doi:10.12741/ebrasilis.v8i1.474
e-ISSN 1983-0572
Publicação do Projeto Entomologistas do Brasil
www.ebras.bio.br

Comunicação Científica

First Record of *Anopheles darlingi* Root (Diptera, Culicidae) in the Volta Grande Environmental Reserve, Conceição das Alagoas Municipality, Minas Gerais, Brazil

Rafael Martins[1]✉, Graziella França Monteiro[1], Fábio Medeiros da Costa[2] & Yasmine Antonini[1]

1. Universidade Federal de Ouro Preto (UFOP-MG), e-mail: rafmartins.cbio@hotmail.com (Autor para correspondência✉), graziellafranca@gmail.com, antonini.y@gmail.com. 2. Oikos Consultoria e Projetos, e-mail: fabiologocosta@gmail.com.

EntomoBrasilis 8 (1): 82-84 (2015)

Abstract. Three specimens of *Anopheles darlingi* Root were found in the Volta Grande environmental reserve, an area influenced by the Rio Grande dam constructed by the Volta Grande hydroelectric plant in Conceição das Alagoas, Minas Gerais, Brazil. The mosquito *An. darlingi* is one of the main vectors of human malaria in Brazil due to feeding preference for human blood, a factor that is accentuated by endophilic behavior. The information recorded here may be helpful to local entomological surveillance toward monitoring impacts generated by hydroelectric reservoir formation, as the presence of this vector in this type of environment indicates a potential risk for malaria transmission.

Keywords: Hydropower; Malaria; Monitoring; Mosquitoes; Vectors.

Primeiro registro de *Anopheles darlingi* Root (Diptera, Culicidae) na Região do Reservatório de Volta Grande, Conceição das Alagoas, Minas Gerais, Brasil

Resumo. Três espécimes de *Anopheles darlingi* Root foram encontrados na reserva ambiental Volta Grande, na área de influência da barragem do Rio Grande construída pela usina hidrelétrica de Volta Grande, em Conceição das Alagoas, Minas Gerais, Brasil. O mosquito *An. darlingi* é um dos principais vetores da malária humana no Brasil, devido à sua preferência alimentar por sangue humano, um fator que é acentuado pelo comportamento endofílico da espécie. O presente relato poderá ser útil à vigilância entomológica local para monitoramento dos impactos gerados pela formação do reservatório hidrelétrico, uma vez que a presença deste vetor neste tipo de ambiente indica um risco potencial de transmissão da malária.

Palavras-chave: Hidrelétrica; Malaria; Monitoramento; Mosquitos; Vetores.

Anopheles darlingi Root, is the main vector of human malaria parasites (*Plasmodium* spp.) in Brazil (Collucci & Sallum 2006). The species is common in Latin America, with a broad distribution from southern Mexico to southern Brazil (Forattini 2002; Collucci & Sallum 2006). This is a vector that is markedly anthropophilic (i.e., has a preference for feeding on human blood), and is regularly found within human households and in peridomestic environments (Consoli & Lourenço-de-Oliveira 1994; Forattini 2002). *An. darlingi* breeding sites consist of water sources such as ponds, reservoirs, and dams, and pockets of water formed in river bends where current is minimal. Water in these breeding is typically deep, slightly murky and partially shaded (Consoli & Lourenço-de-Oliveira 1994). In these environments, larvae and pupae survive among emergent or floating vegetation and plant debris (Consoli & Lourenço-de-Oliveira 1994).

One of the greatest concerns regarding this vector, is its high breeding success in face of the anthropogenic environmental changes, such as human settlement, agricultural and industrial activities, forestry, mining, and construction of hydroelectric power plants (Hiwat & Bretas 2011). These activities encroach upon wilderness areas where the vector is present, contributing to the formation of new potential breeding sites. Further, such activities attract human settlers and workers, potentially from areas with active malaria transmission (which could spark an epidemic).

The Volta Grande hydroelectric plant reservoir (UHE) was built in 1974 by damming the Rio Grande between Minas Gerais and São Paulo states (20 ° 01'54 "S; 48 ° 13'17" W). The reservoir catchment area occupies the Conceição das Alagoas, Água Comprida and Uberaba municipalities in Minas Gerais, and the Miguelópolis, Aramina and Igarapava municipalities in São Paulo (Figure 1). Much of the original riparian vegetation has been greatly impacted by vegetation removal and flooding during periods of river damming, construction, and the filling of the plant's reservoir. The reservoir flooded an area of 222 km² with a water volume roughly equivalent to 23 billion m³, now used for electric energy production. This paper reports the occurrence of *An. darlingi* for the first time in the Volta Grande Environmental Reserve, Conceição das Alagoas municipality, Minas Gerais.

Females of *An. darlingi* were sampled in a patch of riparian forest when they were naturally blood-feeding on humans, using a Castro catcher or flying into the house. Sampling of specimens was performed in April 2014, a period that includes the end of the dry season and the beginning of the rainy season in the region. The specimens were identified by researcher empowered by the laboratory of medical entomology Public Health School, University of São Paulo using stereomicroscope, following Forattini (2002) and Deane *et al.* (1946).Voucher specimens are deposited in the entomological collection of the Departamento de Biodiversidade Evolução e Meio Ambiente, Universidade Federal de Ouro Preto Ouro Preto, MG.

Funding Agencies: CEMIG, CNPq and FAPEMIG

The feeding behavior of the sampled specimens (i.e., on humans) and the capture locations (i.e., inside the house) are in agreement with data from the literature indicating *An. darlingi* as an anthropophilic mosquito with endophilic behavior (Consoli & Lourenço-de-Oliveira 1994; Forattini 2002). This report may be used to direct local entomological surveillance for monitoring impacts generated by hydroelectric reservoir formation, as the presence of the vector in this environment indicates a potential risk for malaria transmission in the event of presence and circulation of infected humans.

According to records from the Information and Epidemiological Surveillance System for Malaria (SIVEP/Malaria), no autochthonous malaria cases have been recorded in Minas Gerais state for over a decade (Brazil 2014). However, there are reported cases of the disease being carried in from endemic areas elsewhere (Brazil 2014). These records of human movement between hypo-and hyperendemic regions confirm the risk of malaria outbreaks due to the presence of the vector in both environments. Leisure and economic activities, especially those involved with the construction of dams, are among the main activities that put people at risk of contracting *Plasmodium* infections and disseminating them to other regions (Tadei *et al.* 2007; Chaves *et al.* 1995.)

According to Gomes *et al.* (2010) noted differences in the dynamics of *Anopheles* species during the construction and operation stages of the Porto Primavera hydroelectric plant, located on the border between Mato Grosso do Sul and São Paulo states. The authors observed that *An. darlingi*, a species rarely found before construction stages of the project was found in abundance in both immature and adult forms after the first flooding. Previous rarity and subsequent ease of sampling after flooding was also noted for *An. darlingi* at the Itaipu hydroelectric plant (Guimarães *et al.* 1997, Falavigna-Guilherme *et al.* 2005).

In their researchs, Tubaki *et al.* (2004) observed an increase in the abundance of *An. darlingi* in the Igarapava area, also located on the Rio Grande, due to an increase in breeding sites after plant reservoir construction. However for the Volta Grande UHE, no studies or survey records exist describing insect vector fauna, not even during the licensing process for the project. Additionally, the Environmental Control Plan (PCA) of the plant does not mention monitoring the proliferation of biological vectors in their mitigation program for impacts on the biotic environment.

Activities attributed to economic development, when they result in radical changes in humans/environment interactions, can potentially disrupt patterns of disease by producing new areas of prevalence and disease outbreaks (Tubaki *et al.* 2004). The impacts caused by Culicid fauna should be reevaluated based on, among other reasons, environmental changes due to recent expansion of the hydropower sector in Brazil. Our example, among others, of negative impacts of large hydropower projects demonstrates the need for development of programs for the surveillance and control of vector fauna (Guimarães *et al.* 1997).

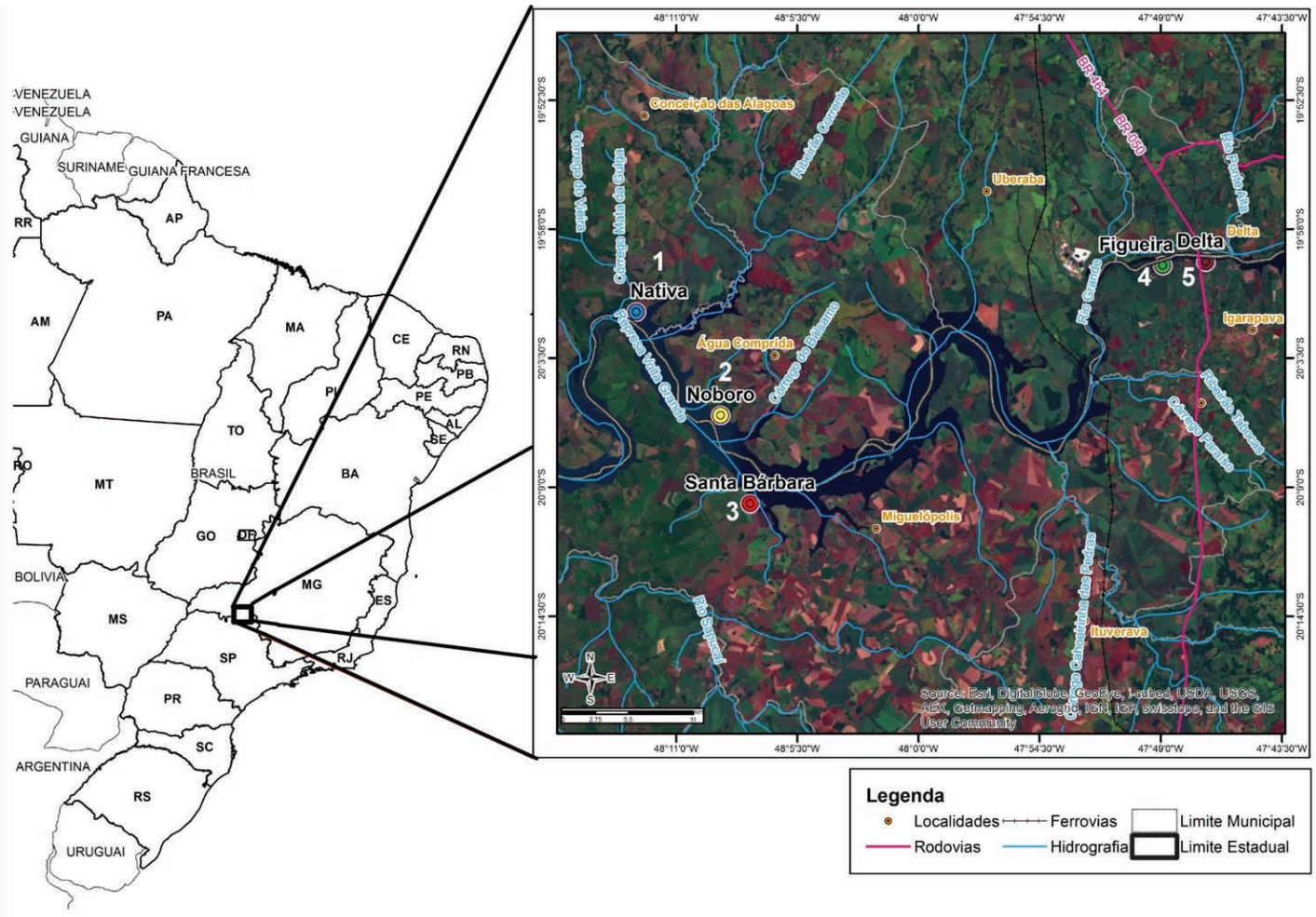

Figure 1. Map of the study area. Specimens of *An. darlingi* were captured at the area 1. Zone 22K 791531S 7783262 W.

e-ISSN 1983-0572

ACKNOWLEDGEMENTS

CEMIG, CNPq and FAPEMIG provided grants and scholarship to RM and YA. We thank the staff of the Volta Grande power station for support during fieldwork, and UFOP for logistics.

REFERENCES

Brasil, 2014. Ministério da Saúde. Sistema de Informação de Vigilância Epidemiológica para Malária - SIVEP/Malária. Brasília, Distrito Federal. Available in: <http://portalweb04.saude.gov.br/sivep_malaria/default.asp> [Accessed in: 07.15.2014].

Chaves, K.M., J.F. Zumpano, M.C. Resende, F.G.P. Junior & M.O.C. Rocha, 1995. Malária em Minas Gerais, Brasil, no Período 1980-1992. Malaria in the State of Minas Gerais, Brazil, 1980-1992. Cadernos de Saúde Pública do Rio de Janeiro, 11**:** 621-623.

Collucci, E. & M.A.M. Sallum, 2006. Records of *Anopheles* (Nyssorhynchus) (Diptera, Culicidae) in artificial containers in Ribeirão Preto City, State of São Paulo, Brazil. Revista Brasileira de Entomologia, 50: 431-432.

Consoli, R.A.G.B. & R. Lourenço-de-Oliveira, 1994. Principais Mosquitos de Importância Sanitária no Brasil. Fundação Oswaldo Cruz, Rio de Janeiro, Brasil, 228 p.

Deane, L.M., O.R. Causey, L.M. Deane, 1946. Chave ilustrada para a identificação de 35 espécies de anofelinos das regiões nordestina e amazônica do Brasil pelos caractéres da fêmea, com notas sôbre os transmissores de Malária (Diptera, Culicidae). The American Journal of Hygiene, Monographic Series, nº 18.

Falavigna-Guilherme, A.L., A.M. Silva, E.V. Guilherme & D.L. Morais, 2005. Retrospective study of malaria prevalence and *Anopheles* genus in the area of influence of the binational Itaipu reservoir Revista do Instituto de Medicina Tropical de São Paulo, 47: 81-86.

Forattini, O.P., 2002. Culicidologia Médica, vol. 2: Identificação, Biologia, Epidemiologia. Universidade de São Paulo, São Paulo, Brasil, 860 p.

Gomes, A.C., M.B. Paula, D. Natal & S.L.D. Gotlieb, 2010. Ecologia de *Anopheles* (Nyssorhynchus) *darlingi* Root em área de implantação de empreendimento hidrelétrico, na divisa dos Estados do Mato Grosso do Sul e São Paulo. Revista da Sociedade Brasileira de Medicina Tropical, 43: 272-276.

Guimarães, A.E., R.P. Mello, C.M. Lopes, J. Alencar & C. Gentile, 1997. Prevalência de anofelinos (Diptera: Culicidae) no crepúsculo vespertino em áreas da usina hidrelétrica de Itaipu, no município de Guairá, Estado do Paraná, Brasil. Memórias do Instituto Oswaldo Cruz, 92: 745-754.

Hiwat, H. & G. Bretas, 2011. Ecology of *Anopheles darlingi* Root with respect to vector importance: a review. Parasites & Vectors, 4: 177.

Tadei, W.P., I.B. Rodrigues, J.M.M. Santos, M.S. Rafael, R.A. Passos, F.M. Costa, R.C. Pinto & A.E.M. Oliveira, 2007. Entomologia e controle de vetores: o papel da entomologia no controle da malária. Revista da Sociedade Brasileira de Medicina Tropical, 40: 22-26.

Tubaki, R.M., R.M.T. Menezes, R.P.J. Cardoso & E.S. Bergo, 2004. Studies on entomological monitoring: mosquito species frequency in riverine habitats of the Igarapava Dam, Southern Region, Brazil. Revista do Instituto de Medicina Tropical de São Paulo, 46: 223-229.

Received in: 09/17/2014
Accepted in: 01/25/2015

****

Suggested citation:

Martins, R., G.F. Monteiro, F.M. da Costa & Y. Antonini, 2015. First Record of *Anopheles darlingi* Root (Diptera, Culicidae) in the Volta Grande Environmental Reserve, Conceição das Alagoas Municipality, Minas Gerais, Brazil. EntomoBrasilis, 8 (1): 82-84.
Available in: doi:10.12741/ebrasilis.v8i1.474