

Bioassay evaluation of residual activity of attractive toxic sugar-treated barrier fence in the control of *Phlebotomus papatasi* (Diptera: Psychodidae)

Abedin Saghafipour^{1,2}, Hassan Vatandoost^{1,3}, Ali Reza Zahraei-Ramazani², Mohammad Reza Yaghoobi-Ershadi², Yavar Rassi², Mohammad Reza Shirzadi⁴ & Amir Ahmad Akhavan^{2,3}

¹Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran; ²Department of Public Health, School of Public Health, Qom University of Medical Sciences, Qom; ³Department of Chemical Pollutants and Pesticides, Institute for Environmental Research, Tehran University of Medical Sciences, Tehran; ⁴Communicable Diseases Management Center, Ministry of Health and Medical Education, Tehran, Iran

ABSTRACT

Background & objectives: *Phlebotomus papatasi* is the main vector of the zoonotic cutaneous leishmaniasis (ZCL) in Qom Province and many other provinces of Iran. Attractive toxic sugar baits (ATSB) treated barrier fence is one of the new methods for controlling the vectors such as sandflies. The present study was designed to evaluate the residual activity of ATSB-treated barrier fence that was used in control of *P. papatasi*.

Methods: Following the selection of villages in Markazi district of Qom Province, central Iran during 2015 for ATSB and ASB (bait containing no active ingredient) methods; barrier fences on the ground in front of the rodent's colony were installed. A total of four conical tubes were installed and fixed on surfaces of treated barrier net of dimension 25 × 25 cm at biweekly interval. In each conical tube, 10 sand flies were released and after 3 min of exposure they were transferred to sterile cups. After 24 h, the obtained results were recorded according to the survival and mortality rate of sandflies. These tests were carried out five days after the installation of barrier fences, and repeated every 15 days until the mortality rate decreased to 60–65%.

Results: The bioassay tests results showed that the mortality rate of *P. papatasi* on ATSB-treated barrier fence for 5, 15, 30 and 45 days after spraying was 100, 95.83, 88.18 and 66.67% respectively, which decreased to 50.83% after 60 days.

Interpretation & conclusion: Persistence and residual activity of the active ingredient of the bait in the hot and dry climatic conditions of Qom Province remained significantly effective for at most 45 days, which subsequently decreased at a high rate. Hence, every 45 days barrier fences need to be impregnated with ATSB bait. The method also appeared cost-effective and could be practical in implementation of vector control programmes against ZCL.

Key words Attractive toxic sugar bait; bioassay test; Iran; *Phlebotomus papatasi*; Sandflies

INTRODUCTION

Phlebotominae sandflies (Diptera: Psychodidae) are biologic and proven vectors of human leishmaniasis across the world^{1–2}. These insects are also capable of transmitting some other pathogens to human such as *Bartonella* spp—the agent of bartonellosis (Carrion's disease or Oroya fever), papatasi fever virus (family Bunyaviridae, genus Phlebovirus), Toscana virus, Chagres, Punta Toro, and Flaviviruses, Orbiviruses, Vesiculoviruses *etc*^{2–3}. The phlebotominae sandflies of the subgenus *Adlerius* are well-known vectors for all types of visceral and cutaneous leishmaniasis (CL) in the Old World countries such as Iran². Among >800 species of these insects, only 98 species have role in disease transmission to human, including 42

Phlebotomus species in the Old World and 56 species of the *Lutzomyia* genus in the New World¹. Sandflies inhabit in human dwellings, stables, pet shelters, cracks on walls and cliffs, natural caves of mountainous areas, rodent burrows, fallen and decaying leaves in forests floor *etc*⁴. They have a wide geographical distribution ranging from Australia, through the Indian subcontinent to Central Asia, and Mediterranean countries in Europe, Africa and America⁵.

The sandfly vector species, *P. papatasi* is reported as the main vector of *Leishmania major* species in many countries such as Uzbekistan, Turkmenistan, Azerbaijan, Saudi Arabia, Jordan, Tunisia, Morocco and Iran⁶. This species is also recognized as the vector of *L. arabica* in Saudi Arabia and some arbovirus diseases in Iran and other countries in the world^{6–7}. Moreover, *P. papatasi* is