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DIURNALLY SUBPERIODIC BANCKOFTIAN FILARIASIS IN ANDAMAN AND NICOBAR GROUPS OF ISLANDS, INDIA

Lymphatic filariasis is a major public health problem in many tropical countries with over 751 million people at the risk of infection[1]. India alone accounts for about a third of them. There are 22 million carriers of microfilaria (mf) in India and a further 16 million have symptoms and sign of filariasis[2]. *Wuchereria bancrofti* causing Bancroftian filariasis is the most prevalent species accounting for about 98% of mf carriers and is distributed widely in India. Brugian filariasis caused by *Brugia malayi* has a restricted distribution and is reported to occur in Kerala, Assam, Madhya Pradesh, Tamil Nadu, Andhra Pradesh and Orissa with over 90 million people at the risk[3]. Bancroftian filariasis is transmitted by *Culex quinquefasciatus* (ubiquitous breeder in polluted habitats) while Mansonioides mosquitoes that breed in close association with hydrophytes such as *Pistia, Eichhornia* and *Salvinia* are the vectors of brugian filariasis[4]. The subperiodic form of lymphatic filariasis transmitted by *Aedes niveus* in India is prevalent only in the Nicobar group of Andaman and Nicobar islands[5-10]. Prevalence, epidemiology, vector incrimination and control of this form of lymphatic filariasis in these islands is reviewed in this report.

Andaman and Nicobar Islands : Topography and Climate

The Andaman and Nicobar islands, big and small, lie as a long and narrow broken chain in the Bay of Bengal between 6° and 14° N latitude and 92° and 94° E longitude (Fig). The Union Territory of Andaman and Nicobar groups of islands is cut off from the mainland by a vast expanse of sea. Approximately 300 islands are grouped into two districts, Andaman and Nicobar. They are elevations of continuous submerged ridge which extends almost up to Australia. On the Eastern side of the ridge lie Sumatra, Java, Bali and other islands of Indonesia. The Andaman and Nicobar groups of islands are separated from each other by a ten degree channel. Ranges of low hills enclosing narrow valleys are characteristic topographic feature of Andamans, while the Nicobar group is generally flat except Great Nicobar and Nancowry group which are hilly. The soil of the Nancowry group is porous coral sand, which quickly absorbs the rainwater leaving hardly any stagnation. The total surface area of these islands is 8249 sq. km.

Both the groups of islands are rich in tropical forests and natural vegetation. Only a small part of the land is under wet cultivation. Considerable areas are under coconut and arecanut plantations. The climate is highly humid (relative humidity about 80%) with a warm temperature ranging between 23°C and 30°C. The area receives heavy rainfall from May to January, influenced by both south-west (May to October) and north-east (November to January) monsoon. In other months rainfall is generally low with February being the driest month. The average annual rainfall is about 2500 mm (10 yr average).

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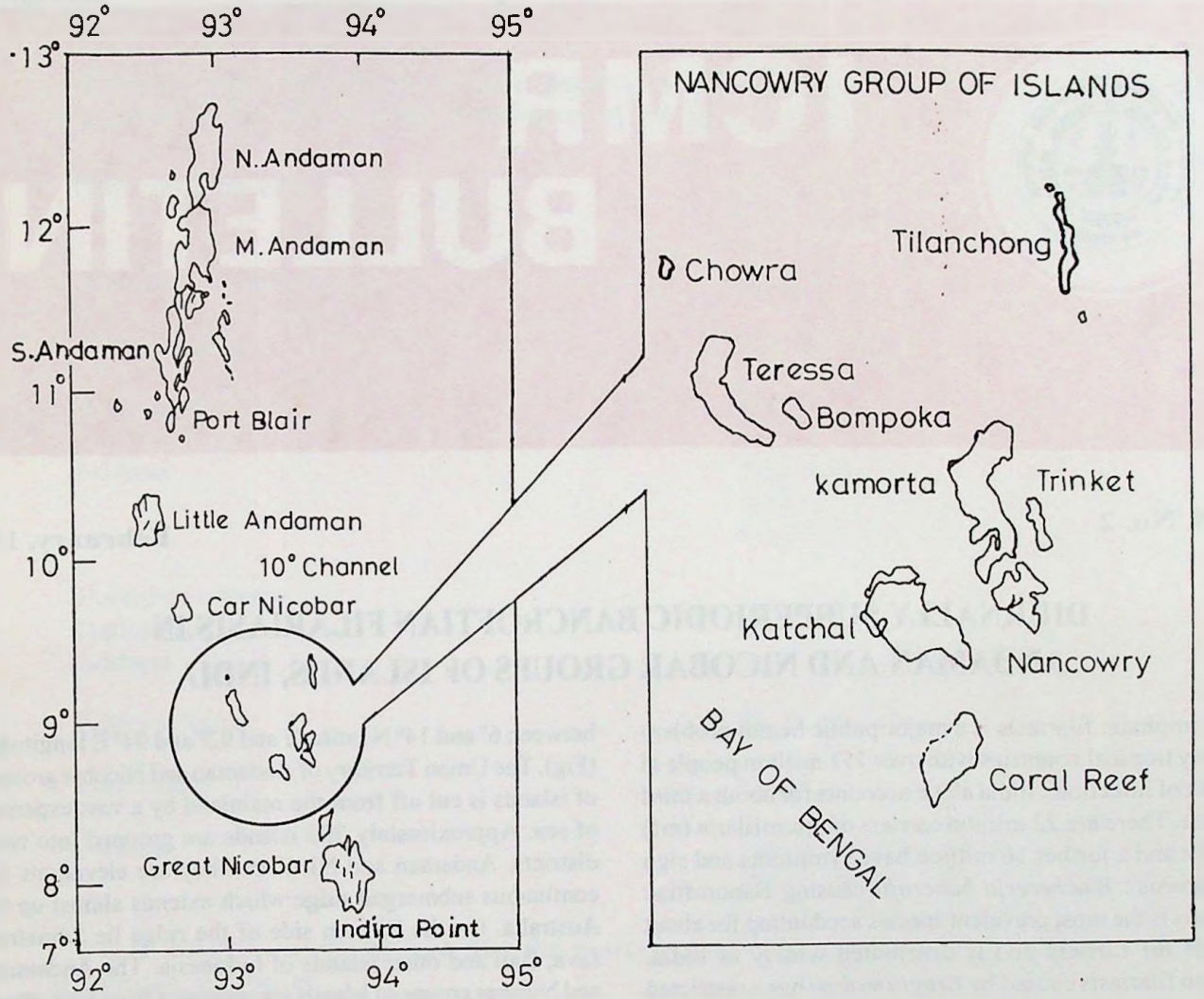


Fig. Andaman & Nicobar Islands

Population, Housing and Socio-Economic Conditions

The total population of Andaman and Nicobar islands is 2,80,661 (1991 census)[1]. Ex-convicts and their descendants, and people from mainland make up the population of Port Blair. The tribal population constitutes 7.9% of the total population. The tribes of Andaman and Nicobar islands can be broadly divided into two distinct racial groups–Negreto in the Andamans and Mongoloid in the Nicobar. The vast majority of the tribal population live in the Nicobar district. Six tribes (Great Andamanese, Onges, Jarawas and Sentinelese of Negreto group and Shompen and Nicobarese of Mongoloid group) inhabit different remotely located islands. Apart from these tribes, mainlanders, for administrative and business purposes also stay on different islands. Of these six tribes, two tribes are still hostile and inaccessible. Three tribes *ie.* Andamanese, Onges and Shompens have been rehabilitated by Andaman and Nicobar Administration and are being provided with regular free rations and other facilities. The Nicobarese depend mainly on pigs which they rear and naturally available coconuts, the rest of the food commodities being supplied from the mainland.

Most of the houses in Port Blair and the administrative headquarters of Car Nicobar and Nancowry group are constructed on wooden platforms. The aborigine tribes live in huts on stilts along the sea coast.

Water Supply and Disposal of Sewage Water

Port Blair and Car Nicobar have protected water supply. In Teressa and Nancowry, wells are the only source for potable water. Water for drinking purpose has to be

brought to Chowra island as the ground water is not suitable for drinking. This necessitates storage of rain water in drums and other containers for summer.

In Port Blair and Nancowry, sewage water is discharged in the sea through drains. In other islands no proper drainage system exists and the sewage water is either absorbed by the porous soil or accumulated as pools or pits.

Prevalence of Subperiodic Filariasis in Nicobar Group of Islands

The prevalence of lymphatic filarial infection in these islands was first identified by Wilcock as early as 1944[5]. He found that in Nicobar group 5.8% of the population surveyed were positive for *W. bancrofti*, while the Andaman group of islands was free of filariasis. Subsequently, a sample survey carried out in 1958[6], showed the prevalence of *W. bancrofti* in Port Blair (Andamans) and Nancowry (Nicobars). In Nicobar islands, 7 and 9% infection rates were detected in human population surveyed during day and night respectively.

The first report of subperiodic *W. bancrofti* among tribes was from studies by Kalra during 1974[7]. Only two villages in Kamorta island and one in Nancowry island were covered during this survey which showed mf rates of 12.3 and 1.7% respectively. Age and gender specific analysis of cases showed that the infection was confined to males only 20 years of age and above.

Russel and co-workers[8] did a day/night survey of 6250 and 491 individuals in four islands of Nicobar district and Port Blair town (Andamans). The survey showed two distinct forms of *W. bancrofti* infection *viz*, a nocturnally periodic form in Port Blair and a subperiodic form in Nancowry and Chowra islands. A low (0.3%) mf rate in Car Nicobar, medium (4.9 and 3.9%) in Port Blair and Nancowry respectively and high rates of 15.8% in Teressa and 13.4% in Chowra were recorded. Clinical manifestations were recorded among 90 of the total 6741 individuals with both men and women being affected. Elephantiasis in association with hydrocele was the commonest disease manifestation encountered during the survey.

After a gap of 15 yr, another survey was carried out during the monsoon season which confirmed the existence of subperiodic filariasis in Nicobar islands[10]. This survey showed that the mf rate was lowest in Trinket (1.2%) and highest in Kamorta (18.7%). The overall disease rate was only 1.9%, the highest being 2.5% from Chowra. Elephantiasis of the legs was the predominant disease manifestation. No information on prevalence of hydrocele is available.

Periodicity of *W. bancrofti* Microfilaria

The first study on the periodicity in the appearance of mf in the peripheral blood was done by Kalra[7] in three islands of Nancowry group. Microfilariae were observed throughout the 24 h period without any distinct peak. The density of mf was relatively lower than that of periodic form. Another such observation with 15 male volunteers from Chowra island[10] also showed that the circulating mf were present in the peripheral blood throughout the 24 h. The mf count was found to vary widely during different periods with a peak at about 18.00 h and a trough between 03.00 and 06.00 h in an individual.

Another study[9] on the periodicity of mf of this species showed the existence of nocturnally periodic form at Port Blair (Andamans) and diurnally subperiodic form in Nicobar group of islands. The existence of both forms in the same host was found in a settler in Nancowry island.

Mosquitoes Implicated in Filariasis Transmission

At least four mosquito species/species groups *viz*, *Aedes (Finlaya) niveus* group, *Ae. (Stegomyia) scutellaris* group, *Mansonia (Mansonioides) dives* and *Anopheles sundaicus* were reported to bite the aborigine tribes in the jungles of Nancowry group of Nicobar islands[7]. Only one specimen of *Ae. (Finlaya) niveus* group of mosquitoes was naturally found infected, but none was found with infective stage larva. The role of *Ae. scutellaris* which is an established vector in Thailand and Singapore[12-14] could not be ascertained during this study. In a survey by Russel and co-workers[8] later in the same group of islands (Kamorta), natural infection was found in *Cx. quinquefasciatus* collected from human dwellings. One of 150 mosquitoes was found to harbour infective stage larva. This suggests the probable co-existence of both periodic and subperiodic forms of *W. bancrofti* in Nancowry group of islands. During this survey, known vectors of subperiodic form of this species were, however, not studied. A recent study[10] showed that aborigine tribes who enter the forests are commonly bitten by *Ae. (Finlaya) niveus* and *Ae. (Stegomyia) seutellaris*. *Ae. (Finlaya) niveus* was found naturally infected with *W. bancrofti* with infection and infectivity rates of 1.1% and 0.9% respectively. *Culex quinquefasciatus* was recorded in very low densities and on dissection was not found infected.

Experimental Infection Studies

Experimental infection studies by allowing mosquitoes to feed on mf carriers of *W. bancrofti* from Nancowry and Chowra (showing mf both in day and night time blood samples) and Port Blair (periodic form) showed the development of mf to infective stage only in *Cx. quinquefasciatus*[8]. The microfilariae were observed to develop into L2 and L3 stages after 14 days postinfection. The mean number of infective larvae per mosquito did not differ significantly in Chowra and Nancowry, though there were significant differences in mf densities among carriers. However, in Port Blair the mean number of infective larvae per mosquito was significantly higher than that observed with mf carriers from Nancowry and Chowra. Only a few mosquitoes of the species *Ae. (Stegomyia) scutellaris* were fed on mf carriers and reported dead within 2-3 days after the infective blood meal.

Similar studies[10] with females of *Ae. niveus, Ae. malayensis* and *Ae. aegypti* fed simultaneously on mf carriers from Chowra (subperiodic form) in two batches were carried out. The first batch of mosquitoes were fed on a carrier with 206 mf/20 cmm, and a second batch on carriers with 300 mf/20 cmm blood at the time of feeding. *Ae. niveus* was the only species in which larvae of *W. bancrofti* developed. L1 stage was found on 2-4 days postinfection, L2 larvae from day 9 onwards and infective stage larvae on the day 13. *Ae. malayensis* and *Ae. aegypti* were found to pick up mf but did not support the development.

Conclusion

While the prevalence of periodic form of *W. bancrofti* has been reported from some islands of Andaman group including Little Andaman[17], diurnally subperiodic form of *W. bancrofti* is known to be prevalent only in Nicobar group of islands with a population of about 39,000. Of the 13 islands in this district, information on the prevalence of filariasis is available only for Nancowry group of islands, comprising 4 islands. The situation in the rest of the nine islands of this district, with a population of nearly 33,500 spread over 172 villages is yet to be explored. From the earlier surveys it is evident that at least 5562 people are at the risk of this infection. Area specific extrapolation of survey results showed that there were 793 mf carriers and 71 patients in the known endemic areas of Nicobar group of islands[10]. While Chowra, Kamorta and Trinket islands have been recorded with only subperiodic form of *W. bancrofti*, there are indications of prevalence of both periodic and subperiodic forms of this species in Nancowry island. This endemic foci is situated in the middle of this district and the distribution of this infection in islands located above and below this belt is not yet known. Further epidemiological investigations may be useful in understanding the spatial distribution of this infection as well as periodic form. The clinical spectrum of this disease in this endemic foci also needs to be understood.

Ae. niveus is the established vector of the subperiodic *W. bancrofti*. Though the members of *Ae. scutellaris* sub group, known vector of subperiodic filariasis elsewhere[12-14] are prevalent in this island[5-10], its role in transmission remains to be verified. All the earlier entomological investigations were based on point surveillance. To understand the transmission dynamics it is essential to gather data from long-term studies. Such studies may also be useful to enlist the mosquito fauna, their population dynamics and breeding habitats. Experimental infection studies are also needed to assess the vector potential of other mosquito species that are prevalent in this area.

The vector of this infection is a mosquito which breeds primarily in tree holes and bite humans and animals during day time. With the given breeding peculiarity of this species, biological control with *Toxorhynchites sp.* could be the only choice of control. As this area is inhabited exclusively by the tribal community who depend on forest produce for their livelihood, their frequenting the forest is unavoidable. Therefore, none of the personal protection measures against the bite of mosquito is feasible including repellents which could well be cost prohibitive. Therefore, the alternative method of containing this infection is chemotherapy to liquidate the parasite load. Among the different chemotherapeutic options[1], distribution of salt fortified with DEC could be a pragmatic proposition in such island situation where the influx of salt can be fairly regulated. Studies on the efficacy of DEC fortified salt may be useful in designing large scale mass medicated salt programme which has been successfully demonstrated in other regions of India[15, 16]. The containment of this infection can be given priority as there exists a threat of its infiltration into the non-endemic receptive areas.

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This write-up has been contributed by Sh. A.N. Shriram, Research Assistant and Dr. S.C. Sehgal, Director, Regional Medical Research Centre, Port Blair.

ABSTRACTS

Some Research Projects Completed Recently

Sequential assay of oxygen free radicals, flitrates and citrulline in experimental peritonitis.

Sequential production of oxygen free radicals, nitrates and citrulline was studied in New Zealand Wistar strain rats of average weight (200-250 g) after creating peritonitis with caecal perforation. These parameters were also studied after closure of the perforations and peritoneal lavage (*ie* reversal of peritonitis). Average survival time of rats after induction of peritonitis was 5.33 h. Baseline values of oxygen free radicals, nitrates and citrulline (for comparison) were obtained in sham operated rats (controls) subjected to laparotomy and closure.

After creating peritonitis sequential assays were performed from 1 to 6 h at 1 h intervals. Reversal of peritonitis was carried out at different intervals after induction of peritonitis (from 1-6 h post peritonitis) and sequential assays were carried out at every 1 h after reversal of peritonitis.

There was a steady increase in the value of oxygen free radicals from 0 to 3 h and in the nitrates and citrulline levels from 0 to 4 h, thereafter they showed a gradual fall. Peak levels of oxygen free radicals were seen at 3 h and for nitrates and citrulline at 4 h post peritonitis. Maximum mortality was observed between 3-4 h post peritonitis. After induction of peritonitis all values were higher than the base line values indicating that it was peritonitis which caused the increase. Reversal of peritonitis produced significant fall in all values. This study thus clearly indicated that the values of oxygen free radicals, nitrates and citrulline were significantly increased in peritonitis and were brought down signifiantly with intervention in the form of reversal of peritonitis.

Harpreet Wasir
R.N. Katariya
Department of General Surgery
Postgraduate Institute of Medical
Education and Research, Chandigarh.

Studies on the effect of furosemide and the mechanism involved in gastric acid secretion.

The study was carried out on CF strain of rats and frogs to elucidate the mechanism of secretagogue stimulated gastric acid secretion on the application of furosemide, a potential antiulcer drug.

Gastric lesions were induced in rats using nonsteroidal anti-inflammatory drugs. Thereafter normal and experimental rats were treated with oral furosemide at the rate of 2 mg/kg body wt/day for six consecutive days.

Increase in the release of defensive factors like hexosamine and mucin with reduction in the gastric acid and pepsin secretion, were observed. There was an enhancement in the rate of DNA and protein synthesis.

Furosemide inhibited histamine stimulated H^+ transport from the secretory side of frog's gastric mucoso by releasing K^+ ion to the medium. The inhibition was rapidly reversed by an increase in K^+ in the secretory solution replacing equimolar Na^+ from the medium. This suggested that the effect of furosemide occurred at or near the secretory membrane and induced a conformational change in K^+/H^+ exchange system resulting in the vectorial transport of H^+ across the membrane. Scanning electron microscopy also revealed the partial interaction of furosemide and gastric parietal cells, resulting in partial inhibition of gastric acid secretion without much alteration in the classical intracellular pathway of acid secretion.

Furosemide at 1 mM concentration partially inhibited (50%) K^+ stimulated H^+, K^+-ATPase activity. Gastric microsomes pretreated with fursemide also exhibited an inhibition of H^+, K^+-ATPase activity.

These findings suggest that furosemide is likely to act as an antisecretory/antiulcer agent *ie* both as a gastric cytoprotective agent as well as in the therapy of gastric ulcer.

S.K. Bandyopadhyay
Department of Biochemistry
University College of medicine
Calcutta.

ICMR NEWS

Meetings of the Project Review Committee (PRC)/ Expert Group (EG) held at New Delhi :

PRC on Diarrhoeal Diseases	February 3, 1998
EG on Strategies for Research on Suicide	February 6, 1998

Participation of ICMR Scientists in Scientific Events :

Dr. V. Sreenivas, Sr. Research Officer, ICMR Headquarters, New Delhi, and Dr. N.S. Wairagkar, SRO, National Institute of Virology, Pune, participated in the II Asian-Pacific Congress of Epidemiology organized jointly with the VIII Scientific Meeting of the Japan Epidemiological Association at Tokyo (January 28-30, 1998).

ICMR AIDED SYMPOSIA/SEMINARS/WORKSHOPS/COURSES/CONFERENCES

Symposium/Seminar/Workshop/ Course/Conference	Date & Place	Contact Address
Conference on Advances in Clinical Pharmacology	February 1-3, 1998; (at Mumbai)	Dr. N.A. Kshirsagar, Prof. & Head, Department of Clinical Pharmacology, Seth G.S. Medical College, Mumbai-400012.
International Conference on Nonlinear Dynamics and Brain Functioning	February 5-11, 1998; (at Bangalore)	Dr. N. Pradhan, Convenor of the Conference. Department of Psychopharmacology, National Institute of Mental Health & Neurosciences, Bangalore-560029.
Update Ayurveda '98	February 9-14, 1998; (at Mumbai)	Dr. S.A. Dahanukar, Professor, Department of Pharmacology, Seth G.S. Medical College, Mumbai-400012.
International Conference on Medicinal Plants Conservation; Utilisation, Trade and Cultural Traditions	February 16-20, 1998; (at Bangalore)	Dr. M. Renugopal, C/o Foundation for Revitalization of Local Health Traditions, 50 MSH Layout, Anand Nagar, Bangalore-560024.
Symposium on Gastrointestinal Protozoal Infection	February 23-24, 1998; (at Lucknow)	Dr. S.R. Naik, Prof. & Head, Department of Gastroenterology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow-226014.
Workshop on Application of Iontophoresis, Sonophoresis and Hyperthermia in Drug Delivery	February 27-28, 1998; (at Manipal)	Dr. N. Udupa, In-charge Principal and Professor, College of Pharmaceutical Sciences, Manipal-576119.
National Symposium on Affective Disorders : The Indian Scene	March 28-29, 1998; (at Chandigarh)	Dr. Ajit Avasthi, Organising Secretary of the Symposium, Department of Psychiatry, Postgraduate Institute of Medical Education & Research, Chandigarh-160012.

COUNCIL'S TRAINING PROGRAMMES FOR 1998-99

Leprosy

At the Central JALMA Institute for Leprosy, Agra:

- Multidrug Therapy Orientation Course in Leprosy for Medical Officers (April 6-17, August 17-28, October 26-November 6; and December 7-18, 1998).

Virology

At the National Institute of Virology, Pune:

- Diploma in Medical Virology (July 1998-May 1999).

Reproductive Biology

At the Institute for Research in Reproduction, Mumbai:

- Workshop on Andrology for Clinicians (November 16-30, 1998)

Endocrinology

At the National Institute of Nutrition, Hyderabad:

- Annual Certificate Course on Endocrinological Techniques and their Applications (August 1-September 15, 1998).

Nutrition

At the National Institute of Nutrition, Hyderabad:

- M.Sc. in Applied Nutrition (June 1, 1998-February 28, 1999).
- Postgraduate Certificate Course in Nutrition (December 1, 1998-February 28, 1999).

Laboratory Animal Technology

At the National Centre for Laboratory Animal Science, National Institute of Nutrition, Hyderabad:

- Training Course for Laboratory Animal Technicians (June 16-July 31, 1998).

Occupational Health

At the National Institute of Occupational Health, Ahmedabad:

- Orientation Course on Occupational Health for Industrial Medical Officers (February 17-28, 1998).
- Training Course on Environmental Hygiene Practice (November 16-20, 1998).

Biomedical Statistics

At the Institute for Research in Medical Statistics, Chennai:

- Basic Course in Statistics for Postgraduate Medical Students (July 1998).
- Basic Course in Statistics for Medical Officers (November 1998).

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Last date for receipt of applications is **31st March, 1998.**

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