Dynamics of Agricultural Biotechnology

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CONTENTS

Advances in plant nematology: Proceedings of the U.S.-Pakistan International Workshop on Plant Nematology. (Karachi: 1986: April 6-8)/edited by MA Maqbool, AM Golden, A Ghaffer, LR Krusberg. National Nematological Research Centre, University of Karachi, Karachi, Pakistan. p. 113-121; 28 ref.

The use of DNA, soluble proteins and enzymes as taxonomic characters in nematology is discussed. These features can be used in the identification of species or forms below species level and can assist in assessing nematode phyletic relationships in terms of biochemical evolution.

1766 VIDHYASEKARAN, P. 1990. **Basic research for crop disease management.** New Delhi: Daya Publishing House, viii + 410 p.

The book contains 33 contributions arranged under the headings: genetic engineering and tissue culture; physiological and molecular plant pathology; virus disease management; bacterial disease management; epidemiology and forecasting; resistance breeding; biological control; and the management of diseases of national (Indian) importance. Articles have been contributed from USA, Israel, Philippines and India.

1767 VIDHYASEKARAN, P. 1990. **Genetic engineering for virus disease management.** *Basic research for crop disease management*/edited by P Vidhyasekaran. New Delhi: Daya Publishing, p. 13-18; 24 ref.

The use of genetic engineering methods for virus disease management is outlined with examples of the application of the techniques. It is concluded that genetic engineering, although still in its infancy could provide an efficient means of virus control.

INSECT PESTS

1768 ANANTHAKRISHNAN, TN; RAMAN, A. 1988. **Dynamics of insect-plant interaction: recent advances and future trends.** New Delhi: Oxford & IBH Publishing, 223 p.

The series of articles presented in this volume aims to highlight recent advances and future directions for the study of insect-plant interactions. The introductory chapter outlines various avenues involved in such research. Areas such as biophysical and biochemical resistance mechanisms, natural plant products in relation to the behavioural physiology of insects and of the nature of changes in insect-plant mutualism, the dynamics of cecidogenous insects in relation to their hosts as well as prospects of genetically engineered plants for enhanced protection from insects are discussed.

1769 ANNAMALAI, P; LALITHAKUMARI, D. 1993. **Biochemical changes and mechanism of resistance in *Bipolaris oryzae* to edifenphos**. *Zeitschrift Fuer Pflanzen. Und Pflanzenschutz*, 100: 5, 497-507.

Physiological changes and mode of resistance in *Bipolaris oryzae* to edifenphos was evaluated. Due to development of resistance, protein, DNA, RNA, total lipid and phospholipid contents were altered. Rate of efflux of electrolytes was decreased and reduced membrane permeability was suggested as the mechanism of resistance. Due to reduced membrane permeability, rate of uptake of edifenphos was also less in resistant strains of *B. oryzae*.

1770 BABU, TR; AZAM, KM. 1987. **Residual toxicity of different insecticides to the adult *Cryptolaemus montrouzieri Mulsant (Coccinellidae: Coleoptera)***. *Tropical Pest Management*, 33: 2, 180-181; 6 ref.

In connection with the possibility of using the predacious coccinellid *Cryptolaemus montrouzieri* as a biological control agent against *Maconellicoccus hirsutus* on grapevines in Andhra Pradesh, India, the toxicity and persistence of 8 insecticides and one acaricide to adults of the coccinellid were investigated in the laboratory. Dichlorvos at 0.1% was found to be the safest insecticide; synthetic pyrethroids were highly toxic and more persistent. The acaricide dicofol was also toxic. Hence sprays of 0.1% dichlorvos could be integrated with release of the predator.

1771 BALOCH, AA. 1982. **Embryogenesis studies of *Anacridium aegyptium L.* (*Catantopidae: Orthoptera*)**. *Pakistan Journal of Zoology*, 14: 2, 185-190; 9 ref.

In the laboratory in Pakistan 17 stages of embryonic development in the eggs of *Anacridium aegyptium* were observed; they are described in detail. At a rearing temperature of 34-36°C, the egg stage lasted 20 days, and morphological changes on each of these days are recorded.

1772 BANERJEE, S; SAHAI, YN. 1983. **Neuroendocrine control of oocyte development in *Poecilocerus pictus Fabr. (Acrididae, Orthoptera)***. *Current Science*, 52: 9, 432-434; 20 ref.

The respective roles of the *Corpora allata* (CA) and the median neurosecretory cells (mNSC) in the oogenesis of *Poekilocerus pictus* (F.) was investigated in the laboratory in India by cautery of the mNSC, ovariectomy or implantation of extra CA. From the results it was concluded that both the CA and the mNSC were necessary for successful oocyte development and oviposition. The NSC hormone affected previtellogenic growth of

oocytes, general protein synthesis in the fat-body and oviposition, while the CA affected the vitellogenic protein synthesis in the fat-body and yolk deposition in the oocyte. Failure in NSC-cauterised females to produce mature oocytes after CA implantation suggested that a factor from mNSC might control and maintain the activity of the CA.

1773 CHOWDHURY, N; DERYCKE, PH. 1985. **Effect of ox bile on the formation of calcareous corpuscles during in vitro growth of *Hymenolepis microstoma*.** *Current Science*, 54: 5, 240-242; 7 ref.

H. microstoma was grown in Eagle's basal medium containing horse serum and fresh lamb liver extract, with different concentrations of ox bile. There was a significant increase in the number of calcareous corpuscles in the proglottides or worms grown with bile (0.015 to 0.60%) compared with those grown without bile. The number of corpuscles increased to a maximum of 67/proglottid at a bile concentration of 0.12% (compared with 47/proglottid in controls). At high concen. of bile the no. of corpuscles was drastically reduced.

1774 GREENSTONE, MH. 1989. **Foreign exploration for predators: a proposed new methodology.** *Environmental Entomology*, 18: 2, 195-200; 58 ref.

A technique using on-the-spot serological stomach analysis of predators is described for identifying natural enemies of target pests. The method was tested by monoclonal antibody-based ELISA assays of individuals of the pentatomid *Podisus maculiventris* fed eggs and 1st- to 5th-instar larvae of the noctuids *Heliothis zea* [*Helicoverpa zea*], *Heliothis subflexa*, *H. virescens*, *Trichoplusia ni*, *Spodoptera frugiperda*, *Anticarsia gemmatalis* or *Pieris rapae* in the laboratory. Monoclonal antibody HZ5-1, which gave the highest signal to noise ratio in ELISA, was chosen for all stomach analyses. HZ5-1 exhibited species, stage and instar specificity for 5th-instar larvae of *Helicoverpa zea*. Larvae of *Heliothis armigera* [*Helicoverpa armigera*] from Pakistan could also be distinguished from those of *T. ni* and *P. rapae* by this method.

1775 GROVER, P; ARA, P. 1983. **Embryology of the gall midge *Aschistonyx baranii Grover (Diptera: Cecidomyiidae)*.** *Cecidologia Internationale*, 4: 1/2/3, 49-56; 5 ref.

Detailed descriptions are provided of the embryonic development of eggs of *Aschistonyx baranii*, a cecidomyiid that forms succulent galls in the flower buds, leaf buds, petioles or leaf veins of the ornamental plant *Crateva religiosa [C. nurvala]* in India.

1776 JAIPAL, S; DENDSAY, JPS. 1985. **Effect of juvenile hormone analogue on protein biosynthesis in *Dysdercus koenigii* F. during oogenesis.** *Behavioural and physiological approaches in pest management.* (Coimbatore, Tamil Nadu, India: Tamil Nadu Agricultural University)/edited by A Regupathy, S Jayaraj, p. 138-145; 10 ref.

The effects of topical treatment of newly-emerged females of *Dysdercus koenigii* with a juvenile hormone analogue at a dose of 20 p.p.m./insect on protein synthesis by the fat-body, haemolymph and ovary during oogenesis were examined in laboratory studies in India. The treatment resulted in initial increases in the protein contents of the fat-body and haemolymph and a reduction in that of the ovary.

1777 JAYARAJ, S; UTHAMASAMY, S. 1990. **Aspects of insect resistance in crop plants.** *Proceedings of the Indian Academy of Sciences, Animal Sciences*, 99: 3, 211-224; 80 ref.

The importance of growing insect resistant crops in pest management programmes and major aspects of insect resistance in crop plants in Tamil Nadu, India, are discussed. Aspects which are dealt with include causes of resistance, genetics of resistance, development of insect resistant crop varieties, induced resistance and genetic engineering of plants for insect resistance.

1778 JHA, PK; NAKHAI, B; SRIDHAR, P; TALWAR, GP; HASNAIN, SE. 1990. **Firefly luciferase, synthesized to very high levels in caterpillars infected with a recombinant baculovirus, can also be used as an efficient reporter enzyme in vivo.** *FEBS Letters*, 274: 1-2, 23-26; 19 ref.

Larvae of the noctuids *Trichoplusia ni* and *Spodoptera littoralis* were infected with a recombinant AcNPV (*Autographa californica* nuclear polyhedrosis virus) having the viral polyhedrin gene replaced with cDNA encoding firefly luciferase. Both target noctuids synthesized very high levels of luciferase. *Luciferase* was apparently not secreted into the haemolymph but was contained within the body tissue. Expression in *S. littoralis* larvae suggested that luciferase could be an excellent reporter enzyme to study virus infection, dissemination and expression in different tissues, host range determination, insect physiology, and also to monitor the release of recombinant virus in the environment when used as a microbial pesticide.

1779 KALRA, VK. 1986. **Record of hymenopterous parasites from sesame leaf roller and pod borer,**

***Antigastra catalaunalis Duponchel* in Haryana**. *Haryana Agricultural University Journal of Research*, 16: 1, 86-87; 5 ref.

The ichneumonid *Trathala flavoorbitalis* and 2 unidentified species of the braconid genus *Apanteles* were reared from larvae of the pyralid *Antigastra catalaunalis* collected from sesame in Haryana, India, in 1981-83. This is the first report of these parasites attacking *A. catalaunalis* in Haryana. Parasitism by *Apanteles sp.* started in the second week of September and peaked (18-20%) in the first half of October. Parasitism by *T. flavoorbitalis* was negligible up until September, but reached a maximum (18%) in October and November. It is suggested that these parasites may prove to be potential biological control agents of *A. catalaunalis*.

1780 LAL, R. 1983. **Factors influencing microbe/insecticide interactions**. *CRC Critical Reviews in Microbiology*, 10: 3, 261-295; Review, 161 ref.

The influence of environmental factors on interactions between microorganisms and insecticides is reviewed. The accumulation of insecticides in microorganisms depends on the water solubility and chemical structure of the insecticide, and on the cell number, cell size and physiological state of the microorganisms. Microbial metabolism of insecticides is influenced by the nutritional conditions and oxygen concentration of the substrate, and the chemical nature of the insecticide. A previous application of an insecticide generally leads to greater activity on retreatment. Successful metabolism of an insecticide depends on the combined activities of a wide range of microorganisms with diverse metabolic capabilities. The sensitivity of microorganisms towards a particular insecticide depends on the nutritional status of the environment, the chemical composition of the media, the soil type, the properties and formulation of the insecticide and the inherent nature, stage of growth and number of the microorganisms.

1781 LAL, R. 1984. **Insecticide microbiology**. Berlin: Springer-Verlag, xv + 268 p.

Insecticide microbiology has emerged as a separate discipline in the last 10 years, and this volume, to which 12 authors have contributed, provides a reference book on insecticide-microbe interactions and an authoritative review of recent advances and discoveries. The effects of insecticides on microorganisms such as bacteria, fungi, algae and protozoa have gone unnoticed until recently, although they may have marked effects on the productivity of the biosphere. Chapters of this publication are devoted to insecticides and microbial environments; experimental, methodological and analytical approach to the study of microbe-insecticide interactions; microbial accumulation of insecticides; metabolism of insecticides by microorganisms; enzymes associated with the microbial metabolism of insecticides; genetic engineering and biological degradation of insecticides; effects of insecticides on soil microorganisms; effects of insecticides on algae; and cytological and biochemical effects of insecticides on microorganisms.

1782 PANT, U; BANERJEE, K. 1990. **Arthropod tissue culture in India (1967-1988) - a review**. *Indian Journal of Medical Research, Section A, Infectious Diseases*, 91: November, 397-407; 81 ref.

Since the first ever successful establishment of a mosquito cell line was reported (from *Aedes albopictus*) by K.R.P. Singh in 1967 from the National Institute of Virology (formerly Virus Research Centre), Pune, several cell lines from various species of mosquitoes and other arthropods have been established in India. Results obtained are summarized with regard to the establishment, growth characterization, cell morphology and susceptibility to viruses or other pathogens of cell cultures from mosquitoes (*Aedes albopictus*, *A. w-albus*, *A. novalbopictus*, *A. vittatus*, *A. aegypti*, *Culex quinquefasciatus*, *C. infula, C. sp. aff. tritaeniorhynchus* and *Anopheles stephensi*), ixodid ticks (*Haemaphysalis spinigera*, *H. obesa* and *Rhipicephalus sanguineus*), bedbugs *(Cimex hemipterus*) and the gelechiid lepidopteran *Gnorimoschema operculella* [*Phthorimaea operculella*]. It was found that cultures of the latter insect did not support the multiplication of any of the numerous arboviruses or other mammalian viruses tested. Numerous arthropod cell lines which originated in India have been used throughout the world and vice versa. Future prospects for the use of arthropod tissue culture in India include the diagnosis of parasitic and viral diseases of man, domestic animals, insects and plants, the propagation of protozoan parasites, the production of microbial biological control agents and the development of vaccines.

1783 PATHAK, KML; GAUR, SNS. 1990. **Immunization of pigs with culture antigens of *Taenia solium***. *Veterinary Parasitology*, 34: 4, 353-356; 9 ref.

Eight laboratory-bred 15-day-old pigs were immunized against *T. solium* infection with excretory/secretory (ES) antigens derived from in vitro culture of oncospheres. Eight unimmunized pigs served as controls. 30 days after immunization, all immunized and non-immunized pigs were challenged orally with 15 000 eggs. All animals were killed 12 weeks later and subjected to a

full post-mortem. The percentage reduction in infection rate of immunized animals compared with controls was 94.9%. The reduction in the number of cysticerci in immunized animals was a positive indication of protection (12-25 compared to 300-515 cysticerci).

1784 PAWAR, AD; TUHAN, NC; PARRY, M. 1984. **Management of codling moth *Cydia pomonella (L.) (Lepidoptera: Olethreutidae)* at Khalsi (Ladakh), Jammu and Kashmir**. *Pesticides*, 18: 10, 39-42; 6 ref.

In 1979, mechanical, biological and chemical control methods and mass-trapping of male adults with sex pheromone traps were combined for the management of *Cydia pomonella* on apple at Khalsi in the Ladakh area of Jammu and Kashmir, India. Larvae were collected manually from loose bark, from tree bands and from fallen damaged fruits. The exotic egg parasites *Trichogramma embryophagum* (92 000 adults) and *T. cacoeciae* pallidum (135 000 adults) were released and gave 28.8% parasitism. The sex pheromone traps were used both for direct control and for population monitoring, which led to timely application (at the end of June and at the end of July), against the larvae of the 2 generations that apparently occurred, of sprays containing 88% phosphamidon and 76% dichlorvos, both at 5 ml in 10 litres water/tree. The combined effect of all these control measures was the reduction of *C. pomonella* infestation to 5.2-10.15%, as compared with 32.5-68.4% for no treatment.

1785 RAGHAVAN, KV; KAUR, J; PARANJAPE, J; RODRIGUES, V. 1992. **The east gene of *Drosophila melanogaster* is expressed in the developing embryonic nervous system and is required for normal olfactory and gustatory responses of the adult**. *Developmental Biology*, 154: 1, 23-36.

D. melanogaster larvae and adults respond to a wide range of chemosensory stimuli. Genetics and developmental expression of the east gene, mutations which result in adult-specific chemosensory defects is discussed. Several mutations have been generated, some of which are recessive lethals and others that are viable alleles that show a recessive, adult-specific, chemosensory defect. No larval chemosensory defects were observed. The east gene is expressed in the neurogenic region at the time of neuroblast segregation and in cells in the peripheral and central nervous system. Results suggest that east+ expression in the nervous system is required for a normal adult chemosensory response and both increases and decreases in levels of the gene product result in a mutant phenotype.

1786 RAHMAN, MH. 1984. ***Acetylcholinesterase* in developing embryos of *Hyalomma rufipes Koch, 1844 (Ixodoidea: Ixodidae)***. *Annals of Tropical Medicine and Parasitology*, 78: 4, 405-408; 9 ref.

Acetylcholinesterase was detected in the neuropile of the oesophageal ganglia and in the nerve endings of the appendages of developing embryos of *Hyalomma marginatum rufipes Koch (H. rufipes)*; it was not detected in the neurons and neurolemma of the nerve ganglia. This is thought to be the first time the enzyme has been detected in tick embryos.

1787 RAHMAN, MH. 1983. **Embryogenesis in *Hyalomma rufipes Koch, 1844 (Ixodoidea: Ixodidae)***. *Bangladesh Journal of Zoology*, 11: 1, 25-38; 14 ref.

Observations made in the laboratory in Bangladesh on embryogenesis in *Hyalomma marginatum rufipes* Koch (H. rufipes) are described. The centrolecithal composition of the eggs and external morphological changes seen during development confirmed the close phylogenetic relationship of H. m. rufipes with other chelicerates. Yolk contraction prior to germ-disc formation, the formation of 2 types of vitellophages, the appearance of an epineural space and participation of vitellophages in mid-gut development are apparently recorded for the first time in tick embryogenesis.

1788 RAJVANSHI, SK; SHARMA, MC; GOEL, SC. 1983. **Effect of temperature on the oviposition and hatching percentage in *Riptortus linearis Fabr (Heteroptera: Coreidae)*.** *Insect Ecology and Resource Management*. (Muzaffarnagar, India: 1983)/edited by SC Goel, p. 24-27; 4 ref.

Oviposition by adult females of *Riptortus linearis L.* collected on *Vigna unguiculata (sinensis)* in the field was observed at room temperatures in the laboratory in India in August and September 1977 and 1978. Oviposition began 2-3 days after mating. The eggs were laid singly or in rows of up to 11 on various substrates. Oviposition continued for 2-4 days. Hatching averaged 83.3-100% at mean temperatures of 27-29.5°C, but fell to 45% at 32.5°C.

1789 RAO, CGP; RAY, A; RAMAMURTY, PS. 1983. **Biochemical studies on DNA, RNA and protein contents of the labial glands during postembryonic development in *Spodoptera litura* (*Noctuidae: Lepidoptera*)**. *Entomon*, 8: 1, 71-74; 18 ref.

Changes occurring in the content of nucleic acids (DNA and RNA) and protein in the labial glands of *Spodoptera*

litura (F.) during postembryonic development were determined in laboratory studies in India. Large amounts of nucleic acids and small quantities of protein were synthesised during larval development up to the 1st half of the 5th instar (the growth phase). Large quantities of exportable proteins and only small quantities of nucleic acids were produced during the 2nd half of the 5th instar and non-feeding stages (the secretory phase). Degeneration of the gland occurred during the prepupal stage (the histolytic phase).

1790 RAY, A; RAO, CGP; SRIDEVI, R; RAMAMURTY, PS. 1984. **Changes in acid phosphatase activity in *Spodoptera litura* (*Lepidoptera-Noctuidae*) during the post-embryonic and adult development**. *Entomon*, 9: 3, 161-167; 31 ref.

Acid phosphatase is an enzyme that is important in biological processes that need high levels of energy such as development, growth, maturation and histolysis. Observations in India on changes in the activity of the enzyme in whole-body, fat-body and testis homogenates of *Spodoptera litura* during post-embryonic and adult development are described.

1791 SEN-SARMA, PK. 1987. **Insect pest problems in social forestry plantations and their management**. *Indian Journal of Forestry*, 10: 4, 239-244; 24 ref.

An account of the various pests that damage social forestry tree species in stored seeds, nurseries and forest plantations in India. The term 'social' forestry is taken to include community forestry and agroforestry, and the species covered are multipurpose, the most common genera being *Acacia*, *Albizia*, *Artocarpus*, *Azadirachta*, *Casuarina*, *Celtis*, *Emblica* (*E. officinalis* [*Phyllanthus emblica*]), *Eucalyptus*, *Madhuca*, *Mangifera*, *Moringa*, *Pongamia*, *Prosopis*, *Sesbania*, *Syzygium*, *Tamarindus* and *Zizyphus* [*Ziziphus*], although others are also included in the account. The plantation pests section includes defoliators, sap suckers and wood borers and is written mainly with reference to the monocultures used in 'pure' social forestry plantations. The various management techniques (cultural methods, chemical and biological control agents) used to prevent and control insect infestation are discussed.

1792 SETHI, K; DHILLON, SS. 1983. **Post-embryonic development of optic ganglia in *Earias vittella* (*Fabr.*) (*Lepidoptera: Arctiidae*)**. *Indian Zoologist*, 7: 1/2, 165-171; 13 ref.

The morphology and postembryonic development of the optic ganglia in the noctuid *Earias vittella* are described.

1793 SHARMA, SK; GUPTA, JS. 1982. **Role of *Streptomyces rochei* against some pathogenic fungi**. *Indian Journal of Mycology and Plant Pathology*, 12: 2, 227-228; 1 ref.

Spore suspensions and (more effectively) culture filtrates of *S. rochei* reduced disease development by *Colletotrichum gloeosporioides* [*Glomerella cingulata*] on mango, *Alternaria alternata* on barley and *C. falcatum* [*G. tucumanensis*] on sugarcane.

1794 SHARMA, VL; NEENA; SINGH, M. 1991. **Glycogen content during kpost - embryonic development of *Epilachna vigintioctopunctata (Fabr.)* (*Coleoptera : Coccinellidae*)**. *Annals of Entomology*, 9: 1, 61-63.

1795 SINGH, JP; SARWAL, V. 1983. **Changes in glycogen content during post-embryonic development of *Leucinodes orbonalis (Guenee)* (*Lepidoptera: Pyraustidae*)**. *Indian Zoologist*, 7: 1/2, 107-110; 18 ref.

Changes in the glycogen content of the pyralid *Leucinodes orbonalis*, a pest of aubergines, were studied during its postembryonic development. The levels decreased during pupation.

1796 SINGH, JP; BAUGH, SC. 1984. **Embryos and embryonic envelopes in eggs of two cyclophyllidean cestodes**. *Angewandte Parasitol.*, 25: 1, 12-16; 16 ref.

The egg envelopes of *Cotugnia digonopora* (for the first time for a *Cotugnia*) and of *Raillietina (R.) echinobothrida* are described. The embryo of *C. digonopora* (0.14-0.19 X 0.21-0.28 mm) has an oncospheral membrane. It is surrounded by 3 envelopes and 3 membranes/capsules, namely, oncospheral envelope, tough inner capsule, inner (cytoplasmic) envelope, middle capsule, outer envelope and outer capsule. It closely resembles that of Diplophallus polymorphus. The uterine capsules of *R. echinobothrida*, as in *R. galeritae*, have an opaque central and a semitransparent peripheral part. The embryo, which measures 0.065-0.090 mm in diameter when round, is surrounded by a spherical rigid inner capsule, a cytoplasmic envelope and an outer capsule; an onchospheral membrane could not be observed. The embryonic hooks were collared in both species.

1797 SINGH, JP; NEENA. 1983. **Lipids during the post-embryonic development of *Tribolium castaneum* (*Herbst*)**. *Indian Zoologist*, 7: 1/2, 95-98; 12 ref.

The changes in the lipid content of the tenebrionid *Tribolium castaneum* during its development were measured. The total lipid and triglyceride contents

increased in amount from the 1st- to the 6th-instar larva, decreased during the pupal stage and increased again in the adult. The free fatty acid content increased up to the 4th instar, decreased in the 5th instar and prepupal stage and then increased again. The amounts of cholesterol and phospholipid reached a maximum in the adult stage.

1798 STEPHAN, W; MITCHELL, SJ. 1992. **Reduced levels of DNA polymorphism and fixed between - population differences in the centromeric region of *Drosophila ananassae***. *Genetics*, 132: 4, 1039-1045.

We have estimated DNA sequence variation within and between two populations of *Drosophila ananassae*, using six-cutter restriction site variation at vermilion (v) and furrowed (fw). These two gene regions are located close to the centromere on the left and right X chromosome arms, respectively. In the fw region, no DNA polymorphism was detected within each population. In the v region, average heterozygosity per nucleotide was very low in both populations (pi = 0.0005 in the Burma population, and 0.0009 in the India population). These estimates are significantly lower than those from loci in more distal gene regions. The distribution of DNA polymorphisms between both populations was also striking. At fw, three fixed differences between the Burma and India populations were detected (two restriction site differences and one insertion/deletion of approximately 2 kb). At v, each DNA polymorphism in high frequency in the total sample was nearly fixed in one or the other population, although none of them reached complete fixation. The observed pattern of reduced variation within populations and fixed differences between populations appears to correlate with recombination rate. We conclude that recent hitchhiking associated with directional selection is the best explanation for this pattern. The data indicate that different selective sweeps have occurred in the two populations. The possible role of genetic hitchhiking in rapid population differentiation in gene regions of restricted recombination is discussed.

1799 YAMAOKA, Y; KAWAMURA, Y; MURAKAMI, R. 1988. **A complicated symbiosis in the lower termite *Reticulitermes speratus (Koilbe)***. *Annals of Entomology*, 6: 2, 57-62.

Insect pests control

1800 Entomology/nematology. *Thirty ninth annual report 1985-86*, Central Coffee Res. Inst., Coffee Res. Sta., 577 117, Chikmagalur District, Karnataka, India. 90-212.

The results are presented of investigations in India (mainly Karnataka) on the biology and control of insect pests (and some natural enemies) and nematode pests of coffee (and shade trees). The coffee insects dealt with include *Xylotrechus quadripes*, *Xylosandrus compactus*, *Planococcus citri* (including biological control), *Coccus viridis* and *Holotrichia spp*. Many other pests and natural enemies are listed. The major nematode pests dealt with are 3 species of *Hemicriconemoides*, but several other genera are listed.

1801 ANANTHAKRISHNAN, TN. 1992. **Emerging trends in biological control of phytophagous insects**. New Delhi: Oxford & IBH, 255 p.

This volume is based on the proceedings of a National Symposium on Emerging Trends in Biological Control of Insects held at the Entomology Research Institute, Loyola College, Madras, India, in January 1991. The 29 chapters, by various authors, discuss current research and future prospects in the use of nematodes, parasitoids, insect predators, fungi, bacteria, viruses, neuropeptides, host plant resistance and genetic engineering for the control of insect pests, with emphasis on pests of crops occurring in India. Species, subject and author indexes are included.

1802 CHOWDHURY, N; KORENAGA, M; MIMORI, T; TADA, I. 1985. **In vitro culture of *Strongyloides ratti* larvae**. *Japanese Journal of Parasitology*, 34: 4, 229-235; 8 ref.

Axenic culture of *S. ratti* L4 and infective and parasitic L3 in various defined and complex media under different gas phases at 37°C showed infective free-living L3 to be aerobic. Parasitic L3 may be maintained under CO2 for up to 11 days in RPMI 1634, 8 days in 90:10 MEM (double concentration): duodenal fluid, and up to 8 days under O2 in Hanks' solution. Parasitic L3 and L4 moult best under CO2 + O2 in NCTC 135 (73.1 and 64.5% respectively), RPMI 1640 (70.8 and 62.7% respectively) and Medium 199 (65.7 and 59.1% respectively).

1803 KAPUR, J; SOOD, ML. 1984. **Amino acid biosynthesis in *Haemonchus contortus* from C14-labelled precursors, in vitro**. *Veterinary Parasitology*, 15: 3/4, 293-299; 20 ref.

Adult *H. contortus* were able to synthesize essential and non-essential amino acids. Glutamic acid, aspartic acid, alanine, glycine and serine were synthesized to a greater extent than the other amino acids, regardless of the precursor used (glucose, acetate, CO2, palmitic acid). However, with glucose there was comparatively less

incorporation into glycine and serine. It is concluded that the tricarboxylic acid cycle operates in *H. contortus* and that *H. contortus* is capable of catabolizing long-chain fatty acids.

1804 KAPUR, J; SOOD, ML. 1984. ***Haemonchus contortus*: lipid biosynthesis from C14-labelled acetate and glucose**. *Z. fur Veterinarmedizin, B*, 31, 225-230.

Incorporation studies with labelled substrates showed that adult *H. contortus* has extremely active mechanisms for synthesizing all classes of complex lipids including free cholesterol. More of the label from acetate was incorporated into total lipids than from glucose. The ratio of synthesis of polar:non-polar lipids was 3.991 with acetate and 1.223 with glucose. Among non-polar components, most of the label from acetate was incorporated into free fatty acids, triacylglycerols, hydrocarbons and pigments, whereas label from glucose was incorporated into triacylglycerols and free fatty acids only. Among polar lipids most of the label from acetate was incorporated into phosphatidyl choline and from glucose into phosphatidyl choline and phosphatidyl ethanolamine.

1805 PADHI, NN; DAS, SN. 1985. **Intra-uterine embryogenesis in *Helicotylenchus abunaamai* Siddiqi, 1972**. *Ind. J. of Nematology*, 15: 1, 125-126; 7 ref.

Intra-uterine embryogenesis is described in *H. abunaamai*. It is suggested that it is a result of unfavourable environmental conditions.

1806 PAWAR, CS; BHATNAGAR, VS; JADHAV, DR. 1985. **Some predatory insects and their parasites**. *Science and Culture*, 51: 3, 101-102; 1 ref.

Lists are given of recently discovered insect and nematode parasites of the predators of insect pests of gramineous and leguminous crops in Andhra Pradesh, India. The predators were the coccinellid *Menochilus sexmaculatus*, which fed on mites, aphids and eggs and larvae of noctuids of the genus *Heliothis*; eumenids of the genus Delta, which also preyed on *Heliothis* larvae; the syrphid *Xanthogramma scutellaris* [*Ischiodon scutellaris*], which preyed on aphids infesting sorghum, maize and pearl millet; *Chrysopa spp.*, which fed on aphids and eggs and small larvae of other insects on maize, sorghum, groundnut, safflower and *Vigna radiata*; and *Mantis spp.*, which were general predators of insects on pigeonpea [*Cajanus cajan*]

1807 PRASAD, RS; SINGH, RP. 1983. **Studies on immunity produced by irradiated infective larvae of *Haemonchus contortus***. *Haryana Agricultural University Journal of Research*, 13: 2, 183-190; 17 ref.

Four goats were inoculated intravenously with divided doses of serum collected and pooled from goats which had been double vaccinated with irradiated *H. contortus* larval vaccine before or after the latter had been challenged with infective larvae. Challenge of the passively immunized goats 48 hours after serum inoculation, along with controls, produced PM worm burdens indicating 47% protection in animals given serum from vaccinated goats and 67% protection in animals given serum from vaccinated and challenged goats. Cell mediated immunity, as indicated by the leukocyte migration inhibition test, did not seem to be involved. Polyacrylamide gel electrophoresis showed a significant increase in beta globulins in vaccinated animals. Countercurrent electrophoresis was a promising test for detecting immunity.

1808 SWARUP, G; DASGUPTA, DR. 1986. **Plant parasitic nematodes of India.** Indian Agricultural Research Institute, New Delhi, India. 497 p.

This book contains 27 chapters by different authors on a variety of subjects concerning nematology in India. Chapter 1 deals with the achievements of nematological research in India in the last 25 years and outlines future prospects, while chapters 2-4 deal with the general morphology, taxonomy and physiology of nematodes. The next 8 chapters give individual accounts of the root-knot and cyst forming nematodes, *Rotylenchulus reniformis*, *Pratylenchus spp.*, *Radopholus similis*, *Tylenchulus semipenetrans*, *Fergusobia spp.* and entomophilic nematodes. Chapter 13-21 assess the effect and control of plant parasitic nematodes on rice, wheat, vegetables, pulse crops, oilseed crops, potatoes, tobacco, mushrooms and sugarcane. The last 6 chapters review the transmission of plant viruses by nematode vectors, nematode management and newer approaches to nematode control, plant resistance, biological control and quarantine methods. Some of the reference lists at the end of chapters are incomplete due to time and space constraints but a full list of references is available from the editors.

WEEDS

1809 IMAM, MM; MIRZA, MY; AHMAD, H. 1987. **Role of biotechnology in weed control**. *Progressive Farming*, 7: 1, 62-64.

Weed biology and conventional weed control methods are discussed and consideration is given to the role of