Rev. Biol. Trop. 51(3): 759-762, 2003
www.ucr.ac.cr www.ots.ac.cr www.ots.duke.edu

COMMUNICATION

Male and mosquito larvae survey at the Arenal-Tempisque irrigation project, Guanacaste, Costa Rica

Mario Vargas V. [1] & Jorge V. Vargas C. [1,2]

1 Departamento de Parasitología, Facultad de Microbiología, Universidad de Costa Rica, Apdo. 2060, San Pedro, San José, Costa Rica.

2 Hospital de Golfito, Puntarenas, Costa Rica.

Received 21-I-2002. Corrected 06-XI-2002. Accepted 06-XI-2002.

Abstract: A monitoring of male and larvae of mosquitoes was conducted during 1991-1994, at the Irrigation Project in Arenal-Tempisque, Guanacaste, Costa Rica. CDC CO_2-baited traps were used to collect adults of mosquitoes and dips were used for immatures of culicids. A total of 1 480 larvae and 1 129 males of culicids were identified resulting in, *Aedes* with 6 species, *Anopheles*, *Mansonia* and *Psorophora* with 2 species, *Culex* with 21 species and *Haemagogus*, *Limatus*, *Toxorhynchites* and *Uranotaenia* with only one species each. The results indicate that, as occurred in other countries, irrigation projects must be under strict monitoring programs to prevent and control possible health problems in which mosquitoes act as vectors.

Key words: Irrigation project, Guanacaste, Costa Rica, monitoring mosquitoes, Diptera, Culicidae.

The Arenal-Tempisque Irrigation Project is located at the northern region of Costa Rica, Province of Guanacaste. The area is characterized by a very strong dry season that limits the agricultural potentialities but, at the same time, possess soils of great fertility and savannah type topography. The total area of the project covers 66 657 ha, is divided into two districts, Arenal and Zapandi, and partly covers the towns of Abangares, Cañas, Bagaces, Liberia, Carrillo and Santa Cruz.

The estimated population covered by the project is about 60 000 inhabitants (Anonymous 1985, Gutiérrez *et al.* 1985).

The climatic conditions of the zone are characterized by high temperatures (28ºC mean) and a seasonal precipitation of 1600 mm, mostly from May through November. Winds limits some of the cultivated crops during the dry season. About 79% of the land belongs to classes I, II and III useful for many varieties of crops.

The importance of irrigation projects on health has been pointed out by Mather and That (1986), Anonymous (1987), Birley (1991) and Tiffen (1991).

An example of the field management of the entomological aspects is given by Amerasinghe and Munasingha (1988a, 1988b) and Amerasinghe and Ariyasena (1990).

The purposes of this entomological observations, were to determine present mosquito species, their possible density changes, population dynamics and diversity of species of medical and veterinary importance.

MATERIALS AND METHODS

Preliminary observations were made during the period January-December 1990 (Vargas and Coto 1991), in the irrigated area at the region of Cañas, Guanacaste, where the dam "Arenal-Tempisque" is located.

The formal phase of the project consisted of 32 field trips in a period from August, 1991 to September, 1994, every 15 days, for a four day period, per each collecting trip.

Larvae of culicids were collected using the standard dipper technique.

For each sample, the immature forms of culicids were split for preservation and for individual rearings to correlate larval stages with the corresponding adults.

Larvae were dissected and mounted in Hoyer's medium.

The adults were collected using six CDC CO_2-baited traps. The collecting period was from 6:00 pm to 6:00 am.

RESULTS

The species of larvae and males of mosquitoes collected are presented in Table 1.

TABLE 1

Genera and species of culicids collected at the Arenal-Tempisque Irrigation Project in Costa Rica, August 1991-May 1994

GENUS	SPECIES	LARVAE	MALES
Aedes	*aegypti*	80	43
	epactius	12	9
	euplocamus	1	3
	homeopus/podographicus	118	52
	scapularis	5	0
	taeniorhynchus	12	83
Anopheles	*albimanus*	116	96
	argyritarsis	1	0
	pseudopunctipennis	8	0
Culex	*airozai*	0	5
	bidens	23	35
	conspirator	27	0
	corniger	1	0
	coronator	146	47
	declarator	16	0
	dunni	0	2
	erraticus	30	253
	interrogator	1	0
	iolambdis/trifidus	1	0
	jenningsi	4	0
	mollis	5	0
	mutator	4	39
	nigripalpus	114	121
	panocossa/ocossa	13	0
	pilosus/unicornis	7	6
	pipiens/quinquefasciatus	98	27
	pseudostigmatosoma	1	0
	stigmatosoma	2	0
Lutzia spp		0	28
Anoedioporpa/Tinolestes		9	2
Not identified		2	1
Haemagogus	*anastasionis*	36	22
Limatus	*durhamii*	2	0
Mansonia	*dyari*	31	0
	titillans	6	11
Psorophora	*confinnis*	543	235
	howardii	0	2
Toxorhynchites	*theobaldi*	3	1
Uranotaenia	*lowii*	2	1
	TOTAL	1480	1129

DISCUSSION

Among the 1480 larvae of mosquitoes identified, *Psorophora* represents 36.7%, *Culex* 34% (both genera represent 70.7%), the other genera in descending order are *Aedes* (15.4%), *Anopheles* (8.4%) *Mansonia* (2.5%), *Haemagogus* (2.7%), *Toxorhynchites* (0.2%), *Limatus* and *Uranotaenia* (0.13%).

The genus *Culex* showed the higher species diversity (21). Meanwhile the diversity of the other species was *Aedes* (6), *Anopheles* (3), *Mansonia* (2), and the genera *Haemagogus*, *Limatus*, *Psorophora*, *Toxorhynchites* and *Uranotaenia* (1).

The most common species collected was *P. confinnis* (with 36.7%), followed by *C. coronator* (9.9%), the complex *Ae.homeopus/podographicus*, *An. albimanus* and *C. nigripalpus* were represented by 8% and others by 29.3%

The relative densities of females between culicines and anophelines were 94% and 6% respectively.

The diversity and population levels of the different culicid species are typical to the neotropical region, but two species would be used as parameters of the changes of habitats and ecological impact of the irrigation project, *An. albimanus* as the primary vector of malaria in Costa Rica, and *P. confinnis* as a potential vector of several arbovirosis.

Because the ecological impact in irrigation projects has been estimated in five years after the project has been finished, a sustainable monitoring strategy to anticipate possible problems with clinical entities transmitted by mosquitoes is recommended.

ACKNOWLEDGEMENTS

The Vicerrectorías de Investigación and Administración, the Centro de Investigación en Enfermedades Tropicales, Facultad de Microbiología, and the Centro de Investigación en Contaminación Ambiental of the Universidad de Costa Rica provided economical and logistic support. SENARA that promptly handled the funds given by the B.I.D. Sergio Alfaro and Juan Carlos Cerdas for his field and laboratory duties. William Bussing of the Escuela de Biología for the improvement of the english language.

RESUMEN

Se realizó un monitoreo de machos y larvas de mosquitos durante los años 1991 a 1994 en el Proyecto de Riego Arenal-Tempisque, Guanacaste, Costa Rica. Los especímenes fueron colectados en 32 giras de cuatro días cada una y cada 15 días. La colecta de adultos se hizo mediante trampas tipo CDC y la de larvas con la técnica estándar del cucharón. Se identificaron un total de 1 480 larvas y 1 129 machos de culícidos, correspondientes a 21 especies de *Culex*, 6 especies de *Aedes*, 2 especies de *Anopheles*, *Mansonia*, y *Psorophora* y una especie de *Haemagogus*, *Limatus*, *Toxorhynchites* y *Uranotaenia*. Los resultados indican que tal y como ha ocurrido en proyectos de riego en otros países, se deben mantener estrictos programas de monitoreo con el fin de prevenir y controlar posibles problemas de salud humana y animal, en los cuales los mosquitos actúen como vectores.

REFERENCES

Amerashinghe, F.P. & N.B. Munasingha. 1988a. A predevelopment mosquito survey in the Mahaweli development project area, Sri Lanka: Adults. J. Med. Entomol. 25: 276-285.

Amerashinghe, F.P. & N.A. Munasingha. 1988b. A predevelopment mosquito survey in the Mahaweli development project area, Sri Lanka: Immatures. J. Med. Entomol. 25: 286-294.

Amerashinghe, F.P. & T.G. Ariyasena. 1990. Larval survey of surface water breeding mosquitoes during irrigation development in the Mahaweli project. Sri Lanka. J. Med. Entomol. 27: 789-802.

Anonymous. 1985. Proyecto de Riego Arenal-Tempisque. Resumen. Servicio Nacional de Aguas Subterráneas Riego y Avenamiento (SENARA).

Anonymous. 1987. Effects of Agricultural development on Vector-Borne Diseases. WHO/FAO/UNEP (eds.). FAO. Roma. AGL/MISC/12/87.

Birley, M.H. 1991. Forecasting the vector-borne disease implications. PEEM Guidelines Series WHO/CWS/91.3.

Gutiérrez, C., O. Lucke. & R. Solórzano. 1985. Integración de la Conservación con el Desarrollo en el Proyecto de Riego Arenal-Tempisque (un estudio de caso). CATIE-IUCN. Turrialba, Costa Rica. Vols I y II.

Mather T.H. & T.T. That. 1986. Ordenación del ambiente para la lucha antivectorial en arrozales. FAO, Roma Nº 41. 155 p.

Tiffen M. 1991. Incorporation of health safeguards into irrigation projects through intersectorial cooperation. PEEM Guidelines Series WHO/CWS/91.2.

Vargas M. & I. Coto. 1991. Entomological aspects of the Arenal-Tempisque irrigation project, Guanacaste, Costa Rica. Preliminary observations. J. Am. Mosq. Control. Assoc. 7: 637.