

SCIENTIFIC NOTE

MOSQUITO REPELLENT ACTION OF NEEMOS®

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ABSTRACT. Two to 3 ml of Neemos®, when applied to the exposed body parts of human volunteers, provided protection for 8 h from the bites of all anopheline species in 2 villages of the Sucre municipality, Bolivar State, Venezuela. Neemos is safe and can be used for protection from malaria in endemic countries.

KEY WORDS Neem, repellent, malaria, *Anopheles darlingi*, Venezuela

The neem tree, *Azadirachta indica* A. Juss (Meliaceae), is known for its insecticidal properties (Schmutterer 1990). The repellent action of neem oil (extracted from the seeds) has been demonstrated in *Anopheles culicifacies* Giles, *Phlebotomus papatasi* (Scopoli), and *P. argentipes* Annandale and Brunetti in India (Sharma et al. 1993, Sharma and Dhiman 1993). We report the results of field studies on the repellent action of Neemos® on mosquitoes. Neemos gel® (BPN-Botanicals BVBA, Kruishoutem, Belgium) is a mixture of neem extract, citronella, and carbomer gel base. This gel does not contain any perfumes or coloring agents.

The repellent action of Neemos was tested in the villages Las Majadas (7°45'N, 64°43'W) and Maripa (7°27'N, 65°12'W) in the Sucre Municipality in Bolivar State, Venezuela. These villages, which are about 215–246 km west of Bolivar City, Venezuela, have a high malaria transmission rate, with many larval mosquito habitats producing large anopheline populations. *Anopheles darlingi* Root is the principal vector of malaria in these regions. Data collected during 1996 on the mosquitoes of Las Majadas and Maripa revealed 3 species of anophelines (90%) and 2 species of culicines (10%). Mosquito densities were estimated at fortnightly intervals by hand-catching methods in 1 room in each of 10 houses, always at the same place and another site, outdoors, close to a residence. The average number of mosquitoes per man hour densities of anophelines and culicines were 217 (range 36–794) and 25 (range 13–39), respectively. Among the anophelines, 70–80% of the specimens were *An. darlingi*, 20–30% were *An. braziliensis* (Chagas), and 10–15% were *An. oswaldoi* (Peryassu).

Two to 3 ml of Neemos gel was applied to the face, arms, and legs of each volunteers and citronella oil solution alone was applied for comparison. Mosquitoes were collected from 1800 to 0600 h for 6 nights each in Las Majadas and Maripa villages. For an all-night collection, a volunteer served as bait from 1800 to 2400 h and was replaced by another volunteer until 0600 h. For each dose of Neemos and citronella oil solution, the volunteers were

assigned separate rooms and were allowed to lie on a cot. Mosquitoes landing on exposed body surfaces were collected by another person (untreated, without any oil) using a flashlight and a suction tube. Volunteers, insect collectors, and experimental rooms were randomized each night and collections were made on the treated and control volunteers concurrently on 12 different nights in September through November 1997. Results of the observations and percentage protection from mosquito biting are given in the Table 1. The percentage protection from man-mosquito biting contact was calculated by subtracting the total number of mosquitoes in the experimental group from the control, divided by mosquitoes in the control and multiplied by 100.

Neemos strongly repelled *An. darlingi* and other anopheline mosquitoes. The protection provided was 98.2% during an 8-h period. A study by Sharma et al. (1993) showed neem oil to be an excellent repellent of *An. culicifacies* (the major vector of rural malaria in India) and other anophelines, even at concentrations as low as 0.5 and 1%. At a concentration of 2%, no anophelines bit and the protection provided was 100% during a 12-h period.

Malaria is endemic in some regions in southern Venezuela, with at least 25,000 cases reported each year. Although residual spraying of insecticides is the mainstay of malaria control, epidemics occur in areas undergoing spraying. Malaria control has be-

Table 1. Repellency of Neemos® applied on the exposed body parts of volunteers to the landing and biting of mosquitos.

	Total no. of mosquitos landing on indoor human baits in 12 nights during September through November 1997	
	<i>Anopheles darlingi</i>	Total anophelines
Neemos	24	102
Control	1,392	1,984
% protection by neem	98.2	94.8

come highly complex and problematical because of socio-anthropologic factors, exophilic and exophagic vector behavior, widespread chloroquine and sulfadoxine-pirimethamine resistance in *Plasmodium falciparum*, and operational failures (Caraballo 1996). Thus, Neemos, by providing protection from the bite of mosquitoes of the genus *Anopheles* may help in the fight against malaria.

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