoyuznogo Instituta Eksperimental'noĭ Veterinarii* (1980) 52, 96-100 [Ru, B]

64 Flowers of sulphur was tested on 28 285 infested colonies of honeybees. Three methods of application were compared: (1) sprinkling the powder on the frame top-bars at 0.2 g per bee way; (2) rubbing the sulphur into a cloth covering the frames, at 10 g per hive; (3) sprinkling 10 g onto sticky paper on the hive floor. Trials were made in April, July and October, 1975. At all seasons method 2 was the most effective. Method 1 was least effective in April, and method 3 in July and October. Treatment with sulphur was as effective as treatment with Varroatin. J. P. Harding

6.8 continued

1311L/77 PETROV, S. G. [Sulphur against the *Varroa* mite.] *Pchelovodstvo* (1976) 96 (4) 18 [Ru, B]
65

254/82 SAKAI, T.; TAKEUCHI, K. [***Varroa jacobsoni* and its control in Japan.**] *Honeybee Science* (1980) 1 (4) 145-150 [Ja, en, B] Inst. Honeybee Sci., Tamagawa Univ., Machida-shi, Tokyo 194, Japan.
66

In Japan, this mite was found on both *Apis mellifera* and *A. cerana* in the 1950s; it spread rapidly throughout the country. Treatments included smoking with sulphur-containing acaricides or spraying with certain pesticides. Such pesticide treatments killed many *A. mellifera* before more suitable application methods were found.

Many beekeepers now use a series of different pesticides to avoid the development of *Varroa* resistance to a single chemical, although the necessity for this has not been established scientifically. Generally, a smoke or spray is applied in October – November when the mite is easy to see, in February – March when colony build-up starts, and in the summer. **Author**

1302/77 SMIRNOV, A. M. [Destroying *Varroa* mites away from hives.] *Pchelovodstvo* (1975) 95 (11) 20-22 [Ru, B] Soviet Scientific Res. Inst. Veterinary Hospital, Moscow, USSR.
67

The mites survived for 7 days in an empty hive, 6–7 days on comb, 15 days on open brood, 32 days on capped brood and 11 days on adult and larval honeybees. Equipment was successfully treated by fumigating for up to 24 h with methyl bromide (100–200 g/m^3) or with 150–200 g sulphur gas/m^3; it was then allowed to stand for 2–3 days before use.

Open ground in the infected apiary was treated with a flame gun: 3.5 min on open ground without grass, 5.5 min on damp ground, 5 min on green grass and 12 min on wet grass. D. Galton

1341/80 VAS'KOV, N. A.; STOLBOV, N. M.; TEREBOV, A. S. [**Purified sulphur for varroa disease in bees in greenhouses.**] *Pchelovodstvo* (1978) No. 7, 22-23 [Ru, B] Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Veterinarnoi Entomologii i Arakhnologii, Tyumen', Kazakh SSR, USSR.
68

Winter treatment of infested colonies with 5–10 g pure sulphur per colony killed *Varroa* mites, but the honeybee cluster was disturbed. Therefore, the treatment is feasible only shortly before the colony is to be used for pollination, and the combs must be destroyed.

When the bees were active in the glasshouse, they were given three doses of 0.4 g sulphur, which did not affect the plants. A single dose of 0.2 g was ineffective against *Varroa*.

For treatment in autumn, a dose of 10 g/kg of bees was applied outside the colony. *Bull. Docum. Centre, Apimondia*

6.9 OTHER AGENTS

ALEKSEENKO, F.M.; YAROSHENKO, V.I.; MUSIENKO, V.M. [Testing new
69 acaricides for the treatment of honeybee infestation with Varroa mites.] Visnik Sil'skogospodars'koi Nauki (1982) (10) 85-87 [Uk, B]

1294L/83 ARZONE, A. **[Chemical control of *Varroa jacobsoni*.]** A proposito
70 di lotta chimica contro *Varroa jacobsoni* Oud. *Apicoltore Moderno* (1982) 73 (2) 45-48 [It, en, B] Beekeepers are urged not to use pesticides for controlling *V. jacobsoni*, as many are also toxic to honeybees.

971/85 ARZONE, A. **The danger of using pesticides to control *Varroa jacobsoni* Oud.**
71 *Apiacta* (1984) **19** (2) 41-45 [En, B] Istituto di Entomologia Agraria, Univ. Torino, Turin, Italy.

Of the 40 products that have been used against *V.jacobsoni*, 18 are also used to control plant pests; these are listed and their uses and properties discussed. The results of previous laboratory tests [see e.g. *AA* 468/74; 1051/79; 637, 978/83] have shown that endosulfan, malathion, phosalone and tetradifon are particularly persistent and have high oral toxicities for honeybees. It is thus considered inadvisable to use these and similar pesticides in hives to control *V.jacobsoni* infestations. D.G. Lowe.

261L/78 BALABAEV, V. A. [Aerosol treatment for *Varroa* disease.]
72 *Pchelovodstvo* (1976) No. 5, 28-29 [Ru, B]

576/85 DE JONG, D.; SEINER, J.; GONÇALVES, L. S.; MORSE, R. A. **Brazilian**
73 ***Varroa* research rates current treatments too expensive.** *American Bee Journal* (1984) **124** (2) 111-112, 138-139 [En, B] Dept. Genetica, Fac. Medicina, Univ. São Paulo, 14100 Ribeirao Prêto, SP, Brazil.

Results so far have indicated that *Varroa* infestations in Brazil cause some loss in production, but colony mortality is rare, and there is little to be gained by using expensive chemical treatments.

D.G. Lowe.

1021L/81 GROBOV, O. F.; SHABNII, M. YA.; VYAZOVSKII, E. N. **[Sineacar**
74 **for use against *Varroa*.]** *Pchelovodstvo* (1979) No. 12, 18-19 [Ru, B] Sineacar (Romanian product) was harmless to bees, but was not 100% effective in killing *Varroa* mites.

934/82 HO, K.-K.; HSU, E.-L.; AN, J. K. **[Chemical control of *Varroa*
75 ***jacobsoni*. 1. Screening tests of acaricides on *V. jacobsoni* and toxicity of 5 acaricides to *Apis mellifera*.]** *Phytopathologist and Entomologist, National Taiwan University* (1980) 78-83 [Ch, en, B] Plant Pathology & Entomology Dept., National Taiwan Univ., Taipei, Taiwan.

In a survey of 52 apiaries, *Varroa jacobsoni* was found in all of them. Topical toxicity tests on honeybees were carried out in the laboratory using 51% Gubitol, 27% Acarthane, 25.5% Folbex (chlorobenzilate), 35% dicofol and 50% Plictran, and the acaricides were also tested in the infested apiaries. Gubitol was the least toxic to adult worker bees and is recommended for use in apiaries (it is O,O-diethyl-O-(3-chloro-4-methyl-7-coumarinyl)-phosphorothioate). Author

6.9 continued

255/82 HO, K.-K.; AN, J. K. [Effects of Gubitol and of its application
76 methods on *Varroa jacobsoni* in Taiwan.] *Honeybee Science* (1980) **1** (4) 155-156 [Ja, en, B] Dept. Plant Pathology & Entomology, Natn. Taiwan Univ., Taiwan.

Gubitol is O,O-diethyl-O-(3-chloro-4-methyl-7-coumarinylphosphorothioate); a 51% wettable powder was used to control the mite. Each frame was treated twice with 25–30 ml of a 0.001% solution with an interval of 7 days, in spring and in autumn. Mortalities of honeybee eggs and larvae were 29.2% and 57.5% respectively if the chemical was applied directly to the cells. Mortality in unsealed brood was 23.6% when sprayed from a vertical position and 6.9% when sprayed at an angle. Author

565/85 IVANOV, YU. A. [A study of the acaricidal properties and toxicity to
77 honeybees of some synthetic fragrances.] *Byulleten' Vsesoyuznogo Instituta Eksperimental'noi Veterinarii* (1981) **41**, 65-68 [Ru, B]

Of the 5 substances studied — citral, citronellal, terpineol, ionone and elenol — only ionone and elenol proved effective against *Varroa jacobsoni*, but they were also rather toxic to bees.

573/78 KAMBUROV, G.; KUNCHEV, K.; STOIMENOV, V. [Testing of chemicals
78 for control of *Varroa jacobsoni* infection in honeybees.] *Acta Microbiologica, Virologica et Immunologica* (1975) **2**, 100-104 [Bg, en, ru, B] Veterinary Inst. Infectious and Parasitic Diseases. Sofia, Bulgaria.

Of 8 acaricide formulations tested, fumigation preparations containing 1.25 g Milbex were the most effective in controlling *V. jacobsoni* infesting honeybee colonies. Best results were obtained by treating colonies 2 or 3 times at 2-day intervals in the autumn. [*Chem.Abstr.* 83 : 142962c (1975).] F. B. Wells

945/84 KOENIGER, N.; KLEPSCH, A.; MAUL, V. [Interim report on the use of
79 lactic acid for treating varroa disease.] Zwischenbericht über den Einsatz von Milchsäure zur Bekämpfung der Varroatose. *Biene* (1983) **119** (7) 301-304 [De, B] Inst. Bienenkunde, Univ. Frankfurt, Karl-von-Frisch-Weg 2, 6370 Oberursel, German Federal Republic.

Of the 3 acids tested, 2% oxalic acid and 2% sulphuric acid were unsuitable. For lactic acid, solutions were tested by spraying about 5 ml onto each side of each comb occupied by bees; a 10% solution killed about 50% of mites, and a 15% solution killed over 60%. There was no damage to brood, but the higher concentration of lactic acid had an adverse effect on adult bees. As with some other treatments for *Varroa*, lactic acid is effective only on uncapped brood, and in these tests was applied in the spring.

P. Walker.

80 **1031/79** LANGE, A. B.; NATSKII, K. V.; TATSII, V. M. **[An evaluation of preparations for controlling *Varroa* disease of honeybees.]** *Veterinariya, Moscow, USSR* (1977) No.9, 73-77 [Ru, B] MGU im. M.V. Lomonosova, USSR.

V. jacobsoni females, which fast in the absence of honeybee brood during the winter, start to oviposit after engorgement on the first bee brood. In untreated hives, infestation increased about 6-fold in a year.

The control measures with various acaricides which were tested did not give significant improvements, and it is suggested that tests should be carried out in the spring, during and after treatment 3 times at weekly intervals.

81 **952/85** MARCHETTI, S.; BARBATTINI, R.; D'AGARO, M. **[Preliminary trials on the use of some plant species for the control of *Varroa jacobsoni*.]** Prove preliminari sull'impiego di alcune specie vegetali nel controllo di *Varroa jacobsoni* Oud. In *Apicoltura sana — agricoltura produttiva. Atti del Convegno Internazionale dell'Apicoltura, Lazise, 29 settembre – 2 ottobre, 1983.* Milan, Italy; Studio Edizioni (1984) 56-67 [It, en, B] Istituto di Difesa delle piante, Univ. Udine, Udine, Italy.

Results are given for 10 plant species that were used in a smoker for fumigating honeybee colonies infested by *Varroa jacobsoni*: *Rosmarinus officinalis, Melissa officinalis, Mentha piperita, Equisetum arvense, Achillea clavenae, Artemisia absinthium, Lycopersicon esculentum, Pinus mugo, Satureja montana, Salvia officinalis. M. officinalis* and (especially) *M. piperita* caused some mites to become detached from adult bees if the hive was closed for 60 min after smoking, but none of the fumigations were effective if the hive remained open. D.G. Lowe.

82 **963/80** MARIN, M. (AND 5 OTHERS) **[Composition for treating mite diseases of honeybees and method for preparing it.]** Medicament destinat combaterii acariozelor la familiile de albine şi procedeu de obţinere a lui. *Romanian Patent* (1975) No.63434, 3 pp. [Ro, B] Inst. cercetări pentru apicultură, Bucureşti, Romania.

A composition for the control of mites on honeybees consists of 0.5% sodium pyrosulphite, 0.272% of an 8% solution of 2,4,4',5-tetrachlorodiphenylsulphone, 0.15% of a 50% solution of isopropyl-4,4'-dibromobenzilate, 0.075% of a 50% solution of 2-methyl-4-chlorophenyldimethylformamide, 0.5% of a 25% solution of isopropyl-4,4'-dichlorobenzilate, and sugar. The composition controlled *Varroa jacobsoni* and *Acarapis woodi* on honeybees. [*Chem.Abstr.* 90 : 98581w (1979).]
F. B. Wells

83 **576/82** MIKITYUK, V. V.; GROBOV, O. F.; CHIGAREVA, O. I. **[Trials of chemicals for controlling *Varroa jacobsoni* infestations of bees.]** *Trudy Vsesoyuznogo Instituta Eksperimental'noi Veterinarii* (1979) **50,** 120-125 [Ru, B] Inst. Exp. Veterinary Sci., Moscow, USSR.

Thymol was effective against infestations of *Varroa jacobsoni* when applied at 7–40°C at a rate of 0.25 g in each beeway between combs. It was either scattered onto the upper bars, or onto muslin or metal gauze, and applications could be repeated with 7-day intervals. Thymol was about twice as effective as sulphur, and as varroatin. J. P. Harding

6.9 continued

1286/83 MIKITYUK, V. V. **[Efficiency of thymol against varroa disease.]**
84 *Veterinariya, Moscow, USSR* (1983) No. 1, 43-44 [Ru, B] Inst. Exp. Veterinary Sci., Moscow, USSR.

Thymol contained in a muslin pack (30 × 30 cm) hung over the brood frames was up to 90% effective against *Varroa jacobsoni* in the Kalyzhsk region and did not harm the bees, but the same treatment in the Krasnodarsk region killed some bees and inhibited egg laying by the queen. Experiments were carried out to determine the effect of the following factors on the rate of sublimation of thymol: the dimensions of the pack, the air temperature, RH, strength of the colony. All exept RH affected the results. Treatment with thymol is not recommended if the air temperature is above 27—30°C, especially if the colony is weak. J.P. Harding

85 NIJHUIS, H.; ENSS, K.; VOSS, S.; TIETGEN, I.; TIETGEN, W. **Untersuchungen zur Bekämpfung der Varroa jacobsoni mit Hilfe von Pyrethrum-Extracten.** Biene (1985) 121 (2) 55-56 [De, B]

1170/80 POLJAKOV, A. A. (AND 9 OTHERS) **[Acaricide preparations for the**
86 **diagnosis and control of ectoparasites of honeybees.]** Akarizides Präparat zur Diagnostik und Bekämpfung von Ektoparasiten der Bienen. *German Federal Republic Offenlegungsschrift* (1978) No. 2719722, 16 pp. [De, B] Vsesoyuznoĭ Nauchno-issledovatel'skiĭ Inst. Veterinarnoĭ Sanitarii, Moscow, USSR.

N-methylcarbamates control infestation of honeybees by *Acarapis woodi* and by *Varroa jacobsoni*. Thus, application to hives of a composition containing 0.025% by weight methyl-N-methylcarbamate, 19.975% acetone, and 80% difluorodichloromethane, completely controlled these mites. The compounds are also useful for diagnosis, since their application to infested bees led to the appearance of dead *V. jacobsoni* on the bottom of the hive. [*Chem. Abstr.* 90 : 49668w (1979).] F. B. Wells

1411/81 RITTER, W. **[A method for testing chemotherapeutical substances**
87 **used in controlling varroa disease.]** Zur Methodik der Prüfung von Chemotherapeutika zur Bekämpfung der Varroatose der Honigbiene. *Apidologie* (1980) **11** (2) 131-141 [De, en, fr, B] Inst. Bienenkunde, Im Rothkopf 5, D-6370 Oberursel/Ts, German Federal Republic.

The methods summarized in *AA* 1029/81 are described more fully. For an approximate estimate of mites remaining in a colony after chemical treatment, the removal and killing of one frame of bees is sufficient. By shaking with benzine, over 99% of mites are washed off; other liquids (e.g. pentane, water plus detergent) are less efficient. P. Walker

87a RITTER, W. **Perizin: Ein neues systematisches Medikament zur Bekämpfung der Varroatose.** Tierärtzliche Umschau (1985) 40 (1) 14-15 [De, en, B]

88 **611L/83** RUIJTER, A. DE **Tobacco smoke can kill *Varroa* mites.** *Bee World* (1982) **63** (3) 138 [En, B]

1275/84 RUIJTER, A. DE **Preliminary results on treatment of *Varroa*-infected**
89 **honeybee colonies with tobacco smoke.** In *Varroa jacobsoni Oud. affecting honey bees: present status and needs [edited by Cavalloro, R.].* Rotterdam, Netherlands; A.A. Balkema for the Commission of the European Communities (1983) 63-70 [En, B] Exp. Bee Farm Ambrosiushoeve, Hilvarenbeek, Netherlands.

Experiments using laboratory cages at Oberursel, German Federal Republic, confirmed preliminary results obtained in Thessaloniki, Greece [see *AA* 611L/83]. In 3 colonies which were smoked 3 times, using 2–5 g tobacco for each application, mortality of *V. jacobsoni* was 75%. Some bees were also killed when 5 g were used.

D.G. Lowe.

957/85 RUIJTER, A. DE; EIJNDE, J. VAN DEN **Detection of *Varroa* mite in the**
90 **Netherlands using tobacco smoke.** *Bee World* (1984) **65** (4) 151-154 [En, B] Exp. Bee Farm, Ambrosiushoeve, Tilburgseweg 32, Hilvarenbeek, Netherlands.

An empty super is added to the hive being investigated, to act as a fumigation chamber and to prevent the bees from being anaesthetized. A piece of cardboard is inserted at the bottom of the hive. At the end of the day, when most bees have returned to the hive, the hive entrance is closed by wet cloth or newspaper, leaving a small opening through which tobacco smoke can be blown using a Dathe pipe connected by a flexible tube to a foot-operated pump. For ordinary hives 3 g tobacco is used, for skeps or small single-body hives, 2 g. The hive is re-opened after about 1 h. On the following day the empty super is removed, and the cardboard insert is inspected for *V.jacobsoni* which have been killed by the tobacco smoke [see *AA* 611/83; 1275/84]. *V.jacobsoni* was first detected in the Netherlands in spring 1983 by beekeepers using this method, but the method is much more sensitive in autumn after most brood rearing is finished.

D.G. Lowe.

948/84 SADOV, A. V. **[Supplementary feeding of honeybee colonies with essential**
91 **oils from pine needles as a measure against varroa disease.]** *Sbornik Nauchnykh Trudov Moskovskaya Veterinariya Akademiya* (1981) **120**, 39-50 [Ru, B]

Honeybee colonies in which 1–20% of bees were infested with *Varroa jacobsoni* were fed 0.25% pharmaceutical extracts of pine needles mixed with candy in the second half of winter and in early spring. The author states that this averted the death and exhaustion of the bees, increased the quantity of sealed brood to 1.2–1.5 times as much as in untreated colonies, and increased the honey harvest by 15–50%. Pine essence may be added to a honey + sugar paste, to candy, or to sugar syrup, or applied as an aerosol sprayed onto the combs.

J.P. Harding.

6.9 continued

617/84 SANTAS, L. A.; EMMANOUEL, N. G.; PAPADOPOULOU-BATZAKI, D. G.
92 **Preliminary observations from the use of two control methods for *Varroa* disease in Greece.** In *Proceedings of the XXVIIIth International Congress of Apiculture, Acapulco, 1981.* Bucharest, Romania; Apimondia Publishing House (1981) 356-360 [En, B] Agric. Coll., Athens, Greece.

In February–April 1980, malathion dust (1% a.i.) at 2 g/hive was used to control *Varroa jacobsoni*, but its residual action was short (c. 36 h) and even after 6 applications mites were still present. In June–October 8 applications of malathion dust at 2 g/hive (1% a.i.) or 4 g/hive (0.5%) were used; the latter formulation was more effective in reducing the mean level of infestation in brood. Malathion had no direct adverse effect on honeybees and no residues were found in honey. As it can be used at any temperature, it is recommended for use in winter when the mite does not breed.

A number of devices that released sulphur dioxide slowly into the hive atmosphere over 25–47 days were also used. They contained 50 or 100 g of $K_2S_2O_5$, and had walls 60 or 100 μ thick. Over 80% of mites were killed, and the mean level of infestation in brood was greatly reduced, but toxic effects on adult bees and brood were observed in some hives and care must be taken in the use of such devices.

D.G. Lowe.

1033/79 SIDOROV, N. G.; STOLBOV, N. M.; PLATUKHINA, N. I. **[The effect**
93 **of volatile oils of higher plants on the *Varroa* parasite of honeybees.]** *Veterinariya, Moscow, USSR* (1977) No.7, 65-68 [Ru, B] VNII Veterinarnoi Entomologii i Arakhnologii, USSR.

Ethereal oils of certain higher plants were investigated as possible fumigants for use against *V. jacobsoni*; their effect on honeybees, particularly with reference to the composition of the haemolymph, was also studied. Vapours of mint, aniseed, wormseed, dragon's head (*Dracocephalum*), citranilic and *Chenopodium* oil at a rate of 8 ml/0.08 m^3, and of menthol crystals at 8 g/0.08 m^3, had an acaricidal effect, varying from weak (wormseed oil) to strong (*Chenopodium* oil). The vitality of bees increased after fumigation with vapour of thymol and oil of fir. The density of haemocytes in the haemolymph of infested bees was less than in uninfested bees. The haemolymph of some bees became markedly infected with micro-organisms, especially in autumn, but their numbers declined after the bees had been fumigated with ethereal oils. It is recommended that preparations based on ethereal oils should be introduced into the hive at the height of seasonal activity, at temperatures above 12°C.

941/82 STORT, A. C.; GONÇALVES, L. S.; MALASPINA, O.; DUARTE, F. A. M.
94 **Study on Sineacar effectiveness in controlling *Varroa jacobsoni*.** *Apidologie* (1981) 12 (3) 289-297 [En, de, fr, B] Dept. Biologia, Inst. Biociências, UNESP, 13.500 Rio Claro, SP, Brazil.

Sineacar powder contains chloropropylate and promopropylate and Tedion (tetradifon) in cellulose or glucose. Each of 9 *Varroa*-infested honeybee colonies was treated with 100 g of the powder, which was dusted over the combs; the treatment was repeated 10 days later. Overall, the treatment was ineffective, and infestations were comparable with those of untreated control colonies.

P. Walker

238L/85 SULIMANOVIĆ, D.; GRBIĆ, D.; TOMAC, I. **[Use of Apiakaridim [smoke] to**
95 **control ectoparasites [*Varroa* and *Braula*] of bees.]** Primjena Apiakaridima u suzbijanju ektoparazita pčela. *Veterinarski Arhiv* (1983) 53 (Supplement) S67-S68 [Sh, en, B]

INDEX TO CHEMICAL AND TRADE NAMES IN SECTIONS 6 and 7

The index cites entry numbers used in Section 6, which run from 1 to 95, and in Section 7 (R96-R104). Where possible, a chemical name is followed by other names and trade name(s) of agents based on the chemical. Trade names have a capital initial letter, and are cross-referenced to the chemical name where this is known.

7. RESIDUES OF CHEMICALS IN HONEY

R96 **274/85** LIAKOS, B. **[Studies on toxic residues of malathion in honey.]** *Hellenike Kteniatrike* (1983) **26** (10) 308-313 [Gr, en, B]

Two hives with different bee populations were fumigated with malathion 5 times on every fifth day, at doses which increased progressively from 0.05 to 0.4 g. Samples of honey were taken by centrifugation and by squeezing on the fifth and tenth days after the administration, and examined by gas chromatography for malathion residues. In samples which had been extracted by centrifugation there were 0.003–0.008 ppm malathion, while in samples extracted by squeezing there were 0.009–0.05 ppm. Honey samples from apiaries where malathion had been used for treatment against *Varroa* were tested 2 months after extraction and found to be free from malathion and other pesticide residues.

Author.

R97 **274/83** MALININ, O. A.; YAROSHENKO, V. I.; ALEKSEENKO, F. M. **[Determination of neoron in honey.]** *Veterinariya, Moscow, USSR* (1981) No. 9, 68-69 [Ru, B] Ukrainskiĭ NII Eksperimental'noĭ Veterinarii, USSR.

Neoron is described as a mildly toxic substance used as a treatment against *Varroa* infestations. The oral LD_{50} in rats is 5000 mg/kg. In the concentrations used against *Varroa* (0.5 g per hive) it is harmless to bees.

A method of detecting residues in honey using gas chromatography is described. After 2–3 applications to hives, residues in honey stored for 6–7 months were 0.028-0.035 mg/kg. With 3–8 applications the quantity found in extracted (centrifuged) and comb honey varied from 0.07 to 0.52 mg/kg. No harmful effects to bees were observed.

After storing for 6 months the content of neoron in honey decreased by 30–60%. This was independent of temperature. J. P. Harding

R98 **615/83** MORITZ, R. F. A. **[Drug distribution in systemic therapy of ectoparasitoses of *Apis mellifera*.]** Präparatverteilung bei systemischer Therapie von Ektoparasitosen bei *Apis mellifera* L. *Apidologie* (1982) **13** (2) 127-141 [De, en, fr, B] Inst. Bienenkunde, Univ. Frankfurt, Im Rothkopf 5, 6370 Oberursel, German Federal Republic.

K-79 (chlordimeform hydrochloride) has been shown to kill *Varroa* mites [see e.g. *AA* 1039/81]; for effective treatment, a good distribution of the chemical throughout the affected colony is necessary. In a study of the distribution using (*A*) a radioactive tracer, and (*B*) methylene blue dye, it was found that Apirêve 80 S (a commercial sugar solution) was a suitable carrier for K-79. After identical applications (2 × 50 ml Apirêve with 0.07% K-79) the mean intake of K-79 was 5.4 and 10.2 µl per worker honeybee, in summer and winter, respectively.

Two treatments of 50 ml Apirêve containing 0.07% K-79 were more effective than single treatments of 50, 100 or 200 ml. In summer, the highest mite mortality was 94.5% and in winter 98.02%, results which agree well with those predicted by Wachendörfer et al. [*AA* 935/82]. A further disadvantage of summer treatment was that K-79 was found in about 75% of honey cells. P. Walker

R99 **617/85** PETUKHOV, R. D. **[Determination of Kelthane in honey by thin-layer chromatography.]** *Byulleten' Vsesoyuznogo Instituta Eksperimental'noĭ Veterinarii* (1981) **41**, 74-76 [Ru, B]

Kelthane (dicofol) may contaminate honey by being present in the nectar of bee plants sprayed with the pesticide, or more directly as a result of its use against *Varroa*.

For chromatography a 30-g sample of honey is mixed with 5 g anhydrous sodium sulphate and extracted 3 times with 40 ml hexane for 10 min. The hexane is then evaporated on a water-bath at 60°C. A chromatogram of the residue is run with a mixture of hexane and benzol and examined under UV light. Dicofol displays a blue-green colour.

J.P. Harding.

R100 **1030/81** RITTER, W. **[Tests with Kelthane [against *Varroa jacobsoni*] at the Oberursel Institute.]** Versuche mit Kelthane am Institut Oberursel. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 146-149 [De, B] Inst. Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

After laboratory testing, the acaricide Kelthane (dicofol) was subjected to field tests in over 4000 colonies. The standard method of application was to spray the bees in a colony with 200 ml of a 1.5% suspension of Kelthane in water. Although this was the most effective of all chemicals tested (see previous abstract), results were variable, and in colonies without brood it was only 55–65% effective. Combinations of Kelthane with other products were no better.

Honey from 7 colonies treated 3 times with Kelthane (during the flow) was analysed; the samples contained from 0.2 to 0.7 ppm of Kelthane. P. Walker

R101 **1033/81** RITTER, W.; RUTTNER, F. **[New methods for the treatment of varroa disease. Formic acid – laboratory and field tests.]** Neue Wege in der Behandlung der Varroatose. Ameisensäure – labor- und Freilandversuche. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 151-153 [De, B] Inst Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

In laboratory tests, 98% formic acid showed low toxicity to bees and high toxicity to *Varroa*. Field trials of formic acid at 25% and 70% concentrations gave poor results, but high mite mortality was achieved when colonies with or without brood were treated in summer with 98% acid. The acid was introduced as a vapour by means of a wick dipping into a flask containing the acid; an improved method of application is needed. Winter treatment was successful in some colonies, but results varied.

Of 6 honey samples from treated colonies, formic acid was not detectable in 2; in 2 others the allowed limit of 40 ppm was exceeded (47 and 64 ppm).

P. Walker

7 continued

R102 **1039/81** RUTTNER, F.; RITTER, W.; GÖTZ, W. **[Chemotherapeutic measures for controlling *Varroa jacobsoni* via the haemolymph of the honeybee.]** Chemotherapie der Varroatose über die Haemolymphe der Biene. *Allgemeine Deutsche Imkerzeitung* (1980) **14** (5) 160-165 [De, E 1569, B] Inst. Bienenkunde, Univ. Frankfurt, im Rothkopf 5, 6370 Oberursel, German Federal Republic.

Preliminary results using K-79 (chlordimeform hydrochloride) were reported in the previous abstract. In further laboratory and field trials the colony was either fed with 35 mg K-79 in 50 ml water, or the solution was sprinkled onto the bees, which then licked it. In wintering colonies the solution was sprinkled onto bees at the top of the cluster. The chemical was absorbed into the bees' haemolymph and was thus ingested by mites feeding on the bees. The chemical was not harmful to the colony, but it killed almost 100% of mites feeding on adult bees. However, concentrations of K-79 in larval haemolymph were not sufficient to kill mites feeding on brood.

Analysis of honey samples from treated colonies showed levels of K-79 at or below the detectable limit of 0.01 ppm. P. Walker

R103 **253L/82** RUTTNER, F.; RITTER, W.; GOTZ, W. **Chemotherapy treatment of *Varroa* via the haemolymph of the honey bee.** *Scottish Beekeeper* (1981) Nos. 5; 6; 7, 74-76; 92-93; 108-109 [En, B] Published English translation of *AA* 1039/81.

R104 **617/84** SANTAS, L. A.; EMMANOUEL, N. G.; PAPADOPOULOU-BATZAKI, D. G. **Preliminary observations from the use of two control methods for *Varroa* disease in Greece.** In *Proceedings of the XXVIIIth International Congress of Apiculture, Acapulco, 1981.* Bucharest, Romania; Apimondia Publishing House (1981) 356-360 [En, B] Agric. Coll., Athens, Greece.

In February–April 1980, malathion dust (1% a.i.) at 2 g/hive was used to control *Varroa jacobsoni*, but its residual action was short (c. 36 h) and even after 6 applications mites were still present. In June–October 8 applications of malathion dust at 2 g/hive (1% a.i.) or 4 g/hive (0.5%) were used; the latter formulation was more effective in reducing the mean level of infestation in brood. Malathion had no direct adverse effect on honeybees and no residues were found in honey. As it can be used at any temperature, it is recommended for use in winter when the mite does not breed.

8. LEGISLATION

235L/79 FRANCE. LAWS AND STATUTES [*Varroa* disease recognized legally as contagious.] La varroase maladie reconnue légalement contagieuse. *Abeilles et Fleurs* (1977) No. 274, 2 [Fr, B] Extract from *Journal Officiel*, 8 April 1977, modifying the certificate which must accompany consignments of bees addressed to France.

892L/79 ITALY. LAWS AND STATUTES [**Ministerial ordinance 31 March 1978. Rules for the importation of foreign live bees and of bee brood, for the prevention of varroa disease.**] Ordinanza ministeriale 31 Marzo 1978. Norme per l'importazione dall'estero di api vive e di covata di api ai fini della prevenzione della varroasi. *Apicoltore Moderno* (1978) **69** (3) 93-95 [It, B]

514L/79 UNITED KINGDOM. LAWS AND STATUTES **The importation of bees order 1978.** *Statutory Instrument* (1978) No. 683, 4 pp. ISBN 0-11-083683-9 [En, B, Price £0.20] Bees imported into the UK must now (after 1 July 1978) be certified free of *Varroa jacobsoni*.

1023L/81 USSR. MINISTRY OF AGRICULTURE [**Regulations on prevention and treatment of varroa disease.**] *Pchelovodstvo* (1980) No. 7, 14-16 [Ru, E 1565, B]