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***Late Dr. Durga Datt Joshi, Founder of NZFHRC***



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*Zoonoses and Food Hygiene News, published four times a year, provides a medium for disseminating technical information on matters related to zoonoses and food hygiene generated in the world, particularly in Nepal. The editors welcome submissions on these topics with appropriate illustrations and references. The views and opinions expressed in the News are those of the authors.*

***CONTENTS:***



## Distribution of Mosquito species in Kathmandu, Rupandehi, Kapilbastu and Morang Districts of Nepal

*Mahendra Maharjan, Shishir K. Pant and Dhan K. Pant, NZFHRC*

**ABSTRACT**

Mosquito borne diseases like Japanese encephalitis (JE), filariasis, malaria and dengue are prevalent in Nepal. Diseases like JE have a seasonal pattern with cases appearing typically after the monsoon season. In order to assess the distribution of mosquito vectors, post-monsoon mosquito survey was carried out in Morang (Eastern Development Region), Kathmandu (Central Development Region) as well as Rupandehi and Kapilbastu (Western Development Region) districts of Nepal using standard mosquito collection techniques and identification keys. A total of 21 species of mosquitoes comprising five different genera were found in the four districts of the study areas. Seven *Culex* species collected were; *Cx. quinquefasciatus*, *Cx. tritaeniorhynchus*, *Cx. bitaeniorhynchus*, *Cx. fuscocephala*, *Cx. gelidus*, *Cx. vishnui* and *Cx. epidesmus*. Eight *Anopheles* species includes; *An. vagus*, *An. sinensis*, *An. jamesii*, *An.annularis*, *An. maculates*, *An. fluviatilis*, *An. culicifacies* and *An. nigerrimus*. Two species of *Mansonia:M. annulifera* and *M. uniformis* were also collected along with *Armigeres kuchingensis* and *Aedes vittatus*, *Ae. albopictus* and *Ae. aegypti*. Species of mosquitoes distributed in the study area shows that the four districts are high-risk districts for mosquito borne diseases.

**INTRODUCTION**

Mosquitoes are members of the family Culicidae, which has been divided into three sub- families; Toxorhynchitinae, Anophelinae and Culicidae. Over 3500 species of mosquitoes have been described from different countries. They occur in tropical and temperate zones, even above the Arctic Circle but are absent in the Antarctic. They are found at altitudes above 6,000 m in mountainous regions and as deep as 1250m below sea level in caves and mines (Lane & Crosskey, 1993).

Distribution and density of the mosquito species depend upon the presence of suitable larval breeding sites. The larval breeding sites for mosquitoes are aquatic. Some species are very specific in their habitat requirements, whereas others may exploit a wide range of breeding sites. The numbers of factors influence the abundance of mosquito larvae and their development such as water depth, salinity, fertilizers, and the presence of predatory fish and insects in the water (Sunish & Reuben, 2001; Sunish & Reuben, 2002). Particularly rain provides more breeding grounds for most of the mosquitoes.

*Culex quinquefasciatus* is the principal vector of lymphatic filariasis (Sucharit *et al,* 1988; Jitpakdi *et al,* 1998). This species typically breeds in stagnant and organically polluted water. *An. Culicifacies* is responsible for 60–65% of the malaria burden throughout the world (Goswami et al., 2006; Dash et al., 2008; Singh et al., 2009). In Nepal *An. annularis* was incriminated as a vector of malaria in southern Terai belt (Parsa, Nawalparasi and Kapilvastu). In Southeast Asia, both *Aedes aegypti* and *Ae. albopictus* are important vectors of dengue (DF) and dengue hemorrhagic fever (DHF).

In 1990, Darsie and Pradhan published an extensive account of the mosquitoes of Nepal, recording 130 species in 14 genera. A total of 24 species of *Aedes* mosquitoes were reported from Gandaki, Janakpur, Mahakali, Seti, Koshi, Bagmati, Narayani and Karnali Zones of Nepal. This genus has been reported from low to high altitudes ofJumla district. The recorded 45 species of Anopheles mosquitoes are distributed from the Terai and inner Terai areas to the hills and mountains of the country. Similarly, 9 species of *Armigeres* distributed in Bagmati, Lumbini, Narayani and Koshi zones of Nepal. After Anopheles another largest genus of mosquito distributed in Nepal is *Culex* with 29 recorded species. Like *Anopheles*, *Culex* are also distributed throughout the country except high mountains but has been reported in the high altitudes of Jumla from various habitats.

**MATERIALS AND METHODS**

The present study was carried out in four districts of Nepal covering Kathmandu valley (Mill hill, Central Development region); Morang District (Terai, Eastern Development Region); and Kapilbastu and Rupandehi districts (Terai, Western Development Region) of the country. Post-monsoon adult mosquito samples were collected during September - November, 2013.

Adult mosquitoes were collected using four different techniques; 1) Indoor Resting Collection, 2) Human Baited Trap Net Collection, 3) Animal Bait Collection, and 4) Light Trap Collection. Collected mosquitoes were taken to the laboratory alive, anaesthetized with ether, identified under Stereoscope microscope using standard keys. (Richard F Darsie, Jr. and Shreedhar P. Pradhan).

**RESULTS**

A total of 21 species of mosquito comprising five different genera were distributed in the study area. Distribution of *Culex* mosquitoes was found in the entire district with highest density *culex quinquefasciatus* in Kathmandu and Morang. The overall prevalence of *culex quinquefasciatus* was found highest (51.5%) among all other *culex* species of mosquitoes followed by *Cx. Tritaeniorhynchus* (16.9%). Density of *Culex tritaeniorhynchus* was found high in Rupandehi district compared to other district. Even though, both



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species of *Culex* were found to be distributed in all four districts. Only three species of *Culex* mosquitoes was recorded in Eastern Development Region (Morang) and four species of *Culex* in Central Development Region (Kathmandu). Both distribution and density of the *Culex* was higher in Western Development Region (Rupandehi and Kapilvastu, Table 1).

**Table No.1: Distribution of Mosquito species in four districts of Nepal**

| Mosquito species | Kathmandu | | Rupandehi | | Kapilbastu | Morang | Total |
|---|---|---|---|---|---|---|---|
| | Dharmasthali(%) | Gothatar(%) | Majuwa(%) | Charangye (%) | Pipari (%) | Marik (%) | (%) |
| *Culex quinquefasciatus* | 95 (61) | 171 (76) | 59 (26.5) | 9 (5) | 6 (2.3) | 442 (92.2) | 782 (51.3) |
| *Cx. tritaeniorhynchus* | 1 (0.6) | 8 (3.5) | 105 (47) | 114 (62.3) | 16 (6) | 14 (3) | 258 (16.9) |
| Cx. *bitaeniorhynchus* | | 2 (0.8) | 1 (0.4) | 3 (1.6) | - | - | 6 (0.3) |
| *Cx. fuscocephala* | 36 (23) | 19 (8.5) | 12 (5.4) | 7 (4) | 10 (4) | - | 84 (5.5) |
| Cx. *gelidus* | 16 (10) | 16 (7) | - | 6 (3.2) | 1 (0.4) | 6 (1.2) | 45 (2.9) |
| Cx. *vishnui* | - | 2 (0.8) | 22 (10) | 27 (14.7) | 91 (35) | - | 142 (9.3) |
| *Cx. epidesmus* | - | - | - | - | 26 (10) | - | 26 (1.7) |
| *Anopheles vagus* | - | - | 6 (2.7) | 5 (2.7) | 65 (25) | - | 76 (4.9) |
| *An. sinensis* | - | - | 1 (0.4) | 2 (1) | 14 (5.4) | 9 (2) | 26 (1.7) |
| *An. jamesii* | - | - | - | 1 (0.5) | - | - | 1 (0.06) |
| *An. annularis* | - | - | - | 2 (1) | - | - | 2 (0.13) |
| *An. maculatus* | - | - | - | 1 (0.5) | - | - | 1 (0.06) |
| *An. fluviatilis* | - | 1 (0.4) | - | - | - | - | 1 (0.06) |
| *An. culicifacies* | - | - | - | 2 (1) | - | - | 2 (0.13) |
| *An. nigerrimus* | 2 (1) | 4 (1.8) | 2 (1) | 1 (0.5) | - | - | 9 (0.59) |
| *Mansonia annulifera* | - | - | - | - | 9 (3.5) | - | 9 (0.59) |
| *M. uniformis* | - | - | - | - | 18 (7) | 5 (1) | 23 (1.5) |
| *Armigeres kuchingensis* | 6 (4) | 1 (0.4) | 8 (3.6) | 2 (1) | - | 3 (0.6) | 20(1.3) |
| *Aedes vittatus* | - | - | - | - | 3 (1) | - | 3(0.19) |
| *Ae. albopictus* | - | - | 4 (1.8) | 1 (0.5) | - | - | 5(0.32) |
| *Ae.aegypti* | - | - | 3 (1.3) | - | - | - | 3 (0.19) |
| Total | 156 | 224 | 223 | 183 | 259 | 479 | 1524 |

Among eight different species of mosquitoes belonging to genus *Anopheles* collected during the study period, overall prevalence of *Anopheles vagus, An. Sinensis, An. Jamesii, An. Annularis, An. Maculates, An. Fluviatilis, An. Culicifacies* and *An. nigerrimus* was found to be 4.9%, 1.7%, 0.06%, 0.13%, 0.06%, 0.06%, 0.13% and 0.59% respectively. For genus wise distribution, 1343 (88.12%) Culex mosquitoes and 118 (7.74%) Anopheleses were identified from all four districts of project area. Both distribution and density of the *Anopheles* was not found to be uniform in four districts of the study area. Similar to the *Culex* mosquito, distribution of *Anopheles* was also found to be high in Kapilbastu and Rupandehi, although the density was very low. Both distribution and density of Anopheles was comparatively less in Katmandu and Morang districts.

Two species of *Mansonia* mosquito were collected from Kapilbastu district with less density while only *M. uniformis* was reported from Morang district. Besides, Kapilbastu district, *Armigeres Kuchingensis* has been reported from all three district of the country with overall prevalence (1.3%). Three species of mosquito belonging to genus *Aedes* includes *Ae. vittatus, Ae. albopictus and Ae. aegypti* with prevalence rate 0.19%, 0.32% and 0.19% respectively. These species has been reported only from the Kapilbastu and Rupandehi districts.

## DISCUSSION AND CONCLUSION

Although the four important mosquito borne diseases are prevalent in Nepal, studies on the distribution of their specific vector in Nepal are still limited. Besides the taxonomic extensive report published by Darsie and Pradhan (1990), scanty work on mosquito vectors had been carried out in Nepal. During this study 21 mosquito species were collected under five genera which includes seven *Anopheles* species seven *Culex* species, two species of *Mansonia*, one species of *Armigeres* and two species of *Aedes.*

Species composition of the *Culex* mosquito in four districts was compared. *Culex tritaeniorhynchus* is the only considered JE principal vector in Nepal (Bista & Shrestha 2005), while other *Culex* species are considered as JE potential vectors in different parts of the world (Mariappan et al, 2014). In Nepal, the role of *Culex* species on JE transmission as well as other diseases transmission is not known. Surprisingly, species diversity of *Culex* species in Morang district showed very less compared to other three districts. Among the three species recorded *Cx. quinquefasciatus* showed maximum (95%) compared to JE vector *Cx. tritaeniorhynchus*. It is remarkable that during this year Morang district came ahead reporting JE cases compared to other districts. Similar distribution was observed in Kathmandu too. But in case of the Western development region, Rupandehi and Kapilbastu, distribution of *Culex* species showed quite different from that of the Kahmandu and Morang district. In these two districts *Culex quinquefasciatus* was less than Kathmandu and Morang. Rupandehi showed 60% distribution of *Cx. tritaeniorhynchus*, potential vector of JE whereas Kapilbastu districts showed 60% of distribution of *Cx. vishnui*, which is also considered as potential vector of JE. Interestingly *Cx. epidesmus* was only reported from the Kapilbastu district not from other district. Comparison of *Culex tritaeniorhynchus*, principal vector of JE in four districts indicated maximum in Rupandehi compared to others.

According to the WHO, along with the various species of *Culex,* other mosquito species belong to genera *Anopheles* as well as *Mansonia* have also been reported as possible vectors of JE. Hence the report indicated that in Kathmandu, only *Culex* species were found to be widely distributed which have been reported as JE vector where as in Rupandehi district, *An. vagus* and *An. annularis* have been reported along with the *Culex* species. While in Kapilbastu district two species of *Mansonia* have also been reported. It is important to note that JE probable vectors, *Anopheles* and *Mansonia* have been reported from Western Development Region of the country. Even in Morang district *Mansonia* species was reported in addition to *Culex* species.

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## One Health Epidemiology Fellowship Program Coordinator: Nepal

One Health epidemiology program was launched in Nepal on October, 2014 by National Zoonoses and Food Hygiene Research Center (NZFHRC) as a key contractor and Animal Science, Veterinary Science and Fisheries University (AFU) as the sub-contractor. This project is funded by the European Union and implemented by Massey University of New Zealand. It is two year program and six fellows were selected from the public health, animal health and wildlife health sectors in Nepal. The contract was signed between Vice Chancellor of Massey University and Executive Chairman of NZFHRC as per predefined roles and responsibilities. As per the guideline, NZFHRC is facilitating OH fellows to provide student friendly academic environment.

The overall objective is to develop a collaborative approach to investigation and control of zoonotic diseases among the human, animal, and wildlife health sectors through education and joint action.

The core of the program is a One Health Epidemiology Fellowship in which participants from the human health, animal health, and wildlife sectors in Bangladesh, Nepal, Bhutan and Afghanistan undertake Master's degree education in epidemiology and bio-security delivered by Massey, and then apply that education in a collaborative framework to conduct applied research and education extension activities using a multi-sectoral One Health approach. The participants will undertake the Fellowship program in their home country within an organizational framework that provides a collegial and collaborative work environment and facilitates in-country supervision of fellowship activities.

**Components**

The program has four major components contributing to a total of 320 credits (representing ~3,200 hours of study):

- Master's degree training in epidemiology and biosecurity, taught by Massey University using a combination of distance learning modalities and face-to-face workshops (mixed-mode; 120 credits).
- Professional engagement with faculty, postgraduate and undergraduate students in the participating institutions, with related government sectors and other One Health professionals in the South Asia Region (20 credits).
- Applied epidemiology research involving situation assessments, field studies and evaluation of disease control strategies for priority zoonotic diseases in each country using a multi-sectoral approach (120 credits).
- Training the trainer, in which Fellowship participants will design a One Health epidemiology and/or zoonotic disease control curriculum and prepare suitable training materials for undergraduate, postgraduate and/or in-service training of health professionals in their country (60 credits).

The overarching design principle is "integrating education and action", combining education, applied research, professional engagement and training-the-trainer components.

***On the memory of Late Dr. Durga Datt Joshi***

## National Symposium on Priority Zoonoses in Nepal

**Background**

A two-day symposium on priority zoonoses was organized jointly by National Zoonoses and Food Hygiene Research Centre (NZFHRC), World Health Organization Country Office for Nepal, Epidemiology and Disease Control Division (EDCD), DHS/MoHP, and One Health Alliance Nepal (OHAN). Dr. Billy R. Heron, USA also contributed small grant to conduct the National symposium in the memory of pioneer veterinarian Late Dr. Durga Datt Joshi. It was attended by zoonotic disease subject matter specialists, relevant and concerned authorities of Ministry of Agriculture and Cooperatives, Department of Livestock Services, Department of Health and Population, Department of wildlife, Nepal Agriculture Research Council, Medical and Veterinary colleges, and students from health professionals. Attendees were directly and indirectly associated with planning, evaluation, monitoring, implementation and decisions on research activities related to zoonoses in Nepal.

The major objective of the symposium was to disseminate and update on priority zoonotic diseases research in Nepal. A total 60 participants representing the animal and human health, wildlife and environmental sectors, academic institute attended in the national symposium. A total of eighteen papers were presented from experts working in the field of zoonotic diseases in Nepal for a long period of time. The experts presented comprehensive scenario of the zoonotic diseases status with critical review of the present status and recommended future strategy to be incorporated in national policy and planning to control and eliminate/eradicate in Nepal.

**First day of the symposium (14th December, 2014)**

**Inaugural session**

The two days symposium was organized at hotel Yak and Yeti, Durbar Marg, Kathmandu, Nepal from 14-15 December, 2014 with the collaboration of EDCD, WHO and OHAN. The programme started at 08.30 AM with registration. The program was coordinated by Dr. Anita Ale under the chairmanship of Dr. Nar Bahadur Rajwar, Secretary, and the Office of the Nepal Trust, GoN Darbarmarg, Kathmandu. The symposium was inaugurated by lighting the lamp and delivering the opening addresses by Mr. Shanta Bahadur Shrestha, Secretary of Ministry of Health and Population.

Dr. Babu Ram Marasini, Director, EDCD, DHS, Teku, and Kathmandu welcomed the entire participant and acknowledged the NZFHRC for hosting the symposium. He emphasized that there is a periodic emergence of highly pathogenic infectious diseases at the human animal interface and it demands coordinated, multidisciplinary and community-based action to address priority zoonoses in Nepal. Likewise, Dr. Padam Raj Bista, Executive Chairman, NZFHRC delivered the objectives and expected outcome of the symposium. Similarly, Chief Guest Mr. Shanta Bahadur Shrestha, Secretary, Ministry of Health and Population delivered few remarks on the current situation of health problems in Nepal. He further added that his academic field was not health but he was



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familiar with the situation of health while he was working in ministry of finance as secretary. He wished for the success of symposium.
Dr. Garib Das Thakur, Ministry of Health and Population mentioned the journey of One Health Alliance Nepal. He remembered late Dr. D.D. Joshi and his contribution on zoonotic disease and also appreciated his initiative action for the establishment of OHAN. Likewise, Dr. Nihal Singh, country officer for Nepal, WHO, delivered few remarks for health promotion and multi collaborative approach for disease prevention. Finally, Chairperson, Dr. Nar Bahadur Rajwar, Secretary, The office of the Nepal Trust, GON, Darbargmarg Kathmandu Nepal discussed the contribution of late Dr. D. D. Joshi on zoonotic diseases and also emphasized to follow foot step of late Dr. D.D. Joshi. A tea break after the inauguration session was followed by a technical session.

**Technical Session**

The technical session started at 11AM under the chairmanship of Dr. Nar Bahadur Rajwar, Secretary, the Office of Nepal Trust, GoN. Dr. Jitendra Man Shrestha, Chief, Zoonotic Control Division, EDCD and Dr. Sher Bahadur Pun, Clinical Research Unit Head, Sukra Raj Tropical and infectious Disease hospital, Teku were as rapporteurs.

Dr. Babu Ram Marasini, Director, EDCD, Teku presented his paper entitled Human Rabies Elimination: issues and challenges. Likewise, Dr. Nihal Singh presented paper on Ebola covering the global situation of Ebola, preventive measures, risk to South East Asia regions, activities of SEAR countries to combat with this disease, and preparedness of Nepal. Dr. Basudev Pandey, public health officer, DHS, Teku presented paper on overview of viral zoonoses in Nepal. Dr. Ramesh Prasad Adhikari, public health officer, DHS, Teku, presented paper on one health approach for prevention and control of zoonotic disease. Similarly, Dr. Padam Raj Bist, Executive Chairman, NZFHRC, presented the paper on identification and assessment of socio-environmental risk setting for Japanese encephalitis (JE) transmission and re-emergence in Nepal.

The second technical session was held under the chairmanship of Dr. Dinesh Prasad Parajuli, Joint Secretary, MoAD Singhdarbar, Kathmandu, Nepal. Dr. Mahendra Maharjan, Research Co-ordinator, NZFHRC and Dr. Sujan Rana, Veterinary Officer, Department of Livestock Service (DLS) were as rapporteurs.

Prof. Dr. Shiba Kumar Rai, Nepal Medical College, Jorpati presented his paper entitled on Parasitic Zoonoses in Nepal: Toxoplasmosis. Likewise, Dr. Bhoj Raj joshi, Nepal Agriculture Research Council (NARC) presented his paper on Brucellosis in Nepal. Similarly Mr. Dibesh Karmacharya, CMDN presented his paper entitled Wildlife zoonotic disease in Nepal especially the virus (H7N9) in migratory birds in Nepal focusing the preparedness and emergency response for H7N9 building on the existing capacities and tools. Mr. Dhan Kumar Pant, Microbiologist, NZFHRC presented paper on epidemiological aspect of Echinococcus in Nepal: A systematic review. Similarly, Mr. Shreeram Paudel presented his paper on the sero-prevalence of brucellosis in pigs in 6 VDC of Rupandehi districts of Nepal.

**Second day of the symposium (15th December, 2014)**

The second day's symposium stated at 9:30-10 with tea/coffee. The technical session was started at 10 AM under the chairmanship of Prof. Dr. Shiba Kumar Rai, Nepal Medical College, Jorpati. Dr. Mukul Upadhyay, senior veterinary officer and Mr. Dhan Kumar Pant, NZFHRC were as rapporteurs.

Dr. Jitendra Man Shrestha, EDCD presented his paper entitled epidemiology of priority zoonoses in Nepal and recommended prevention and control strategy. Similarly, Dr. Mahendra Maharjan, research coordinator, NZFHRC presented his paper entitled on Neurocysticecosis and porcine cysticercosis in Nepal. Likewise, Dr. Doj Raj Khanal, Animal Health Research Division, NARC, presented his paper on epidemiology of leptospirosis in Nepal and recommended preventive and control strategy. Similarly, Dr. Anita Ale, MVPH student of (Universitat Berlin/Chinag Mai University, Thailand) presented paper entitled on the burden of parasitic zoonoses in Nepal: A systematic review.

The second technical session was chaired by Dr. Dhan Raj Ratala, Nepal Veterinary Council (NVC), Tripureshwor, Kathmandu, Nepal. Dr. Sujan Rana and Mr. Dhan Kumar Pant were as rapporteurs.

Prof Chitra Kumar Gurung, Public Health and Infectious Disease Centre, Newbaneshwor, Kathmandu, presented paper entitled Feasibility of a Combined Camp Approach for Vector Control Together with Active Case Detection of Visceral Leishmaniasis, Tuberculosis, Leprosy and Malaria in Nepal. Likewise Dr. Shristi Ghimire presented her paper entitled on Factor assessment of Japanese encephalitis in Rupandehi and Kapilvastu district pigs and human sero survey and risk. Similarly, Dr. T.R. Gompo, Animal Quarantine Office, Kathmandu presented paper entitled on Study of Caprine Brucellosis at Live Goat Market, Kalanki, Kathmandu.

**Closing session**

Dr. Jitendra Man Shrestha, Chief, Zoonotic Control Division, EDCD, delivered closing remarks and stated that outcome would be useful for formulating policy for priority zoonoses disease control in Nepal. Similarly, Prof. Dr. Shiba Kumar Rai, Nepal Medical College, Jorpati, delivered closing remarks and stated that this symposium was initiative step for multicollaborative approach. Vote of thanks was delivered by Ms. Minu Sharma, program co-ordinator, NZFHRC. Closing remarks were delivered by Dr. Dhan Raj Ratala, Chairperson, Nepal Veterinary Council. The programme was ended with special tea/coffee.

**NEWS**

Dr. Anita Ale is a Master degree student of Veterinary Public Health of Freie Universität Berlin, Germany. She will conduct her thesis work entitled "**Prevalence of *Salmonella* spp., *Pseudomonas* spp. and *Staphylococcus* spp. and knowledge and practices of meat cutters associated with hygienic aspects in retail meat shop in Kathmandu, Nepal**" at NZFHRC.

**K.D.M.A. Research Award:**

***Please kindly submit your research work paper on allergy award for the year 2014 for the consideration by the end of April 2015 to KDMART office Chagal, G.P.O. Box 1885, Kathmandu, Nepal, Phone: 4270667, 4274928 and Fax 4272694. This award was established by Late Dr. Durga Datt Joshi in 2049 B.S. (1992) on the memory of his wife, the late Mrs. Kaushilya Devi Joshi. The award includes a grant of NCRs. 10,001 with certificate.***

***From: Zoonoses& Food Hygiene News, NZFHRC***
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***TO:***

***Dr/Mr/Ms .....***

***.....***



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