Species Composition of Medically Important Mosquitoes in Selected Areas of Kurunegala, Gampaha, Kegalle and Kandy Districts in Sri Lanka.

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Mosquito borne diseases are one of major health problems in almost all tropical and subtropical countries including Sri Lanka. Knowledge on breeding places and the larval distribution are important parameters for risk assessment and sound mosquito control strategies. Thus, the present study aimed to investigate the diversity and species composition of medically important mosquito immature stages in selected areas of Kurunegala, Gampaha, Kegalle and Kandy districts in Sri Lanka. Larval surveys were conducted in selected areas in each District from June 2017 to September 2018 on monthly basis. The species density and distribution was calculated. A total of 4369 mosquito larvae belong ten species under five Genera (*Aedes, Anopheles, Culex, Mansonia and Armigeres*) was identified. *Aedes aegypti, Ae. albopictus, Anopheles subpictus, An. vagus, Armigeres subalbatus, Culex quinquefasciatus, Cx. tritaeniorynchus, Cx. gelidus, Cx. whitmorei* and *Mansonia uniformis* were encountered as species. *Cx. gelidus* showed highest density (27.49%, n= 411) in Kurunegala district followed by *An. vagus* and *Ae. aegypti* as satellite species (D<1%) and subdominant species (1<D<5%), respectively. In Gampaha district, *Mansonia uniformis* and *Cx. whitmorei* were found as a subdominant species. In both Kegalle and Kandy districts, *Cx. whitmorei* was found as a subdominant species and all the other mosquito species were recorded as dominant species (D>5%). However, *Ae. albopictus* was a dominant species in both Gampaha and Kandy districts which showed an infrequent distribution (C2; 20.1 – 40%). The presence of medically important mosquitoes in these areas in considerable numbers can cause public health concerns as dengue is one of the major challenges in these areas. Therefore, the study of this nature would be useful to identify the entomological potential for disease transmission and update would be facilitated for implementing appropriate vector control interventions.

Keywords: Mosquito, breeding, species

Introduction

Adult mosquitoes of major genera of *Anopheles*, *Aedes*, *Culex* and *Mansonia* are mainly involved in the transmission of infectious diseases to human and animals and one of major health problem in almost all over the tropical and subtropical countries including Sri Lanka (Amerasinghe *et al*., 1995). Adult females of many mosquito species are obligate blood feeders of which some play an important role in transmitting various vector borne diseases aside from the nuisance of mosquito bites (Evenhuis and Gon, 1989). Mosquito borne diseases are caused by arboviruses or parasites. Suitable larval breeding habitats are one of the major determinants of abundance of adult mosquitoes and thereby increasing the spread of mosquito borne diseases causing outbreak situations. The immature stages of mosquitoes (egg, larvae, and pupae) can be found in variety of aquatic habitat of ponds,

temporary and permanent pools, streams, ditches, swamps, marshes, lake margins, artificial containers and plant parts such as leaves, fruits, husks, tree hoes and bamboo nodes (Samarawickrema *et al*., 1982, Yadav, 2009). Mosquito abundance and species distribution are also determined by the geographic location, waterbody dimensions, climate, predatory abundance, anthropogenic activities and human and animal population distributions (Okogun *et al.,* 2

Knowledge on where mosquitoes breed and their habitat preference over others, as well the larval distribution are important parameters for risk assessment and sound mosquito control strategies.

Methodology

Mosquito sampling

Entomological surveys were conducted from June 2017 to september 2018 in selected areas of Kurunegala, Gampaha, Kegalle and Kandy districts using standard dipping or siphoning method according to the nature of the breeding habitat. The location of the temporary or permanent breeding habitats were recorded using a portable global positioning (GARMIN-etrex SUMMIT). Collected mosquito larvae were safely transported to the laboratory at the Department of Zoology and Environmental Management, University of Kelaniya, Sri Lanka.

Sample Identification

The stage I & II were reared under laboratory conditions until they reached to stage III. Larval stages III and IV (Field caught and lab reared) were initially killed with 50 – 60 ^{0}C of water followed by dehydration with 70% ethanol. The larvae were identified under a Binocular light microscope using morphological taxonomic keys (Amerasinghe*,* 1995; Gunathilaka *et al.,* 2014).

Data analysis

Dynamics of medically important larval population encountered in the sampling sites were expressed according to the following mathematical expression.

C= (n/ N) *100%

C-Distribution, n- number of sites of the species, N-Number of all sites.

The following distribution classes were adopted (Dzieczkowski, 1972),
C1- sporadic appearance (constancy 0-20%)
C2- infrequent (20.1-40%)
C3-moderate (40.1-60%)
C4-frequent (60.1-80%)
C5-constant (80.1-100%)

Density was expressed as percent of specimens of the species in whole sample according to the formula (Banaszak and Winiewski, 1999).

D = (l/L) *100 % D- Density, l- Number of specimens of each mosquito species, L- Number of specimensThe following density classes were accepted after;

Satellite species (D<1%)
Subdominant species (1<D<5%)
Dominant species (D>5%)

Results and discussion

Species composition

A total number of ten medically important mosquito larval species belong to five genera; *Ae. aegypti, Ae. albopictus, An. subpictus, An. vagus, Armigeres subalbatus, Cx. quinquefasciatus, Cx. tritaeniorynchus, Cx. gelidus, Cx. whitmorei and Mansonia uniformis* were encountered from

breeding habitats sampled throughout the study period (Table 1). Out of ten medically important mosquito species recorded from the study area, nine species were found from Kurunegala district. *Culex gelidus* showed highest density (27.49%) in Kurunegala district and *An. vagus* was found as satellite species (D<1%) while *Ae. aegypti* found as a subdominant species (1<D<5%). There were only two species of Anopheles mosquitoes; *An. subpictus* and *An. vagus* which were recorded from study area. All the medically important mosquito species recorded from the Kurunegala district showed a sporadic appearance (constancy 0-20%). In Gampaha district, *Ma. uniformis* and *Cx. whitmorei* found as a subdominant species (1<D<5%) while all other species were found as dominant there. *Ae. aegypti* and *Cx. quinquefasciatus* recorded from Gampaha district showed an infrequent distribution (C2; 20.1-40%). In both Kegalle and Kandy districts, *Cx. whitmorei* was found as a subdominant species (1<D<5%) and all the other mosquito species recorded as dominant species (D>5%). However, *Ae. albopictus* was found as the species with highest density in both Gampaha and Kandy districts which showed an infrequent distribution (constancy 20.1-40%). *Ae. albopictus* was prominently found from temporary discarded container habitats in the study area.

Breeding habitat diversity and occurrence of species

Mosquito breeding habitats selected for the study included blocked drainages, garbage dumping sites, coconut shells, buildings under construction, clay pots, tires, tree holes, rice fields, marshy lands, irrigation canals, abandoned wells, ponds and leaf axils tank margins, reservoirs, footprints, gutters, broken PVC, discarded glassware, barrels and temporary water accumulated plastic/metal containers. Marshy land was identified as the most conducive breeding habitat indicating the presence of higher number of species. *Ae. albopictus* was identified from many of the breeding habitat s encountered.

Conclusion

The presence of medically important mosquitoes in these areas in considerable numbers can cause public health concerns as dengue is one of the major challenges in these areas. Therefore, the study of this nature would be useful to identify the entomological potential for disease transmission and update would be facilitated for implementing appropriate vector control interventions.

References

Amerasinghe, F.P. (1995). Illustrated keys to the genera of mosquitoes (Diptera: Culicidae) in Sri Lanka, *Journal of National Science Council of Sri Lanka*. 23 (4), 183-211.

Amerasinghe, F., Indrajith, N. and Ariyasena, T. (1995). Physico chemical characteristics of mosquito breeding habitats in an irrigation development area in Sri Lanka. *Ceylon Journal of Biological Science.* 24 (2), 13-29.

Banaszak, J. and Winiewski, H. (1999). *Foundation of Ecology*. Bydgoszcz, Poland: Wydawnictwo Uczelniane WSP. Podstawyekologii, 630.

Chelliah, R.V. (1984). Keys and illustrations to the genera of mosquitoes of Sri Lanka (Diptera: Culicidae). *Contr. Am. Entomol. Inst*. 7(4), 1–84.

D zieczkowski, A. 1972. Badania ilociowe. Limakow buczyn po^{3}udniowo-zachodniej Polski. (Quantitative researches of the beech malacofauna in south-west of Poland). Studium ekologiczno faunistyczne. Prace Komisji Biologicznej PTPN, 35, 243-332.

Table 1. Occurrence of characteristic mosquito species in the sampling site

		Kurunegala		Gampaha		Kegalle		Kandy	
Genera	**Species name**	**Density (%)**	**Distribution(%)**	**Density(%)**	**Distribution(%)**	**Density(%)**	**Distribution(%)**	**Density(%)**	**Distribution(%)**
Aedes	*Ae. aegypti*	2.81	17.24	16.04	20.83	21.15	20.00	10.89	21.74
	Ae. albopictus	12.24	17.24	28.45	33.33	15.32	30.00	38.73	34.78
Anopheles	*An. subpictus*	7.36	3.45	0.00	0.00	0.00	0.00	0.00	0.00
	An. vagus	0.54	3.45	0.00	0.00	0.00	0.00	0.00	0.00
Armigeres	*Ar. subalbatus*	0.00	0.00	0.00	0.00	12.18	5.00	0.00	0.00
Culex	*Cx. quinquefasciatus*	15.79	13.79	21.93	20.83	20.45	20.00	14.30	17.39
	Cx. tritaeniorynchus	26.35	10.34	18.18	8.33	17.15	10.00	20.38	8.70
	Cx. gelidus	27.49	17.24	11.44	8.33	11.66	10.00	14.18	13.04
	Cx. whitmorei	6.76	10.34	2.67	4.17	2.09	5.00	1.52	4.35
Mansonia	*Ma. uniformis*	0.67	3.45	1.28	4.17	0.00	0.00	0.00	0.00