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Bio-ecology of malaria vectors in an endemic area, Southeast of Iran

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ABSTRACT

Objective: To determine some bio-ecological aspects of malaria vectors in Jask County, where is targeted for malaria elimination in the national program.**Methods:** Mosquitoes were collected monthly during 2013–2014 using different collection methods. Subsequently, ELISA test was used to detect the human blood index of mosquitoes. The susceptibility status of *Anopheles stephensi* was evaluated against the diagnostic dosages of seven WHO recommended insecticides.**Results:** A total of 3650 female and 4736 *Anopheles* larvae were collected including *Anopheles stephensi*, *Anopheles culicifacies* s.l., *Anopheles dhali*, *Anopheles fluviatilis* s.l., *Anopheles moghulensis* and *Anopheles turkhodi* species. *Anopheles stephensi* was the dominant collected species on human baits and indoors with high rate of unfed and gravid specimens in internal and external window traps. Human blood index was calculated as 14.3% for this species. It was also found to be resistant to DDT and Dieldrin.**Conclusions:** The collected species had a wide range of habitats, and resting behaviors. With regarding to the presence of most important malaria vectors in Jask, control of the disease may be so complicated; as based on the weather condition it can be transmitted during the whole year, expect for cold months. With this strong potential of transmission, existing population movements in the area may lead to imported cases of malaria and local outbreak(s). So, more specific studies on malaria vectors in high risk areas of Jask County are recommended.

1. Introduction

Malaria is the main vector-borne infectious diseases in the world with more about 584000 deaths during 2013, 90% of them occur in African countries, and in children aged less than 5

years [1]. The disease vector is *Anopheles* mosquito and about 70 species of this insect have capacity to transmit malaria [2]. To combat the malaria transmission and vectors it is necessary to understand the behavior of the vector(s) species. Spatial distribution of mosquitoes highly depends on the environmental and climatologically factors, so each species has its own range in a given area. Knowledge about the fauna and bionomics of malaria vectors in a given area is a very important issue in the assessment of malaria risk and planning vector control and prevention. Moreover seasonal changes in vector population are important to determine their population size and peak(s) of activity and implementing control measures [3]. Also when the study area has more than one climate, the survey should cover different climates to better understanding the malaria epidemiology and transmission dynamics [4].

The main malaria vector control tools are indoors residual spraying (IRS) and long lasting insecticide impregnated bed-

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nets. Correct using these tools highly depends on mosquitoes biting and resting habitats as well as their susceptibility to the applied insecticides. Extensive and long term using of chemicals in malaria vector control programs led to change in vector behavior [5–7].

Based on the WHO classification, Iran is now in the elimination stage for malaria control with 1373 confirmed cases in 2013. About 746000 residents are living in malaria active foci of the country [1]. Two *Plasmodium* species are reported from malaria patients in Iran: *Plasmodium vivax* (82%) and *Plasmodium falciparum* (18%). Seven *Anopheles* species are introduced as main and secondary vectors in the country: *Anopheles stephensi* (*An. stephensi*), *Anopheles culicifacies* s.l. (*An. culicifacies* s.l.), *Anopheles fluviatilis* s.l. (*An. fluviatilis* s.l.), *Anopheles dthali* (*An. dthali*), *Anopheles superpictus* s.l., *Anopheles maculipennis* complex and *Anopheles sacharovi*. The first five species are responsible for malaria transmission in southern parts, where active foci of the disease are available.

Nowadays, malaria transmission and indigenous cases occur mainly in three Provinces including Sistan va Baluchestan, Hormozgan and Kerman. Malaria has a long history in Hormozgan Province and is a major public health problem in some areas. Jask County, a less developed area in the eastern part of the province, contains active foci of malaria, where transmission occurs. On the other hand, it has been the most important malarious area in Hormozgan province during current years [8]. With due attention to the lake of formal information about malaria vectors in the study area, their monthly activity and abundance, human blood index, mosquito vector behavior and susceptibility status to insecticides, this study was aimed to determine the biocology of malaria vectors in Jask County.

2. Materials and methods

2.1. Study area

Jask County with a population of 56788 is located in eastern part of Hormozgan Province, southern Iran. The county is distributed between 57° 10'–59° 16' E and 25° 23'–26° 13' N. Jask is bordered with Sistan va Baluchestan Province (East and Northeast), Bashagard County (North), Sirik County (Northwest and West) and Oman Sea (South). The weather in Jask is dry and warm with hot summers and temperate winters. In 2013 the average of minimum and maximum monthly temperature were recorded as 13 °C and 39.6 °C in January and May, respectively. The county can be divided into two parts: more than 90% of the area is located in plain/coastal area with less than 400 m, and 10% has an altitude of more than 400 m and covered by mountains. Generally, the most villages of county are located in lowland area (100 m above sea level) (Figure 1). Weather in southern part of the county is warmer than northern mountainous areas. A total precipitation of 135.3 mm was recorded in 2013 as well. The altitude of Jask County is –23 to 1900 m above the sea level.

2.2. Entomological studies

This part of the study was conducted monthly for 12 months from June 2013 till June 2014 in four selected villages. The villages were located at the following coordinates and altitudes: 58.1728 °E, 25.7929 °N, 45 m; 58.1398 °E, 25.8966 °N, 83 m; 58.0870 °E, 25.9509 °N, 85 m and 58.3360 °E, 25.9548 °N, 115 m. The last village was located in mountainous area but other in plains.

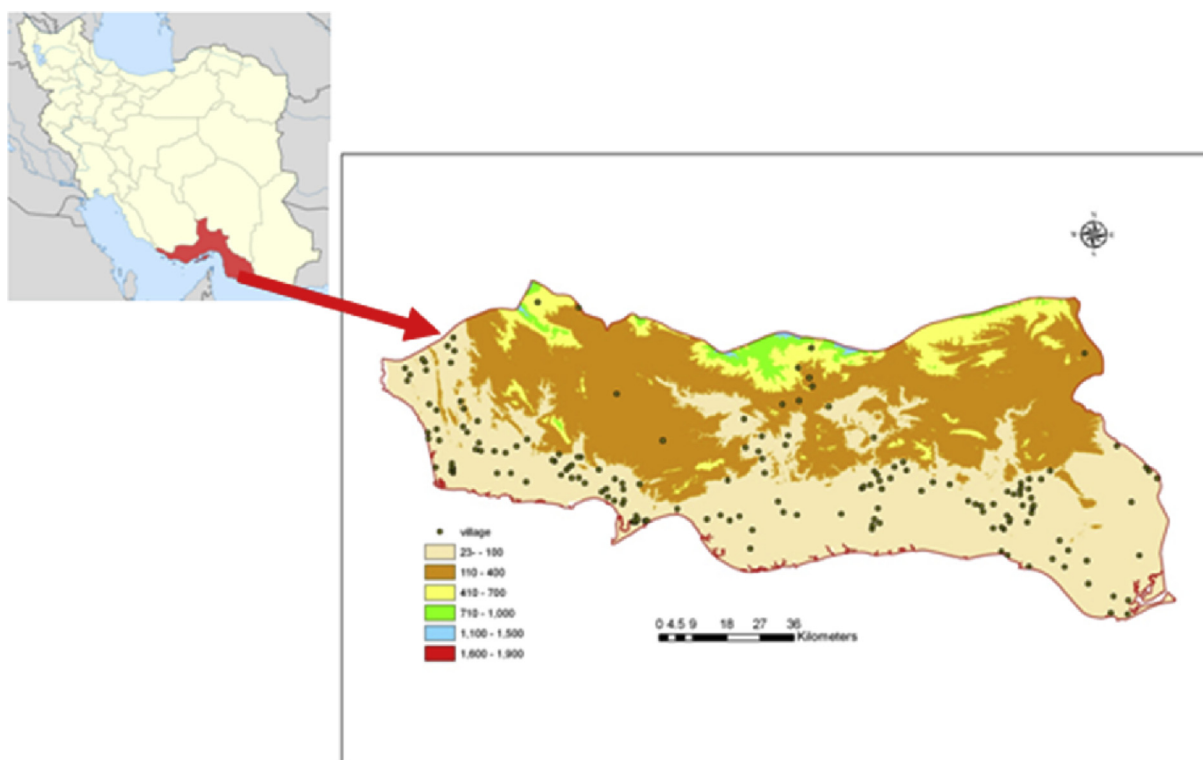


Figure 1. Distribution of villages (dots) in Jask County in Hormozgan Province, Southern Iran. The majority of villages are located in plain/coastal area.

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