**Original Article**

# Fauna and Larval Habitats of Mosquitoes (Diptera: Culicidae) of West Azerbaijan Province, Northwestern Iran

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## Abstract

**Background:** Several important diseases are transmitted by mosquitoes. Despite of the potential of the occurrence of some mosquito-borne diseases such as West Nile, dirofilariasis and malaria in the region, there is no recent study of mosquitoes in West Azerbaijan Province. The aim of this investigation was to study the fauna, composition and distribution of mosquitoes and the characteristics of their larval habitats in this province.

**Methods:** Larvae and adult collections were carried out from different habitats using the standard methods in twenty five localities of seven counties across West Azerbaijan Province.

**Results:** Overall, 1569 mosquitoes including 1336 larvae and 233 adults were collected from 25 localities. The details of geographical properties were recorded. Five genera along with 12 species were collected and identified including: *Anopheles claviger*, *An. maculipennis* s.l., *An. superpictus*, *Culex pipiens*, *Cx. theileri*, *Cx. modestus*, *Cx. hortensis*, *Cx. mimeticus*, *Culiseta Longiareolata*, *Ochlerotatus caspius* s.l., *Oc. geniculatus* and *Uranotaenia unguiculata*. This is the first record of *Oc. geniculatus* in the province.

**Conclusion:** Due to the geographical location of the West Azerbaijan Province, it comprises different climatic condition which provides suitable environment for the establishment of various species of mosquitoes. The solidarity geographical, cultural and territorial exchanges complicate the situation of the province and its vectors as a threat for future and probable epidemics of mosquito-borne diseases.

**Keywords:** Culicidae, Arboviruses, Larval habitat, Mosquito-borne diseases, Fauna



## Introduction

The family Culicidae (Diptera) comprises at least 3531 species representing 111 genera divided into two subfamilies, Anophelinae and Culicinae (Harbach 2013). Several important diseases are transmitted by them, among which some of mosquito-borne viruses such as West Nile and Sindbis have been reported from Iran (Naficy and Saidi 1970, Saidi et al. 1976). Chinikar et al. (2010) reported a case of Dengue fever in Tehran, imported from Malaysia Moreover the possibility of the outbreak of some other mosquito-borne arboviruses such as Japanese encephalitis and Rift Valley fever in the WHO Eastern Mediterranean Region, including Iran, should be considered (WHO 2004). Other mosquito-borne diseases such as dirofilariasis (Azari-Hamidian et al. 2009) and many other mosquito-borne diseases are endemic in some parts of Iran, including West Azerbaijan Province.



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Several studies have been conducted to identify the fauna of mosquitoes across Iran (Zaim 1987, Vatandoost et al. 2004, Ghavami and Ladonni 2005, Vatandoost et al. 2006, Abai et al. 2007, Azari-Hamidian 2007b, 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). According to the most updated checklist of Iranian mosquitoes, 64 species representing seven genera occur in the country (Azari-Hamidian 2007a). In addition to morphological studies, molecular studies have been carried out in order to clarify some problematic situations (Sedaghat et al. 2003, Oshaghi et al. 2007, Naddaf et al. 2012). Oshaghi et al. (2008) recently identified *Anopheles superpictus* Grassi as a complex of three genotypes (X, Y, and Z). Naddaf et al. (2010) reported *An. fluviatilis* James species U from Fars Province and were in doubt about the occurrence of the species (form) V in Iran. Besides, Mehravaran et al. (2011) recorded the species U in southeastern Iran.

Mosquito oviposition sites include different types which may differ in the point of the quantity and quality of water and environmental characteristics (Machault et al. 2009). Each mosquito species prefer certain breeding site for oviposition. The breeding habitat plays a crucial role for mosquito population dynamics. There is a strong association between the density and distribution of the mosquito larval stages and that of the adults. Then larval control programs can reduce the health problems caused by mosquitoes (Floore 2006).

The province of West Azerbaijan is located at the northwestern part of Iran and has a common border line with other countries such as Turkey, Armenia, Azerbaijan and Iraq. The solidarity geographical, cultural and territorial exchanges complicate the situation of the province. An example of such complexity is the collapse of the Soviet Union and the destruction of health infrastructures in the newly independent countries, leading to resurgence and outbreaks of malaria in the region and neighboring countries such as Iran (Greenwood et al. 2002, Lak et al. 2002, Vatandoost et al. 2003).

Furthermore the presence of other mosquito-borne diseases such as West Nile fever (Ahmadnejad et al. 2011) and dirofilariasis (Azari-Hamidian et al. 2007) in the province indicates the importance of investigation of mosquitoes in this region. According to the results of the previous studies, 24 species of mosquitoes in six genera have been reported from the province, although there is doubt about the presence of some species (Beklemishev and Gontaeva 1943, Zolotarev 1945, Kalandadze and Kaviladze 1947, Lotfi 1973, Saebi 1987, Sedaghat et al. 2003).

There is no recent study of mosquitoes in West Azerbaijan Province, despite of the occurrence of some mosquito-borne diseases such as West Nile, dirofilariasis, and malaria in the region. The aim of this investigation was to study the fauna, composition and distribution of mosquitoes in this province.

## Materials and Methods

### Study area

West Azerbaijan Province is located in the northwest of Iran, bordering the countries: Turkey, Iraq, Armenia, Azerbaijan, and the provinces of East Azerbaijan, Zanjan and Kurdistan. It covers an area of 39,487 km², or 43,660 km² including Lake Urmia. The 12 counties of this province have been located in different climate and geographical areas such as mountainous areas near the border with Iraq and Turkey, plains near the Aras and other rivers and the coast-line of the Urmia Lake (Fig. 1). The geographical details of collecting localities have been presented in Table 1.





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**Specimen and data collection**

In the present study, larvae collection was carried out from different habitats using the standard (350 ml dipper) dipping method (Silver 2008) in twenty five localities of seven counties across the province (Table 1).

Sample collections were done during May–November 2012. The larvae were transferred to the laboratory and the microscope slides of the larvae were prepared. The third- and fourth-instar larvae were identified using the keys of Shahgudian (1960) and Azari-Hamidian and Harbach (2009).

For collecting the adult mosquitoes, several methods such as hand catch, night landing catch on human, cow, total catch, and pit shelter collection were employed fortnight (Silver 2008). Collected samples were transferred to the laboratory and identified using the standard keys (Azari-Hamidian and Harbach 2009). The abbreviations of the genus name have been used according to Reinert (Reinert 2009).

**Physical and biological characteristics of larval habitats**

Various physical and biological characteristics of the breeding places of larvae including habitat type (natural or artificial), water condition (standing, slow running, transient or permanent water) vegetation (presence of vegetation and the kind of vegetation) and sunlight exposure (full or partial sunlight or shaded) were recorded visually or using proper equipments.

## Results

Specimen collections were carried out on 35 occasions during May–November 2012. Overall, 1569 mosquitoes including 1336 larvae and 233 adults were collected from 25 localities. The details of geographical properties (Latitude, Longitude and altitude) of localities are presented in Table 1.

Five genera along with 12 species were collected and identified, including: *An. claviger*, *An. maculipennis* s.l., *An. superpictus*, *Cx. pipiens*, *Cx. theileri*, *Cx. modestus*, *Cx. hortensis*, *Cx. mimeticus*, *Cs. longiareolata*, *Oc. caspius* s.l., *Oc. geniculatus* and *Ur. unguiculata* (Table 2). This is the first record of *Oc. geniculatus* in West Azerbaijan Province.

The species, *Ur. unguiculata* and *Cx. mimeticus* were collected only in larval stage and *Oc. caspius* s.l., and *Oc. geniculatus* only as adults adjacent to trees and green spaces using hand catch method. In larval stage, Cx. *pipiens* (25%), *Cx. theileri* (21%), *Cx. hortensis* (13.4%) and *An. maculipennis* complex (11.6%), were the most prevalent species respectively but in contrast in adult stage, *An. maculipennis* (41.6%), *Cs. longiareolata* (19.3%), *An. claviger* (18.45%), *Cx. pipiens* (3.86%) and *Cx. hortensis* (3.86%) were the most abundant species. However, *Ur. unguiculata* (0.07%) was scarce species (Table 2).

Species such as *Cx. pipiens*, *Cx. theileri* and *An. maculipennis* have a wide distribution in the study areas but some species such as *Oc. geniculatus*, *Oc. caspius* and *Ur. unguiculata* have been collected from limited areas (Table 3).

All of the different types of habitats were occupied by mosquito larvae. The breeding places with vegetation were more favorable for larvae. Most of *Anopheles* larvae were collected from permanent, still and clear water. Artificial habitats like artificial standing water (Nav-Jihan), slow running water (Ghezel-Kurd, Ghezel-Ajam) were the most common habitats for culicinae larvae but most of *Anopheles* larvae were collected from natural habitats like natural standing water (Bazargan) and transient water (Zakerloo). Likewise the members of the genus *Culex* were collected from wider range of habitats and this shows their adaptation ability to different conditions. The properties of larval habitats have been shown in Table 4.





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**Table 1.** Geographical properties of collecting localities, West Azerbaijan Province, Iran, 2012

| Location | | Latitude | Longitude | Altitude (m) |
|---|---|---|---|---|
| Urmia | Nazloo 1 | 37°39'24.39"N | 44°59'0.39"E | 1358 |
| | Nazloo2 | 37°39'0.69"N | 44°59'5.50"E | 1365 |
| | Sero | 37°43'50.12"N | 44°39'33.78"E | 1572 |
| | Nav-Jehan | 37°42'51.58"N | 44°39'41.83"E | 1605 |
| | Bavan-kanisi | 37°49'28.46"N | 44°44'3.31"E | 2071 |
| | Marmisho | 37°34'45.91"N | 44°37'50.47"E | 1749 |
| | Issar | 37°33'25.95"N | 45° 0'12.52"E | 1466 |
| Makoo | Ghale-Joogh | 39°16'46.06"N | 44°28'19.15"E | 1299 |
| | Baghche-joog | 39°17'21.80"N | 44°25'29.81"E | 1411 |
| | Sangar | 39°18'59.73"N | 44°25'53.99"E | 1348 |
| | Boljak | 39°17'7.10"N | 44°41'24.22"E | 991 |
| | Ghezel- Kurd | 39°15'27.66"N | 44°40'0.29"E | 1012 |
| | Ghezel- Ajam | 39°15'51.23"N | 44°39'12.11"E | 1021 |
| Bazargan | Bazargan 1 | 39°24'31.87"N | 44°26'11.77"E | 1400 |
| | Yarim-Ghiye | 39°26'45.90"N | 44°26'4.27"E | 1409 |
| Poldasht | Poldasht | 39°36'2.58"N | 44°51'43.20"E | 795 |
| | Ghizil arkh | 39°24'25.66"N | 44°58'58.85"E | 788 |
| | Zakerloo | 39°21'55.62"N | 45° 3'16.74"E | 782 |
| Naghadeh | Sarisoo | 39°20'26.52"N | 44°53'58.04"E | 858 |
| | Naghadeh | 36°57'28.22"N | 45°21'51.71"E | 1313 |
| Mahabad | Mahabad1 | 36°48'53.18"N | 45°44'3.86"E | 1304 |
| | Kavelan | 36°23'45.33"N | 45°40'32.42"E | 1538 |
| | Mahabad2 | 36°45'42.49"N | 45°42'23.85"E | 1371 |
| Sardasht | Sardasht Pol | 36° 9'20.63"N | 45°32'7.05"E | 994 |
| | Kapran | 36° 9'40.37"N | 45°24'41.30"E | 1562 |

**Table 2.** Relative abundance of adults and larvae of mosquitoes West Azerbaijan Province, Iran

| Species | Adults | | Larvae | |
|---|---|---|---|---|
| | n | % | n | % |
| ***An. claviger*** | 43 | 18.45 | 99 | 7.4 |
| ***An. maculipennis*** | 97 | 41.6 | 155 | 11.6 |
| ***An. superpictus*** | 3 | 1.28 | 15 | 1.12 |
| ***Cx. hortensis*** | 9 | 3.86 | 180 | 13.4 |
| ***Cx. mimeticus*** | 0 | 0 | 7 | 0.52 |
| ***Cx. modestus*** | 3 | 1.28 | 47 | 3.5 |
| ***Cx. pipiens*** | 9 | 3.86 | 336 | 25 |
| ***Cx. theileri*** | 14 | 6 | 281 | 21 |
| ***Cs. longiareolata*** | 42 | 19.3 | 215 | 16 |
| ***Oc. caspius*** | 6 | 2.57 | 0 | 0 |
| ***Oc. geniculatus*** | 4 | 1.7 | 0 | 0 |
| ***Ur .unguiculata*** | 0 | 0 | 1 | 0.07 |
| **Total** | 233 | 100 | 1336 | 100 |


**Fig. 1.** West Azerbaijan Province and the location of the studied counties, 1) Bazargan, 2) Poldasht, 3) Makoo, 4) Urmia, 5) Naghadeh, 6) Mahabad and 7) Sardasht





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**Table 3.** Composition and abundance of mosquitoes, West Azarbaijan Province, Iran, 2012

| County | Mosquito-life stage | Species of Mosquito | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Cx. pipiens* | *Cs. longiareolata* | *Cx. theileri* | *Cx. modestus* | *Cx. hortensis* | *An.claviger* | *An.maculipennis* | *Oc. geniculatus* | *Oc. caspius* | *Ur. anotaenia* | *An. superpictus* | *Cx. mimeticus* |
| **Urmia** | Larvae | 146 | 212 | 160 | 19 | 153 | 63 | 63 | - | - | - | - | - |
| | Adult | 5 | 34 | 3 | - | 1 | 26 | 65 | - | - | - | - | - |
| **Makoo** | Larvae | 80 | 3 | 20 | 20 | - | - | 1 | - | - | - | - | - |
| | Adult | 2 | - | 3 | 3 | - | 1 | 6 | 4 | 6 | - | - | - |
| **Bazargan** | Larvae | - | - | 10 | 1 | - | - | 21 | - | - | - | - | - |
| | Adult | 1 | - | 3 | - | 5 | - | 4 | - | - | - | - | - |
| **Poldasht** | Larvae | 55 | - | 86 | 3 | - | - | 7 | - | - | 1 | - | - |
| | Adult | - | - | 3 | - | - | - | 3 | - | - | - | - | - |
| **Naghadeh** | Larvae | - | - | | - | - | 26 | 40 | - | - | - | - | - |
| | Adult | - | 7 | | - | - | 6 | 16 | - | - | - | - | - |
| **Mahabad** | Larvae | 55 | - | 5 | 4 | 27 | - | 8 | - | - | - | 5 | 7 |
| | Adult | 1 | 4 | 2 | - | 3 | 1 | | - | - | - | 3 | - |
| **Sardasht** | Larvae | - | - | - | - | - | 10 | 15 | - | - | - | 10 | - |
| | Adult | - | - | - | - | - | 9 | 3 | - | - | - | - | - |
| **Total** | Larvae (%) | 336(25%) | 215(16%) | 281(21%) | 47(3.5%) | 180(13.4%) | 99(7.4%) | 155(11.6%) | - | - | 1(0.07) | 15(1.12%) | 7(0.52%) |
| | Adult (%) | 9(3.86%) | 45(19.3%) | 14(6%) | 3(1.28%) | 9(3.86%) | 43(18.45) | 97(41.6%) | 4(1.7%) | 6(2.57%) | - | 3(1.28%) | - |
| **Total (%)** | | 345(22%) | 260(17%) | 295(19.8%) | 50(3%) | 189(12%) | 142(9%) | 252(16%) | 4(0.25%) | 6(0.38%) | 1(0.19%) | 18(1.1%) | 7(0.46%) |





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**Table 4.** The characteristics of larval habitats of collecting localities, West Azerbaijan Province, Iran, 2012

| Location | | Habitat situation | Vegetation situation | Sunlight situation | Habitat kind | Collected species (abundance percentage in the location) |
|---|---|---|---|---|---|---|
| Urmia | **Nazloo 1** | Slow running water | out of water | partial | natural | *Cx. pipiens* (25%), *Cs. longiareolata* (30%), *Cx. theileri* (20%), *Cx. modestus* (6%), *Cx. hortensis* (11%), *An. claviger* (8%) |
| | **Nazloo2** | transient | water surface | partial | artificial | *Cx. modestus* (76%), *An. maculipennis* (24%) |
| | **Sero** | Slow running water | beneath of water surface | full | natural | *Cx. theileri* (55%), *An. maculipennis* (45%) |
| | **Nav-Jehan** | Slow running water | beneath of water surface | partial | artificial | *Cx. theileri (*45%), *An. maculipennis* 25%), *An. claviger* (30%) |
| | **Bavan-kanisi** | Standing water | out of water | partial | artificial | *Cx. pipiens* (100%) |
| | **Marmisho** | permanent | beneath of water surface | shaded | natural | *An. claviger* (15%), *Cx. hortensis* (85%) |
| | **Issar** | Transient | beneath of water surface | full | artificial | *Cx. pipiens* (20%), *Cs. longiareolata* (60%), *Cx. theileri* (15%), *An. maculipennis* (5%) |
| Makoo | **Ghale-Joogh** | permanent | out of water | partial | natural | *Cx. theileri* (55%), *Cs. longiareolata* (45%) |
| | **Baghche-joog** | Slow running water | out of water | shaded | natural | *Cx. pipiens* (40%), *Cx. theileri* (60%) |
| | **Sangar** | Standing water | beneath of water surface | partial | natural | *Cx. pipiens* (70%), *Cx. theileri* (15%), *Cx. modestus* (15%) |
| | **Boljak** | Standing water | water surface | shaded | natural | *An. maculipennis* (100%) |
| Bazargan | **Ghezel-Kurd** | Slow running water | out of water | partial | artificial | *Cx. pipiens* (65%), *Cx. theileri* (35%) |
| | **Ghezel-Ajam** | Slow running water | beneath of water surface | shaded | artificial | *Cx. theileri* (80%), *An. maculipennis* (20%) |
| | **Bazargan 1** | Standing water | water surface | full | natural | *An.maculipennis* (100%) |
| | **Yarim-Ghiye** | Slowly running water | beneath of water surface | full | artificial | *Cx. theileri* (80%), *Cx. modestus* (5%), *An. maculipennis* (15%) |
| Poldasht | **Poldasht** | permanent | water surface | partial | natural | *Cx. pipiens* (30 %), *Cx. theileri* (30 %), *Cx. modestus* (20 %), *An. maculipennis* (20 %) |
| | **Ghizil arkh** | Standing water | out of water | full | natural | *Cx. theileri* (100%) |
| | **Zakerloo** | Transient | beneath of water surface | partial | natural | *An. maculipennis* (95%), *Uranotaenia* (5%) |
| Naghadeh | **Sarisoo** | Standing water | water surface | shaded | natural | *Cx. pipiens* (85%), *An. maculipennis* (15%) |
| | **Naghadeh** | transient | out of water | full | natural | *An. claviger* (45%), *An. maculipennis* (55%) |
| Mahabad | **Mahabad1** | permanent | water surface | full | natural | *Cx. pipiens*(35%), *Cx. theileri* (10%), *Cx.modestus* (10%) *Cx. hortensis* (30%), *An. maculipennis* (15%) |
| | **Kavelan** | Slowly running water | beneath of water surface | partial | natural | *Cx. hortensis* (15%), *An. maculipennis* (20%), *An. superpictus* (25%), *Cx. mimeticus* (40%) |
| | **Mahabad2** | Standing water | water surface | shaded | natural | *Cx. pipiens* (20%), *Cx. theileri* (25%), *Cx. modestus* (10%), *An. maculipennis* (25%), *An. superpictus* (20%) |
| Sardasht | **Sardasht Pol** | Slowly running water | beneath of water surface | shaded | natural | *An. maculipennis* (65%), *An. superpictus* (35%) |
| | **Kapran** | Slowly running water | water surface | shaded | natural | *An. maculipennis* (45%), *An. superpictus* (30%), *An. claviger* (25%) |





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## Discussion

This is the first specific and targeted investigation to study mosquitoes in West Azerbaijan Province which showed the presence of 12 species of mosquitoes in the study area. Sporadic studies had been conducted in parts of the north western part of Iran (Beklemishev and Gontaeva 1943, Zolotarev 1945, Kalandadze and Kaviladze 1947, Lotfi 1973, Danilov 1975, Saebi 1987, Azari-Hamidian et al. 2009, Kazemi et al. 2010, Banafshi et al. 2013).

In addition to the 12 species collected and identified in this study, other 13 species such as *An. algeriensis*, *An. plumbeus*, *Cx. deserticola*, *Cx. tritaeniorhynchus*, *Cs. alaskaensis*, *Cs. annulata*, *Oc. dorsalis* (Kalandadze and Kaviladze 1947), *An. hyrcanus* Group (Saebi 1987), *An. marteri* (unpublished data from Institute of malariology, Tehran University of Medical Sciences), *An. sacharovi* (Kalandadze and Kaviladze 1947, Sedaghat et al. 2003), *Cs. subochrea* (Kalandadze and Kaviladze 1947, Zaim 1987), *Aedes vexans* (Kalandadze and Kaviladze 1947, Zaim 1987), *Oc. flavescens* (Kalandadze and Kaviladze 1947, Zaim 1987), were reported from this region. Because of the oldness of the report of some of these species and the probable effect of the climate change during the time, the presence of some of these species in the study area is questionable and uncertain.

Seven genera and 15 species were identified in East Azerbaijan Province (Abai et al. 2007) among which eight species (*An. maculipennis*, *An. claviger*, *An. superpictus*, *Cx. theileri*, *Cx. pipiens*, *Cs. longiareolata*, *Oc. caspius* and *Ur. unguiculata*) were common between the two neighboring provinces and six (*Cx. theileri*, *Cx. pipiens*, *Cx. hortensis*, *Cx. mimeticus*, *Cs. longiareolata* and *Oc. caspius*) are common between West Azerbaijan and Sanandaj County in Kurdistan Province which is in southern neighboring of West Azerbaijan (Kazemi et al. 2010).

The comparison of the results of this study with a recent comprehensive study carried out in Kurdistan Province (Banafshi et al. 2013) showed that nine species (*An. maculipennis*, *An. claviger*, *An. superpictus*, *Cx. theileri*, *Cx. pipiens*, *Cx. hortensis*, *Cx. mimeticus*, *Cs. longiareolata* and *Oc. caspius*) were common between Kurdistan and West Azerbaijan Provinces.

Comparing the results of this study with a similar study carried out in Zanjan Province (Ghavami and Ladonni 2005), showed that six species (*An. maculipennis, An. superpictus, Cx. pipiens, Cx. theileri, Cx. hortensis* and *Cs. longiareolata*) are common between Zanjan and West Azerbaijan Provinces.

In Turkey (Aldemir et al. 2010) and northern and central parts of Iran such as East-Azerbaijan, Ardebil and Kurdistan Provinces, *Cx. theileri* is the dominant and most abundant species, except for the low-lying areas bordering the Caspian Sea and urban areas (Azari-Hamidian et al. 2009). The results of this study showed that in the case of larvae collection, *Cx. pipiens* (25%) and *Cx. theileri* (21%) were the most abundant species respectively and widely distributed in all parts of West Azerbaijan Province.

The presence of these two species (*Cx. pipiens*, *Cx. theileri*) in other studies in Iran (Azari-Hamidian 2007b, Azari-Hamidian et al. 2009, Kazemi et al. 2010, Nikookar et al. 2010, Saghafipour et al. 2012) and other neighboring areas in neighboring countries such as eastern parts of Turkey and Iraq (Rueda et al. 2008) show a wide distribution of these species in the region.

The species *Oc. geniculatus* is recorded for the first time in West Azerbaijan Province but this tree-hole mosquito has not been reported from neighboring areas of Iran and other neighboring countries. This species had been reported previously from northern parts of the country such as Ardabil, Guilan and





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Mazandaran Provinces (Zaim 1987, Azari-Hamidian et al. 2009).

The West Azerbaijan Province comprises different geographical areas with climatically different condition. These diverse climatic conditions can provide suitable environment for the establishment of various species of mosquitoes and this is the explanation for the richness of the composition of mosquito species in this province.

Some of identified species are principal vectors of several mosquito-borne pathogens such as West Nile virus, Rift valley virus. Six species of known species in this study (*An. maculipennis*, *Cx. modestus*, *Cx. theileri*, *Cx. pipiens*, *Cs. longiareolata*, *Oc. caspius*) are among the important vectors of West Nile fever. According to reports of the existence of this disease in the study area (Saidi et al. 1976, Ahmadnejad et al. 2011) and surrounding countries (Zeller and Schuffenecker 2004), the existence of mentioned species should be considered and further investigations are needed.

Minding this fact that birds are involved in the cycle of transmission as amplifying hosts and existence of several ponds such as Urmia Lake, Mahabad pond, Aras basin and Sardasht nature which are the destination of migrant birds from other countries, emerging of this disease in the region is more conceivable. Picking these facts together should act like a wake for health system and more attention will turn to the mosquito-borne diseases.

On the other hand, *Cx. pipies* and *Cx. theileri*, which have been identified in this study, reported as potential vectors of Rift Valley Fever (Zeller and Schuffenecker 2004). The presence of this disease in Mediterranean Region (Moutailler et al. 2008) indicates the need for more attention to this disease and its vectors.

The results of this study also revealed the presence of the vectors of helminths such as *Setaria labiatopapillosa* and *Dirofilaria immitis* in the region. *Anopheles maculippenis* and *Cx. theileri* are well known vectors of the mentioned parasites in Ardebil Province (Azari-Hamidian et al. 2009).

## Conclusion

The results of this study revealed the presence of different species of mosquitoes across the West Azerbaijan Province. Among the reported species, some of them are probable vectors of important mosquito-borne diseases. Further studies are needed regarding the epidemiology of mosquito-borne diseases and the role of mentioned species.

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