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MOSQUITO CONTROL POTENTIAL OF BACILLUS THURINGIENSIS SUBSP ISRAELENSIS AND BACILLUS SPHAERICUS

Among several biocontrol agents, extensive studies have been carried out on two potential bacterial candidates, *viz, Bacillus thuringiensis* subsp. *israelensis* (BTI) and *Bacillus sphaericus* (BS). The first strain of BTI belonging to the serotype H14 was isolated in 1977, in Israel[1]. The first strain of mosquito larvicidal BS belonging to serotype H5a5b was isolated in 1965 in the USA[2]. Thereafter several strains belonging to different serotypes of these two species have been isolated. While strains of BTI are active against both mosquito and blackfly larvae[1], those of BS are active against only mosquito larvae[2]. Both these organisms are found to occur naturally in most of the mosquito breeding sites.

Many formulations of these bacteria have recently become operational and some of them have also been registered in India. Those that have been tested extensively for mosquito control include wettable powder (WP), flowable concentrates (FC), granules (G), microgels (MG) and slow release formulations (SRF). The present review summarises the results of field experiments that have been carried out with some of the formulations.

Bacillus thuringiensis Subsp. israelensis

Control of anophelines

Prasertphon and Knudsen[3] studied the efficacy of Rogor Bellon WDP (10 mg/l) to ditches and laterite ponds against *Anopheles gambiae* and obtained 75-100 per cent control (Table I). Garcia *et al*[4] have reported (here and in their unpublished report of 1980) 100 per cent control against *An. franciscanus* with Bactimos (1 kg/ha) in fresh water pools and rivers with algal mats. Sudomo *et al*[5] used BTI (2 l/ha) in brackish water lagoons against *An. sundaicus* and *An. subpictus* and obtained near 100 per cent control. Garcia *et al*[6] used SAN 402 WDC in salt marshes (5 kg/ha) and rice fields (2-3 kg/ha) against *An. freeborni* and *An. punctipennis* and got 86-100 per cent control. Application of Bactimos (WP) to troughs, pools and rice fields at 1 kg/ha controlled *An. albimanus* for 4-8 days[7] and Bactimos FC (5 l/ha) resulted in 98-100 per cent control of anophelines[8]. When there was a relatively sharp decline in larval mortality 48 h post-treatment, Bactimos (FC) was reapplied suggesting five-day applications to prevent pupal production. Jambulingam *et al*[9] studied three formulations, *viz.* Deltox (10 kg/ha), Bactimos

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Table I. Effect of different formulations of *B.t.* subsp *israelensis* on the larvae of target vector species

Target vector species	Formulation	Dosage	% Reduction	Reference
An. albimanus	Bactimos	1 kg/ha	100	7
An. arabiensis	Vectobac 12AS and Vectobac G	1.17 l/ha 2.5 kg/ha	100	13
Anophelines and culicines	Bactimos	5 l/ha	98-100	8
An. gambiae	Rogor Bellon	10 mg/l	75-100	3
An. franciscanus	Bactimos	1 kg/ha	100	4
An. sundaicus and *An. subpictus*	BTI	2 l/ha	100	5
An. freeborni and *An. punctipennis*	SAN 402WDC	2-5 kg/ha	86-100	6
An. culicifacies and Anopheles spp.	Deltox Bactimos Teknar	10 kg/ha 10 kg/ha 30 l/ha	60-100 100 82-100	9
Cx. quinquefasciatus	Bactimos	1.5 briq/11 m^2	100 (10days)*	19
Cx. quinquefasciatus	Deltafix	10 kg/ha	37-100 (>8 weeks)*	23
Aedes spp	Vectobac	2.8-5.6 kg/ha	>98	25
Ae. vexans	SAN 402SC98 and ABG 6188	0.25 l/ha 1 l/ha	>97	24
Aedes spp.	Acrobe	4.68 l/ha	88.5	26
Ae. tarsalis & Cs. inornata	Vectobac+Sand	6.7 kg/ha	70-100	27
Aedes spp.	Bactimos	2.8-5.6 kg/ha	>98	25

*Data in parentheses indicate period of residual activity.
In other cases the residual activity was restricted to < 3 days.

(10 kg/ha) and Teknar 30 l/ha) for their efficacy against *An. culicifacies* and *Anopheles* spp breeding in casuarina garden pits and achieved 60-100 per cent, 100 per cent and 82-100 per cent control respectively, with 24 h residual activity. When the treatments were repeated five times at weekly intervals there was no increase in the residual activity suggesting that weekly applications were required for effective suppression of pupal production. Three granular formulations, Vectobac (22.4 kg/ha), Bactimos (11.2 kg/ha) and Teknar (7.5 kg/ha) were applied to rice fields against *An. crucians* and *An. quadrimaculatus* resulting in 96-100 per cent control[10]. Application of Teknar resulted in 100 per cent reduction in the larval density of the malaria vector, *An. albimanus* for at least 10 days[11]. Yu and Yu[12] have applied a 20 per cent dust preparation over an area of 283 ha of rice fields at 8 day intervals and observed 90 per cent reduction in the density of *An. sinensis* with concomitant and significant reduction in malaria cases. Romi *et al*[13] treated the ponds and rain water ditches with Vectobac granules (2.5 kg/ha) and Vectobac 12AS FC (1.17 l/ha) for the control of *An. arabiensis* and

obtained very good control. Balakrishnan *et al*[14] used Deltox briquettes (36 kg/ha) in casuarina garden pits against *An. subpictus* and reported 84 per cent control for more than 29 days.

Control of culicines

Garcia *et al*[15] tested Bactimos FC (2.4 kg/ha) in fresh water habitats against *Culex* spp. and got 93 per cent control. Other workers[16] have tested three granular formulations (5.5-55 kg/ha) against *Psorophora columbiae* and obtained 96-99 per cent control. Majori *et al*[17] applied ABG 6138 corn cob granules (5.6 kg/ha) to sullage water against *Cx. quinquefasciatus* resulting in more than 91 per cent control. Drains of Dhaka city treated with Teknar at 3 l/ha resulted in complete control of *Cx. quinquefasciatus* for 7 days[18]. Treatment of stagnant water with Bactimos (0.5 kg/ha) against *Cx. quinquefasciatus* resulted in good control for 28 days[19] Yu and Yu[12] have applied a 20 per cent dust of preparation over an area of 8.4 km^2 (of which polluted water formed 2.46 ha) at 8 day intervals and observed 76 per cent reduction in the density of *Cx. quinquefasciatus* with concomitant and significant reduction in the density of adult mosquitoes. Floore *et al*[20] applied Vectobac 12AS (FC) against *Cx. quinquefasciatus* and *Cx. nigripalpus* and found that it was as good as that of a vegetable oil formulation (Jaxoil) and a mineral oil (GB 1111) in efficacy.

Application of Bactimos briquettes (1.5 briquette/11 m^2) controlled larvae of *Cx. quinquefasciatus* for 10 days in a stream with stagnant water[19]. Schmidt[21] applied Bactimos briquettes (10%) and Clarke 5 per cent Specter Abate (temephos) to ponds and observed that both the preparations performed to their label specifications. But he noted that Bactimos briquettes provided a longer period of control. In another study the Bactimos briquette was tested against ground pool breeding mosquitoes in 3 separate treatment areas[22]. Mosquitoes in the site treated with 1 briquette/1.5 m^2 on day 13 post-flood had 25 per cent survival rate when compared to 67 per cent in the control site during the third generation of *Culex* spp (22-26 days post flood). This five-fold increase above the standard label dosage still failed to prevent *Culex* spp emergence. Arunachalam *et al*[23] applied a SRF, Deltafix (10 kg/ha) against *Cx. quinquefasciatus* breeding in disused wells and observed 88-93 per cent initial control and residual activity for more than 8 weeks with 37-100 per cent control.

Control of aedes and other mosquitoes

Application of FCs, SAN 402 SC98 (0.25 l/ha) and ABG 6188 (1 l/ha) resulted in >97 per cent control of *Aedes vexans*[24]. Floore *et al*[20] have found Vectobac-12AS (Fc) as good as a vegetable oil formulation (Jaxoil) and a mineral oil (GB 1111) in controlling *Aedes taeniorhynchus*. Wilmot *et al*[25] used Vectobac and Bactimos corn cob granules (2.8-5.6 kg/ha) against *Aedes* spp and achieved more than 98 per cent control. Knepper *et al*[26] tried Acrobe FC (4.68 l/ha) against *Aedes* spp and obtained 88.5 per cent control. Application of Vectobac sand granules (4% ai) at 6.7 kg/ha in 17 sites resulted in 70-100 per cent control of *Ae. tarsalis* and/or *Culiseta inornata*[27]. Logan and Linthicum[22] applied Bactimos briquettes in ground pools against *Aedes* spp and observed a survival rate of 64 per cent in treated areas compared to 92 per cent in control areas.

Bacillus sphaericus

Control of anophelines

Karch *et al*[28] attempted to control *An. gambiae* in rice fields and swamps with a granular formulation (10 kg/ha) (Table II). Ten treatment cycles with 15 day intervals were carried out. The treatments reduced larval populations by 98 per cent after 48 h but applications were required to be repeated every 15 days to maintain control. This provided a decrease of 13.6 per cent in human biting density of *An. gambiae* during the post-treatment period. The efficacy of BS does not appear to offer outstanding potential for control of *An. gambiae* in rice fields and swamps and seems to be limited due to different factors tied to ecology and natural conditions in the fields. Sundararaj and Reuben[29] tested a microgel droplet formulation of the strain 1593M (2.2 and 4.3 kg/ha) in rice fields against *An. subpictus*. They noted that a single application, just after transplantation of rice seedlings prevented the build up of anopheline populations and gave 83-100 per cent reduction of pupal density at the lower dosage and 87-100 per cent reduction at the higher dosage for 5 weeks.

Control of culicines

Mullla *et al*[30] applied BSP-2 FC (5.6 l/ha) to dairy waste water lagoons against *Cx. quinquefasciatus* and

Table II. Effect of different formulations of *B. sphaericus* on target vector species

Target vector species	Formulation	Dosage/ha	% Reduction	Reference
An. arabiensis	ABG 6185	18 kg	93	13
An. gambiae	Vectolex G	10 kg	98 (15 days)*	28
Cx. peus and	ABG 6184	4.48 kg	100	
Cx. quinquefasciatus	BSP-2 and	5.6 l	(4 weeks)*	30
	ABG 6185	22.4 kg	>80	
Cx. sitgmatosom	ABG 6184	2.24kg	90	32
	and BSP-2	4.48 kg	(4 weeks)*	
Cx. pipiens	Vectolex	4 l	100	28
Cx. quinquefasciatus	Vectolex	45 l	85	
	Spherimos	15 l	96-100	39
	Spherifix	10 kg	59-87 (63-67 days)*	
Culex spp.	Vectolex G	5.6 kg	77-100	37
Cx. vishnui gr and *An. subpictus*	Microgel 1593M	2.2-4.3 kg	83-100 (5 weeks)	29

*Data in parentheses indicate period of residual activity.
In other cases the residual activity was restricted to < 3 days.

observed complete initial and persistent control for 14-21 days. Mittal *et al*[31] tested BIOCID-S dust (2.7 kg/ha) in polluted ponds against *Culex* spp and observed 58-89 per cent control. Matami *et al*[32] tested BSP-2 (4.8 l/ha) as well as ABG-6184 (FC; 2.24 l/ha) and noted that in both cases there was a reduction of about 90 per cent in the density of *Cx. stigmatosoma* for 4 weeks[31]. Hougard[33] used a FC formulation (10 kg/ha) in cess pits against *Cx. quinquefasciatus* and observed very good control with 5-6 weeks residual activity. He also tested two formulations *viz. a* WP formulation of the strain 1593 and FC formulation of the strain 2362 in cess pits against *Cx. quinquefasciatus* and noted that the latter (10 kg/ha) gave better results with 5-6 weeks of residual activity. This persistence is considered to be due to the slow settlement rate of the spore in the polluted water and due to protection of the toxin from UV light. Karch *et al*[28] applied Vectolex (4 l/ha) four times during a period of 14 days in water treatment settling basins to control *Cx. pipiens* and noted good reduction in the larval population. Application of Spherimos FC in septic tanks produced control of *Cx. quinquefasciatus* breeding for 28 days[19].

Yap *et al*[34] reported 90 per cent control of *Cx. quinquefasciatus* in swampy ditches with a WP formulation (2.86 kg/ha) but with no residual effect. Treatment of 157 sites (river, ponds, dams and pits) with a liquid formulation (10 l/ha) for the control of *Cx. quinquefasciatus* produced 100 per cent mortality within 24 h of treatment in all the habitats with a residual activity for 5 months and a reduction in the mean number of mosquitoes landing on human baits[35].

Mulla *et al*[30] applied ABG 6185 (22.4 kg/ha) and observed more than 80 per cent control of *Cx. quinquefasciatus* breeding in waste water lagoons for 14-21 days. A 90 per cent control of *Cx. quinquefasciatus* has been reported[34] in swampy ditches with a corn cob granular formulation (5.4 kg/ha). Sutherland and McNelly[36] applied Vectolex G (5.2 kg/ha) by aircraft to a waste water treatment facility for the control of culex larvae and observed very good reduction in the density for 14 days. Application of the same formulation (5.6 kg/ha) to a sewage treatment plant by helicopter resulted in 77-100 per cent control[37]. Bhalwar *et al*[38] got about 93-100 per cent control of culicines for 28 days by using

a dust formulation (22.6 kg/ha) of the strain 1593. Application of a microgel droplet formulation (2.2 and 4.3 kg/ha) to rice fields against culicine vectors of Japanese encephalitis resulted in 83-100 per cent reductions of pupal density for 5 weeks[29].

Schmidt[21] tested the efficacy of a briquette formulation (1 briq/100 ft^2) in 5 different habitats against *Culex* spp and noted that in all the habitats control was maintained for 11-17 days. Arunachalam *et al*[39] have reported 96-100 per cent, 85 per cent and 59-87 per cent control of *Cx. quinquefasciatus* for 67, 63 and 67 days, respectively, after the application of Spherimos FC (15 1/ha), Vectolex FC (45 1/ha) and Spherifix SLF (10 kg/ha) to polluted wells.

Control of aedes and other mosquitoes

Pradeepkumar *et al*[40] tested a briquette formulation (15 kg/ha) against *Mansonia* spp in weed infested ponds and reported 72-97 per cent control for 31 days. Bowles *et al*[41] applied ABG 6232 (2.3 1/ha) and observed a reduction of more than 84 per cent in the larval density of *Psorophora columbiae* 2 days post-treatment and 70 per cent 10 days post-treatment.

Conclusions

The available information indicates that the two bacterial candidates can be used for controlling the prolification of vector mosquitoes, especially, *B. t.* subsp. *israelensis* for the control of anophelines and *B. sphaericus* for the control of culicines. Further, it can be noted that the conventional formulations (WP, FC and G) of the two candidates cause rapid and significant level of larval mortality but with very little residual activity necessitating weekly application to keep mosquito breeding under check. In order to control mosquito breeding in a wide variety of habitats, the formulations should ensure the delivery of the active ingredients to the habitat(s) permitting sustained contact with the target organism. The data on the use of controlled/slow release and microgel formulations show that it is possible to control breeding of vector mosquitoes for prolonged periods under certain situations, with one time application of the formulation.

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ABSTRACTS

Some Research Projects Completed Recently

Receptors, growth factors and oncogenes in human breast cancer.

A prospective study was carried out on 150 breast cancer patients to evaluate the potential prognostic significance of various growth factors. The markers investigated were serum epidermal growth factor (EGF) and its receptor (EGFR), C erb B2 oncoprotein and insulin like growth factor-1 receptor (IGF-1R).

Twenty one per cent patients had stage II and the rest had advanced (stage III and IV) disease. Majority of the patients had histological grade II and III tumours (28 and 65% respectively). Of the 150 patients, 58 node positive patients showed C erb B2 expression as compared to 18 node negative patients. The overall survival of patients was significantly unfavourable for patients with node positive, C erb B2 positive breast tumours. There was a significant difference in mean levels of EGF and overall survival in stage II and advanced breast cancer. There was no difference in overall survival in EGFR negative and positive patients.

A total of 21 patients (14%) had tumours positive for IGF-1R and the overall survival was significantly better in them when compared to IGF-1R negative patients.

In the univariate analysis, significant differences in overall survival was not observed for patients with C erb B2 negativity, EGF < 1.0 ng/ml serum and EGFR negativity than those with C erb B2 positivity, EGF > 1.0 ng/ml serum and EGFR positivity. On the other hand, the difference in the overall survival in two subgroups of IGF-1R was statistically significant. IGF-1R was found to be an independent predictor of short-term prognosis in advanced breast cancers.

The multivariate analysis in patients with advanced breast cancers showed that patients who were C erb B2 positive, EGFR positive and IGF-1R negative and had EGF > 1.0 ng/ml had worse prognosis as compared to those who were C erb B2 negative, EGFR negative, IGF-1R positive and had EGF < 1.0 ng/ml.

Based on these observations, stage II patients could be grouped as high-risk (C erb B2 positive, EGFR positive and IGF-1R negative) and low-risk (C erb B2 negative, EGFR negative and IGF-1R positive) groups.

It is thus concluded that the presence of IGF-1R in tumours tissue indicates a good prognosis and over expression of C erb B2 and EGFR with absence of IGF-1R is suggestive of a worse prognosis.

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Ahmedabad.

Selenium in treatment of cancer in animal model system and its mechanism of inhibition of carcinogenesis.

The study was carried out in inbred Sprague-Dawley male rats to find out the optimum dose and mechanism by which selenium functions as an anticarcinogenic agent and to correlate the anticarcinogenic potential of selenium to the activities of oxidative and nonoxidative enzymes associated with the metabolism of carcinogens. Among the three selenium compounds studied selenocystine, selenomethionine and sodium selenite, selenomethionine (8 ppm in drinking water) was selected because it was least cytotoxic and had maximum efficacy in reducing preneoplastic hepatic foci.

It was found that the inhibitory effects of selenomethionine were primarily exerted on the initiation

phase of the hepatocarcinogenic process. However, a continuous long-term exposure would confer a greater degree of protection. Selenomethionine increased the cytochrome P-450 levels and the activities of TPNH-cytochromec reductase and arylhydrocarbon hydroxylase. It caused a decrease in the activities of UDP-glucoronyl transferase and glutathione-s-transferase. Concentrations of selenium were found to be significantly less in hepatomas/nodules than the surrounding areas in both selenium supplemented and non-supplemented groups of carcinogen treated rats. The concentration of selenium in the carcinogen treated livers was greater than that of carcinogen controls.

It is concluded from the present findings that the inhibitory effects of selenomethionine were primarily exerted on the initiation phase of the hepatocarcinogenic process. However, continuous long-term exposure to selenomethionine could confer a greater degree of protection preventing lipid peroxidation and cellular protein damage.

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ICMR NEWS

The following meetings of various technical groups/ committees of the Council were held:

Meetings of the Scientific Advisory Committees of the Permanent ICMR Institutes/Centres:

National Institute of Virology, Pune	March 21,1995 (at Pune)
Regional Medical Research Centre for N.E. Region, Dibrugarh	March 21-22, 1995 (at Dibrugarh)
National AIDS Research Institute, Pune	March 22, 1995 (at Pune)
Institute of Cytology and Preventive Oncology, New Delhi	March 25, 1995 (at New Delhi)
National Institute of Cholera and Enteric Diseases, Calcutta	March 27, 1995 (at Calcutta)
Regional Medical Research Centre, Bhubaneswar	March 28, 1995 (at Bhubaneswar)

Other Meetings held at New Delhi:

Annual Review Meeting of the Human Reproduction Research Centres	April 11-12, 1995

Participation of ICMR Scientists in Scientific Events:

Dr. A.R. Risbud, Asstt. Director, National AIDS Research Institute, Pune, participated in the IUVDT World STD/AIDS Congress 1995 at Singapore (March 19-23, 1995).

Dr. P. Gurumurthy, Asstt. Director, Tuberculosis Research Centre, Madras, participated in IV European Symposium on Saliva in Clinical Practice and Research at Berlin (March 22-24, 1995).

Dr. B.N. Saxena, Senior Dy. Director-General, ICMR, participated in the meeting of the Steering Committee of the WHO Task Force on Research on Introduction and Transfer of Technologies for Fertility Regulation at Geneva (March 27-31, 1995).

Dr. G.V. Satyavati, Director-General, ICMR, presided over the inaugural session of the National Conference of the Indian Association for the Study of Liver Diseases at New Delhi (April 8, 1995).

Dr. G.V. Satyavati participated in the XXI Session of the WHO South-East Asia Advisory Committee on Health Research at New Delhi (April 10-13, 1995). Dr. V.P. Sharma, Director, Malaria Research Centre, Delhi, also participated in the above meeting.

COUNCIL'S TRAINING PROGRAMMES FOR 1995-96

Virology

At the National Institute of Virology, Pune:

- Diploma in Medical Virology (June 1995 - May 1996).

Reproductive Biology

At the Institute for Research in Reproduction, Bombay:

- Training Course on Techniques in Human Semenology (May 15 - June 2, 1995).
- Training Course on Techniques in Immunology, Cell Biology and Molecular Biology (November 2-25, 1995).
- Training Course on Techniques in Neuroendocrine Research (February 6-10, 1996).

Endocrinology

At the National Institute of Nutrition, Hyderabad:

- Annual Training Course on Endocrinological Techniques and their Application (August/September, 1995).

Nutrition

At the National Institute of Nutrition, Hyderabad:

- M.Sc. in Applied Nutrition (June 1, 1995 - February 28, 1996).
- Annual Training Course in Nutrition (December 1, 1995 - February 28, 1996).

Oncology

At the Institute of Cytology and Preventive Oncology, New Delhi:

- Workshop on Molecular Biology of Viruses and Cancer alongwith Oligo DNA Synthesis and Polymerase Chain Reaction (September 18-22, 1995).

Occupational Health

At the National Institute of Occupational Health, Ahmedabad:

- Orientation Course on Occupational Health for Industrial Medical Officers (November 13-24, 1995).
- Training Course on Air Pollution Monitoring and Risk Assessment (December 13-19, 1995).

Medical Entomology

At the Vector Control Research Centre,Pondicherry:

- M.Sc. in Medical Entomology (From August 1995: for 2 years).

Laboratory Animal Technology

At the Laboratory Animal Information Services Centre, National Institute of Nutrition, Hyderabad:

- Training Course for Laboratory Animal Technicians (June - July, 1995).

Haematology

At the Institute of Immunohaematology, Bombay:

- Training Course in Blood Group Serology and Blood Bank Methodology for Medical Officers (August 1 - September 29, 1995).
- Training Course in Blood Group Serology and Blood Bank Methodology for Technicians (August 1-31, 1995).
- Training Course in Advanced Haematology and Immunohaematology (September 11-29, 1995).

ICMR PUBLICATIONS

	Price (Rs.)
Nutritive Value of Indian Foods (1985), by C. Gopalan, B.V. Ramasastri and S.C. Balasubramaniam, Revised and Updated (1989), by B.S. Narasinga Rao, K.C. Pant and Y.G. Deosthale	21.00
Growth & Physical Development of Indian Infants and Children (1972, Reprinted 1989)	10.00
Studies on Weaning & Supplementary Foods (1974, Reprinted 1986)	6.00
Studies on Pre-School Children (1974, Reprinted 1986)	6.00
A Manual of Nutrition (Second Edition 1974, Reprinted 1992)	4.50
Low Cost Nutritious Supplements (Second Edition 1975, Reprinted 1994)	4.00
Menus for Low Cost Balanced Diets and School Lunch Programmes Suitable for South India (Third Edition 1977, Reprinted 1991)	4.50
Menus for Low Cost Balanced Diets and School Lunch Programmes Suitable for North India (Second Edition 1977, Reprinted 1994)	4.50
Some Common Indian Recipes and their Nutritive Value (Fourth Edition 1977, Reprinted 1991) by Swaran Pasricha & L.M. Rebello	10.00
Nutrition for Mother & Child (Third Edition 1978, Reprinted 1991) by P.S. Venkatachalam & L.M. Rebello	9.00
Japanese Encephalitis in India (Revised Edition 1980)	5.00
Some Therapeutic Diets (Fourth Edition 1988, Reprinted 1992) by Swaran Pasricha	4.50
Nutrient Requirements & Recommended Dietary Allowances for Indians (1990, Reprinted 1992)	13.00
Fruits (1983, Reprinted 1992) by Indira Gopalan & M. Mohan Ram	7.00
Count What You Eat (1989, Reprinted 1991) by Swaran Pasricha	9.00
Diet & Diabetes (Second Edition 1993) by T.C. Raghuram, Swaran Pasricha & R.D. Sharma	18.00
Dietary Tips for the Elderly (1990, by Swaran Pasricha & B.V.S. Thimmayamma	3.50
Diet and Heart Disease (1994) by Ghafoorunissa and Kamala Krishnaswamy	26.00
*Depressive Disease (1986) by A. Venkoba Rao	58.00
**Medicinal Plants of India Vol.2 (1987)	136.00
**The Anophelines of India (Revised Edition 1984) by T. Ramachandra Rao	150.00

*10 per cent discount allowed to individuals. **25 per cent discount allowed to individuals.

These publications are available on prepayment of cost by cheque, bank draft or postal order (bank and postal charages will be extra) in favour of the Director-General, Indian Council of Medical Research, New Delhi. Money orders are not acceptable. All correspondence in this regard should be addressed to the Chief, Division of Publication and Information, Indian Council of Medical Research, Post Box No.4911, Ansari Nagar, New Delhi-110029 (India).

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