

## Original Article

# Mosquito Fauna (Diptera: Culicidae) of Hamedan County, Western Iran

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### Abstract

**Background:** This study aimed to identify and determine the larval and adult mosquitoes (Culicidae) fauna in Hamedan County, western Iran.

**Methods:** It was a cross-sectional study which took place in four area of the Hamedan County. Sampling methods for larvae, pupae and adults were dipping, hand catch, night catch and total catch. Larvae and adult mosquitoes collected and were sent to laboratory of Medical Entomology, Hamedan University of Medical Sciences, Hamedan, Iran for further identification to species level to determination of fauna. Data analysis was performed using SPSS software version 19.

**Results:** Three genera and eight species of family Culicidae were collected and identified in Hamedan County, Hamedan Province, West Iran, during May to October 2013. These species included: *Culex theileri*, *Cx. pipiens*, *Cx. antennatus*, *Culiseta subochrea*, *Cs. langiareolata*, *Anopheles superpictus*, *An. maculipennis* and *An. stephensi*. The species *Cx. antennatus* and *An. stephensi* were reported for the first time in Hamedan County.

**Conclusion:** *An. stephensi* and *Cx. antennatus* caught had not been previously recorded in Hamedan Province. Due to vast agricultural activities in the province which provides suitable environment for the establishment of various species of mosquitoes and since many of them are potential vectors of human and domesticated animal pathogens, their ecology needs to be studied extensively.

**Keywords:** Culicidae, Fauna, Iran

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## Introduction

Family Culicidae, belong to the order Diptera, the two-winged flies. The family is a large and abundant group which occurs throughout temperate and tropical regions of the world, and well beyond the Arctic Circle. The family comprises 3,536 species classified in two subfamilies and 112 genera (Harbach 2013). There are many studies on mosquito fauna in Iran (Zaim 1987, Vatandoost et al. 2004, Ghavami and Ladonni 2005, Vatandoost et al. 2006, Abai et al. 2007, Azari-Hamidian 2007, Moosa-Kazemi et al. 2009, Azari-Hamidian et al. 2010, Azari-Hamidian 2011, Oshaghi et al. 2011, Hanafi-Bojd et al. 2012, Khoobdel et al. 2012, Saghafipour et al. 2012, Banafshi et al. 2013, Soleimani-Ahmadi et al. 2013, Khoshdel-Nezamiha et al. 2014). Ac-

ording to the latest checklist of mosquitoes in Iran, seven genera, 16 subgenera and 64 species have been reported (Azari-Hamidian 2007). In Hamedan Province, three genera and eleven species of the family Culicidae were reported as follows: *Anopheles superpictus*, *An. maculipennis sl*, *An. claviger*, *An. dthali*, *An. turkhudi*, *Culex pipiens*, *Cx. theileri*, *Cx. hortensis*, *Cx. perexiguus*, *Culiseta longiareolata* and, *Cs. subochrea* (Manochehri et al. 1970, Saebi 1987, Dehghan et al. 2011). Among the family Culicidae there are vectors of important diseases such as malaria, mosquito-borne viruses, *Dirofilaria immitis* (Dog Heart Worm) and *D. repens* (Dirofilariasis). Some of these diseases are particular importance in Iran

(Naficy and Saidi 1970, Saidi et al. 1976, Azari-Hamidian 2007, Chinikar et al. 2010). These vectors also have an important role in transmission of pathogens to livestock and wild birds and so make them as considerable family for veterinary medicine (Marm Kilpatrick et al. 2006, Azari-Hamidian 2011, Moosa-kazemi et al. 2012).

As a lot of aquatic habitats can be seen around Hamedan County which is good places for breeding of Culicidae, we decided to conduct a study to identify the species of mosquitoes in the County.

## Materials and Methods

This was a faunistic and descriptive study from the methodologies point of view, and took place in four geographically direction including villages and rural districts in Hamedan County (Fig. 1) (Saleh Abad in the West, Dehpyaz in the North, Varkaneh in the East and Darre Morad Beyk in the South). Twelve fixed and variable stations were selected from May to October in 2013 and larvae, pupae and adult mosquitoes collected by different sampling methods (WHO 1992). The neighboring provinces are Zanjan and Qazvin from the North, Kermanshah and Kurdistan from the West, Markazi from the South and East. The main economic activity is agriculture and animal husbandry in the province and maximum and minimum temperature of Hamedan city were 35 °C in July and 0 °C in August respectively. The total amount of rainfall in the area is 222 mm, the lowest 2.1 mm in September and the highest was 22 mm in May. The mean annual relative humidity was 35%.

Sampling was carried out using dipping method for collecting larvae and night catch using suction tubes from animal and human baited traps and total catch with pyrethrum (0.2% in kerosene) spray using a pressurized hand sprayer for adult mosquitoes. After

spraying, the room was kept closed for 15 min and the knocked-down mosquitoes were then collected from the floor sheet with forceps and placed in petri-dishes lined with moist cotton. Habitat characteristics of adult mosquitoes and environmental data such as temperature and humidity were recorded on special forms. Mosquito larvae are founded in many diverse habitats such as ponds, swamps and irrigation canals. The third and fourth collected larvae were preserved in lactophenol medium with recorded information and were sent to the Medical Entomology Laboratory of Hamedan University of Medical Sciences, after a week the specimens were mounted with Berlese fluid on microscope slides. The pupae were reared to adult in emergent cages and identified to species by morphological characters. Also all collected adult mosquitoes were pinned and then identified using valid keys (Zaim and Cranston 1986, Azari-Hamidian and Harbach 2009).

## Results

A total of 697 adult mosquitoes and 1422 larvae were collected including three genera and eight species which are as follows: *Culex theileri*, *Cx. pipiens*, *Cx. antennatus*, *Culiseta subochrea*, *Cs. langiareolata*, *Anopheles superpictus*, *An. maculipennis* and *An. stephensi* (Table 1). *Culex theileri* was most abundant species in Hamedan County in both adult and larvae stages. Two species *Cx. antennatus* and *An. stephensi* were observed as the first record for the province. Number of adults and larvae collected and sampling locations shown in Tables 2, 3. The species *An. stephensi* was collected only in adult stage from Saleh Abad village in the West of Hamedan city. The most and the lowest mosquito collected, were recorded in Saleh Abad in the west and Dehpyaz in the north, respectively.

**Table 1.** Frequency of Culicidae adults and larvae collected in the Hamedan County, May–October 2013

Species	Adult: n (%)	Larvae: n (%)
<i>An. superpictus</i>	21 (3.0)	16 (1.1)
<i>An. maculipennis</i>	12 (1.8)	13 (0.9)
<i>An. stephensi</i>	2 (0.3)	0 (0.0)
<i>Cx. theileri</i>	342 (49.0)	746 (52.5)
<i>Cx. pipiens</i>	191 (27.4)	413 (29.0)
<i>Cx. antennatus</i>	42 (6.0)	53 (3.8)
<i>Cs. subochrea</i>	50 (7.2)	63 (4.4)
<i>Cs. langiareolata</i>	37 (5.3)	118 (8.3)
<b>Total</b>	697 (100)	1422 (100)

**Table 2.** Number and location of larval and adult mosquito collected in four rural regions in Hamedan County, May–October 2013

Species	Village							
	Saleh Abad		Dehpiaz		Varcane		Dare Morad Beik	
	A (%)	L (%)	A (%)	L (%)	A (%)	L (%)	A (%)	L (%)
<i>An. superpictus</i>	13(1.8)	6(0.4)	0(0.0)	0(0.0)	8(1.1)	10(0.7)	0(0.0)	0(0.0)
<i>An. maculipennis</i>	5(0.7)	9(0.4)	0(0.0)	0(0.0)	7(1)	4(0.2)	0(0.0)	0(0.0)
<i>An. stephensi</i>	2(0.2)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
<i>Cx. theileri</i>	161(23.0)	324(22.7)	17(2.4)	36(2.5)	76(10.9)	292(20.5)	65(9.3)	41(2.8)
<i>Cx. pipiens</i>	43(6.1)	118(8.2)	31(4.4)	11(0.7)	48(6.8)	104(7.3)	34(4.8)	115(8)
<i>Cx. antennatus</i>	42(6)	53(3.7)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
<i>Cs. subochrea</i>	11(1.5)	17(1.1)	0(0.0)	0(0.0)	28(4)	39(2.7)	5(0.7)	0(0.0)
<i>Cs. langiareolata</i>	17(2.4)	23(1.6)	2(0.2)	0(0.0)	15(2.1)	81(5.6)	0(0.0)	0(0.0)
<b>Total</b>	294(42.1)	550(38.1)	50(7)	47(3.2)	182(16.9)	530(37)	104(14.8)	156(10.8)

A: Adult

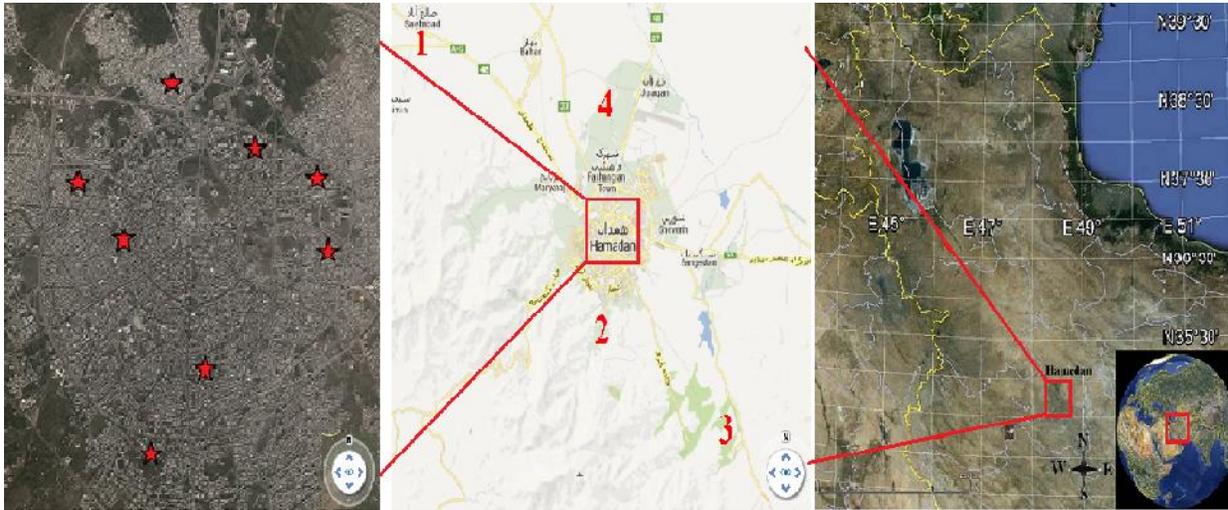
L: larva

**Table 3.** Number and location of larval and adult mosquito family Culicidae collected in four urban regions in Hamedan County, May–October 2013

Species	Area							
	Area1		Area2		Area3		Area4	
	A (%)	L (%)	A (%)	L (%)	A (%)	L (%)	A (%)	L (%)
<i>Cx. theileri</i>	9(1.2)	26(1.8)	3(0.4)	14(1)	10(1.4)	10(0.7)	1(0.1)	3(0.2)
<i>Cx. pipiens</i>	11(1.5)	31(2.1)	2(0.2)	6(0.4)	16(2.2)	23(1.6)	6(0.8)	5(0.3)
<i>Cs. subochrea</i>	3(0.4)	7(0.5)	0(0.0)	0(0.0)	3(0.4)	0(0.0)	0(0.0)	0(0.0)
<i>Cs. langiareolata</i>	1(0.1)	2(0.1)	0(0.0)	0(0.0)	2(0.2)	10(0.7)	0(0.0)	2(0.1)
<b>Total</b>	24(3.2)	66(4.5)	5(0.6)	20(1.4)	31(4.2)	43(3)	7(0.9)	10(0.6)

A: Adult

L: larva



**Fig. 1.** Location of sampling stations in the study area

Villages: 1. Saleh Abad, 2. Darre Morad Beyk, 3. Varkaneh, 4. Dehpyaz

★ Sampling stations in Hamedan City

## Discussion

Eight species belonging to three genera were collected and identified from rural and urban locations in four geographical directions in Hamedan County. Species *Cx. antennatus* and *An. stephensi* are reported from this region for the first time.

*Anopheles stephensi* has a wide distribution in Iran including southern slopes and valleys of the Zagros chain in Ilam, Khuzistan, Kohgiluyeh and Boyer-Ahmad, Lorestan, Sistan and Baluchistan, Bushehr, Fars, Hormozgan, Kerman and also in southern Kermanshah provinces (Manochehri et al. 1976, Zaim and Cranston 1986, Hanafi-Bojd et al. 2012). There are a few published documents about *Cx. antennatus* distribution in the country, but presence of this species has been reported in different parts of Iran including Homozgan and Fars provinces (Lotfi 1970). Six from eleven species which identified already in the province are reported in this study and two species were observed as new record for the region (Manochehri et al. 1970, Saebi 1987, Dehghan et al. 2011). Species *An.*

*claviger*, *An. dthali*, *An. turkhudi*, *Cx. hortensis* and *Cx. perexiguus* which previously reported from the province were not collected in this survey. *Culex pipiens* can be separated from *Cx. torrentium* and *Cx. vegans* by Harbach's key using seta 1-III-V, seta 1-M, seta 1-X, seta 1-C, and some other characters and our identification was supported with this key (Harbach 1988). Our results are similar to previous reports that have been made on the mosquito's larvae in the province (Dehghan et al. 2011).

Some species such as *Cx. theileri* and *Cx. pipiens* are potential vectors for transmission of diseases to humans and animals (Lane and Crosskey 1993, Moosa-kazemi et al. 2012). *Culex theileri* was the most dominant species in this region which is similar to the results of previous studies in Sanandaj (Moosa-Kazemi et al. 2010), Zanjan (Ghavami et al. 2005), Ardebil (Azari-Hamidian et al. 2009), Isfahan (Moosa-kazemi et al. 2000), East Azerbaijan (Abai et al. 2007) and West Azerbaijan (Khoshdel-Nezamiha et al 2014). This

species was collected as the same time in the night which is consistent with the results in Sanandaj (Moosa-Kazemi et al. 2010). Most collected mosquitoes were from rural areas, and the results were consistent with similar studies in Turkey (Simsek 2004) and in Iran (Ghavami and Ladonni 2005). Two species *Cs. langiareolata* and *Cs. subochrea* were collected in our study, these findings are consistent with previous results (Dehghan et al. 2011). Collecting of two adults *An. stephensi* in Saleh Abad region (area 1) for the first time in west of the County could be related to climate change and global warming but further studies are needed to confirm this. However climate change will have enormous implication for human health, especially for the burden of vector borne infections diseases (Emily and Shuman 2010). Abundance of suitable larval breeding places such as ponds, wetlands and water ponds, rivers and streams and drainage water in and around the County which many of them are related to agricultural activities contribute to the high frequency of mosquitoes in this area. Given the importance of mosquitoes in the transmission of pathogens, and potential risk in emerging and re-emerging diseases, research and monitoring in these places to detect and report the status of the family mosquitoes seems to be essential.

## Conclusion

From the results of this study can be concluded that the some species of mosquitoes have a very large distribution in many parts of the province. The results of this and previous studies indicate the presence of different mosquito species across the Hamedan County, which some of them are potentially vectors of medical and veterinary important diseases. In relation to finding *An. stephensi* for the first time more studies are needed to be conducted in the province.

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