

## A prospective study on the seasonal frequencies of insect bites (Diptera: Culicidae and Phlebotominae) and the related environmental and protective method factors in the city of Kashan, central of Iran, 2009

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### ABSTRACT

**Objective:** The current study was carried out in Kashan, central Iran, to find and interpret the factors which influence the mosquito and sand fly biting on human body.

**Methodology:** In this study five hundred residential houses were selected and checked out to determine the frequencies of mosquito and sand fly biting in the different regions of Kashan.

**Results:** Results of this study showed that 64.6% of the family residents, who took part in this study, were bitten by means of the insects (Culicidae and Phlebotominae insects) over one year.

**Conclusion:** The Diptera insect biting (Culicidae and Phlebotominae) is a multi-factor activity. By knowing these factors we can make plan to reduce the insect population using different tools and methods which are discussed in this study.

**KEY WORDS:** Insect bites, Culicidae, Phlebotominae, Kashan, Iran.

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### INTRODUCTION

Culicine mosquitos and phlebotomine sand flies are biting insects with worldwide geographical distribution.<sup>1</sup> Female mosquitoes and sand flies attack and bite humans and other vertebrates such as birds and domestic animals to take blood meals for producing their eggs. They pierce the skin, creating a drop of blood that they suck up. For this reason,

they are considered as primarily medical important insects, which are vectors of different parasitic and arboviral diseases such as malaria, filariasis and yellow fever in the case of culicine mosquitoes and lieshmaniasis and papatasi fever in the case of phlebotomine sand flies. Male mosquitoes and sand flies do not bite and are vegetarian.<sup>1-4</sup>

However, the residents who live close to breeding sites of these insects are initially suffered from their bites, rather than getting the transmitted diseases. Both insect groups are annoying pests and cause considerable discomfort when people are working or enjoying in open air.<sup>5</sup>

This problem of human health is affected by factors which influence the density and dispersal of mosquito and sand fly populations. They are ecological conditions, location of populated areas, availability of shelter and specific habits of the insect biting species.<sup>5</sup>

There is little or no evidence to discuss how these insect bites affect humans in Iran, rather than transmission diseases like malaria and

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Table-I: Frequency of the Protection method against insect bites in the houses according to the season in Kashan, 2009.

Season Protection method No. (%)	Spring	Summer	Fall	Winter	Total
Insect bed net	317(63.4)	311(62.2)	221(44.2)	15(3)	864(43.2)
Window net	334(66.8)	343(68.4)	342(68.4)	315(63)	1334(66.7)
Wells net	100(20)	77(15.4)	59(11.2)	59(11.8)	292(14.6)
Repellents	280(56)	130(26)	52(26.8)	52(10.4)	596(29.8)

lieshmaniosis. Therefore, the current study was carried out in Kashan, central Iran, to find and interpret the factors which influence the frequencies of mosquito and sand fly biting on human body.

### METHODOLOGY

This research was a descriptive retrospective study. In this research study, 500 residential houses were selected, using random clustering method, and checked out to determine the frequencies of mosquito and sand fly biting in the different regions of Kashan.

The seasonal insect biting frequencies were determined regarding the seasonal bite by mosquito/sand fly insects, protecting methods in the different seasons, location of bite in the human body, ecological and environmental niches of the insects, location of bite in the houses and the pest control methods. All the above information and data were obtained using a questionnaire and transferred to the percentage. This questionnaire included 15 questions, which were reduced to 10 by the end of the survey. In addition, both insects were identified using small size sampling by genus level, using different keys of Iranian insect fauna. All the related data was analyzed using Chi-squared statistical test.

### RESULTS

Both Culicidae and Phlebotominae insects were observed in all of 500 houses in this study. The Culicidae insects belonged to the 3 genera of *Anopheles*, *Culex* and *Aedes* and Phlebotomine insects were genus *Phlebotomus*. Results of the current study based on the insect sampling size from resident areas indicated that most of collected insects were recognized as Culicidae insects (70%) and the rest were *Phlebotomus* (30%). We did not observe any other insects at houses among the collected insects.

Results of this study showed that 64.6% of the family residents, who took part in this study, were bitten by means of the insects (Culicidae and Phlebotominae insects) over one year. About 93.4% of

the insect biting happened in the spring, and 70.6%, 75.8% and 18.6% of them in the summer, fall and winter, respectively. Calculated Chi-squared indicated that there was significant relation between the season and frequency of insect biting ( $df = 3$ ,  $P$ -value  $< 0.001$ ).

There was a relationship between the protection method against insect bites in the houses and the season. Overall calculated Chi-squares indicated that there were significant differences between the insect bed net against insect bites in the houses and the seasons (Chi-square: 486.2,  $df = 3$ ,  $P$ -value  $< 0.0001$ ). The details are summarized at Table-I.

Overall calculated Chi-squares indicated that there was no significant difference among using the window net against insect bites in the houses and the seasons (Table-I). In addition, the obtained data has revealed that 83.3% of the families, who took part in the study and did not use the bed, were bitten by the insects, while, only 50.4% of the families who used the bed nets were bitten by the insects. It was also revealed that the insects have targeted the hands more than the other parts of human bodies (44.8%). It was followed by biting in the face (39.9%), legs (13%) and the other parts of human bodies (1%). Details are summarized in the Table-II.

The obtained data of the current study explained that the 40.4% of total biting happened in the presence of green environment such as gardens and local green parks. It was followed by 27.9% and 26.3% of biting in the deserted grounds and small house lakes, respectively. The data is summarized, in details, in the Table-III.

Table-II: Frequency of the insect biting in the parts of human body according to the season in Kashan, 2009.

Season Part of human bodies	Spring	Summer	Fall	Winter	Total
Hands	320(64)	272(54.4)	300(60)	4(0.8)	896(44.8)
Face	322(64.4)	190(38)	210(42)	75(15)	797(39.9)
Legs	80(16)	54(10.8)	62(12.4)	63(12.6)	259(13)
Other Parts	5(1)	4(0.8)	1(0.2)	9(1.8)	19(1)

Table-III: Frequency of the insect bites according to the different ecologic environment and the season in Kashan, 2009.

Season	Spring	Summer	Fall	Winter	Total
<i>Different ecological environment</i>					
Animal houses	52(10.4)	64(12.8)	65(13)	-	181(9.1)
Animal wasted materials	29(5.8)	38(7.6)	26(5.2)	62(12.4)	155(7.8)
Deserted ground	168(33.6)	175(35)	186(37.2)	28(5.6)	557(27.9)
Green environments	113(22.6)	246(49.2)	265(53)	183(36.6)	807(40.4)
House lakes	76(15.2)	88(17.6)	91(18.2)	270(54)	525(26.3)

The most insect biting occurred in the bedrooms (32.7%), which is followed by insect biting in the sitting rooms (28.8%). The obtained data of the current study explained that the 90.4% of total biting took place in the dusk and night and the rest during day. The most frequent measure, which have been used to reduce the biting insects, belonged to the chemical pesticides. This included 80.4% of chemical spraying which took place during the spring.

## DISCUSSION

There are many parameters which affect mosquito and sand fly life cycles. Consequently, the density and dispersal of their populations are influenced by these factors.<sup>5</sup> The better conditions for breeding the insects lead to more increase of insect populations leading to more biting. In this way, the insect biting become a problem. One of these factors is the distance between the residential houses and significant mosquito or sand fly breeding sites.

The most important ecological environment which drives the condition toward existing more insect biting is the presence of artificial or natural vegetation near the residential areas, 40.4% of the insect biting happened in the houses near these environments. These are good breeding places and shelters for sand flies but only good shelters for mosquitoes. This is in agreement with the views of Scott<sup>5</sup> who suggested the prevention of dense growth of emergent vegetation in artificial wetlands/water impoundments, as this would reduce mosquito breeding, allow predators to reach mosquito larvae and increase wave action.

Presence of deserted grounds and small house lakes near or around the residential houses, were two more habitats that included 27.9% and 26.3% of total insect biting, respectively. It is very obvious because they provide the most important breeding places for culicine mosquito larvae after raining.<sup>1</sup>

The living in the houses which are close to the biting insect habitats and breeding places provide closer contact with these biting insects. About 32.7% of total biting by the insects, in a house related the

insect biting, during a year has come from biting in the bed rooms, where the humans were sleeping.

Meteorological conditions are another factor, which have the most effect on the insect biting frequency. Above 93.4% of the insect biting happened in the spring, followed by 75.8% and 70.6% in the fall and summer, respectively. This shows that biting activities of the insects take place throughout the year in Kashan. The meteorological conditions here are suitable for the insect life cycles. Chi-squared test results showed significant differences among the insect biting in the different seasons. It means that the insect biting in Kashan is a season dependent phenomenon. This has also been confirmed by study of Yip and Hui in Hong Kong.<sup>6</sup> They showed increase in biting rate with seasonal changes. One obvious reason being that the insects are cold blooded animals, and decrease significantly both in activity and population during the cold weather, but increase with warmer weather. Consequently, the personal insect bite protection should be considered very seriously throughout the year.

This study also showed that the hands were bitten (44.8% of overall insect biting) more than the faces, legs and other parts of human bodies but the frequencies of insect biting have changed in the different seasons. The least frequency of insect biting belonged to the hands in the winter, because they were covered by gloves during the winter. However, the biggest frequency of insect biting in the winter belonged to the faces because they were exposed to the insect biting without coverings, compared to the other parts of the human bodies.

The most frequent insect biting happened at dusk and overnight. This is confirmed by many of entomological studies. There is an ecological reason that the biting insects are active to take blood meals at dusk or night and keep the rest during day to protect themselves from the warm weather and arid climate.<sup>7,8</sup> Therefore, these findings will contribute to decisions on the timing of mosquito control in the region.<sup>9-13</sup> Applying the protective measures such as

bed net, window net, wells net and repellents can reduce the frequency of insect biting among the residents.

Bed nets are applied as a mobile form of protective barrier around people sleeping under them compared to window nets. But the World Health Organization strategy is to apply the insecticide impregnated bed nets. This kills and reduces the insect population in addition to protect the people. This is same in case of window nets, as Idowu et al<sup>14</sup> emphasize the fact that the use of window nets solely may not be sufficient for prevention of mosquito borne infections.

The metrological parameters are the most important special seasonal factors, which influence the density of the insect population.<sup>15</sup> The increasing human mobility which is not discussed directly in this article should be considered in further studies as another factor that provides more contact with the mosquitoes and sand flies as the vectors of diseases.<sup>16</sup> Habitat modification discussed in the current study as producing artificial green environments is another important factor.<sup>17</sup>

The results of entomology survey in the current study indicated that people of Kashan were at greater risk of biting by Culicidae insects than Phlebotomine insects. However, it is difficult to distinguish the bite of a culicid from a phlebotomine bite by the residents. Therefore, it is concluded that the mosquito biting is more important than phlebotomine biting in Kashan residential area.

### CONCLUSION

Consequently, Diptera insect biting (Culicidae and Phlebotominae) is a multi-factor activity. By knowing these factors we can make plan to reduce the insect population using different tools and methods which are discussed in this study.

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