

Mosquito species geographical distribution in Iraq 2009

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ABSTRACT

Background & objectives: Mosquitoes transmit diseases to >700 million people annually. Malaria kills three million persons every year, including one child every 30 sec. Worldwide there are >3000 mosquito species. In Iraq, 37 species have been identified in different surveys over several decades. We conducted an entomological survey to determine the mosquito species and their distribution in Iraq in 2009.

Methods: Between January 20 and December 31, 2009, mosquitoes in houses in 12 Iraqi provinces were collected and speciated. Five to 10 villages were selected randomly in each province and in each village 10 houses were selected randomly to collect mosquitoes and the density of mosquitoes per room was calculated. Kits for entomological investigation were used and the collected mosquitoes were sent to the vector borne disease section laboratory for classification using the Naval Medical Research Unit 3 standard classification key.

Results: A total of 29,156 mosquitoes were collected, representing two genera: *Anopheles* (n=13,268, or 46% of the total collected) and *Culex* (n=15,888, or 54% of the total collected). Four *Anopheles* (*An. pulcherrimus*, *An. stephensi*, *An. superpictus*, and *An. sacharovi*) and one *Culex* (*Cx. pipiens*) species were identified. *Anopheles pulcherrimus* was found in 11 provinces, *An. stephensi* in 7, *An. superpictus* in 2 and *An. sacharovi* in one province, while *Cx. pipiens* was found in all the 12 provinces. Two peaks of mosquito density were found: the first from April–June and the other from September–October.

Interpretation & conclusion: There are clear differences in *Anopheles* mosquito species geographical distribution and density among Iraqi provinces, while *Cx. pipiens* mosquitoes are distributed all over Iraq. All mosquito genera show clear seasonal density variation. The study highlights that the manual mosquito classification is not enough to identify all the species of mosquitoes in Iraq.

Key words *Anopheles*; *Culex*; Iraq; mosquito species

INTRODUCTION

There are about 3500 species of mosquitoes found throughout the world¹. Mosquitoes transmit diseases to >700 million persons annually². Mosquitoes are known for transmitting many diseases including malaria, yellow fever, dengue fever, and encephalitis. Mosquitoes only transmit the pathogens/diseases they acquire from feeding on other animals or humans. Although insect-borne diseases currently represent a greater health problem in tropical and subtropical climates, no part of the world is immune to their risks³.

Very little has been written about the distribution of mosquito species in Iraq, and there is no precise figure about the number and type of mosquitoes in Iraq. Most published literature suggests the range of mosquito species to be 10–37 mosquito species⁴.

Hence, the present study was undertaken to determine the geographical distribution of mosquito species in Iraq in 2009 to guide our future vector control measures.

MATERIAL & METHODS

A cross-sectional survey was conducted from January 20 to December 31, 2009 in 12 of 18 Iraqi provinces. About 5 to 10 villages were randomly selected in each province according to province size and security situation. In each village, 10 houses were selected randomly and one main bedroom was chosen from each house to collect mosquitoes and measure the mosquito density and species.

Electrical mosquito suckers and kits for entomological investigation were used for mosquito collection by well-trained staff from the Ministry of Health Vector Control section. The collected mosquitoes were classified in the technical laboratory of vector borne disease section/communicable disease control center in Baghdad, using the Naval Medical Research Unit (NAMRU)-3 standard classification key. A Microsoft Excel spreadsheet was used for data entry and statistical analysis.

RESULTS

A total of 29,156 mosquitoes were collected from 2290 houses. Only two mosquito genera were identified, *Anopheles* ($n=13,268$, 46% of the total) and *Culex* ($n=15,888$, 54% of the total). Four species of *Anopheles* mosquitoes were identified, *An. pulcherrimus* ($n= 6689$, 50%), *An. stephensi* ($n = 5178$, 39%), *An. superpictus* ($n = 864$, 7%) and *An. sacharovi* ($n = 537$, 4%). All *Culex* genera identified belonged to one species (*Culex pipiens*) with an average density range of 1.2–22.7 mosquitoes per room in all the 12 provinces. *Anopheles pulcherrimus* was found in all the sampled provinces except Naynawa province, with an average density range of 1.2–12.3 mosquitoes per room. *Anopheles stephensi* was found in seven provinces (Wasit, Karbalaa, Babil, Najaf, Thi-Qar, Missan and Basrah) that lie in south of the capital, Baghdad, and had an average density range of 1.7–26.8 mosquitoes per room.

Anopheles superpictus were found only in two provinces (Naynawa and Dyala) which lie to the north of Baghdad, with an average density range of 1–4.4 mosquitoes per room. *Anopheles sacharovi* was found only in Naynawa province and had an average density range of 1–4.5 mosquitoes per room. Table 1 presents the distribution of species by province and Table 2 presents mosquito density by province and species. Distribution of different species of mosquitoes is shown in Fig. 1.

Although mosquitoes are present throughout the year, there are clear seasonal differences in their detection and density. The increase in density started in March and the peak was in April through June, with a density of 10–14 mosquitoes/room. That was followed by a decline in July and August (density range 7–8 mosquitoes/room). Another peak started in September and continued through October, then declined from November through February (Fig. 2).

Table 1. Number of collected mosquitoes by species and province in 12 provinces of Iraq in 2009

Province	<i>An. stephensi</i>	<i>An. pulcherrimus</i>	<i>An. superpictus</i>	<i>An. sacharovi</i>	<i>Cx. pipiens</i>
Al-Diawania	0	354	0	0	573
Al-Najaf	581	451	0	0	907
Anbar	0	1068	0	0	2679
Babil	1058	796	0	0	2062
Basrah	774	544	0	0	1638
Dyala	0	517	370	0	1058
Karbalaa	656	709	0	0	932
Missan	598	714	0	0	990
Naynawa	0	0	494	537	738
Salah Aldeen	21	509	0	0	1143
Thi-Qar	470	357	0	0	966
Wasit	1020	670	0	0	2202
Grand total	5178	6689	864	537	15888

Table 2. Average mosquito species density per room according to provinces

Province	Average number of mosquitoes (n) /Room				
	<i>An. stephensi</i>	<i>An. pulcherrimus</i>	<i>An. superpictus</i>	<i>An. sacharovi</i>	<i>Cx. pipiens</i>
Al-Diawania	0	3	0	0	5
Al-Najaf	4	3	0	0	5
Anbar	0	3	0	0	8
Babil	3	3	0	0	5
Basrah	8	5	0	0	17
Dyala	0	3	3	0	6
Karbalaa	9	7	0	0	6
Missan	4	5	0	0	7
Naynawa	0	0	2	3	3
Salah Aldeen	0	2	0	0	6
Thi-Qar	5	3	0	0	10
Wasit	4	2	0	0	8

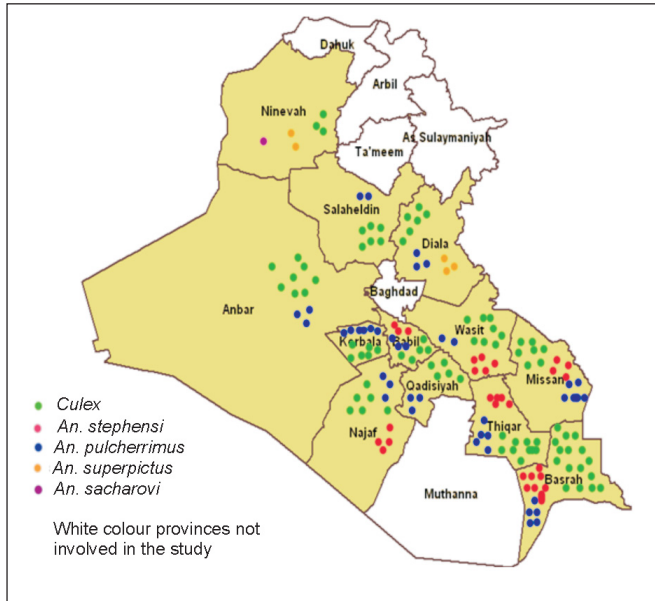


Fig. 1: Map showing distribution of mosquito species in Iraq, 2009 .

DISCUSSION

Our study revealed the presence of only five mosquito species, four species belonging to *Anopheles* genera (*An. pulcherrimus*, *An. stephensi*, *An. superpictus*, and *An. sacharovi*) and only one to *Culex* genera (*Culex pipiens*). This is not consistent with much older studies previously published on the distribution of mosquito species in Iraq⁵. Identification methods were different and may explain why 14 *Anopheles* species were identified in one study and 10 species in four genera (*Aedes*, *Anopheles*, *Culex* and *Culiseta*), and an unidentified species of *Culex* (*Cux.*) were identified in another study, suggesting Iraq had prevalence of 37 mosquito species. This inconsistency may be due to two reasons: first, the difference in methodology of collecting mosquitoes in the houses compared to collecting them outside and, second, using different classification keys to speciate the mosquitoes collected. Variation in the distribution of mosquitoes by Iraqi province is most likely due to differences in terrain, elevation above sea level, and other environmental features, which may have affected the diversity of mosquito species. Fortunately, in spite of the presence of malaria transmitting *Anopheles* species, no endogenous malaria cases were reported in Iraq during 2009.

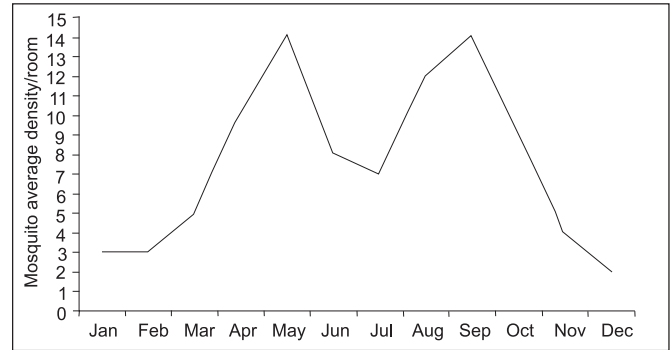


Fig. 2: Seasonal distribution of mosquitoes in the study provinces of Iraq in 2009.

CONCLUSION

There are clear differences in the geographic distribution and density of *Anopheles* mosquitoes among Iraqi provinces and *Cx. pipiens* mosquitoes distributed all over Iraq. All mosquito genera show clear seasonal density variation depending on change in weather temperature. The study highlights that the manual mosquito classification may not be sufficient to identify all species of mosquitoes when compared to other methods previously published.

We need more in-depth entomological studies that involve all the 18 Iraqi provinces and conducting environmental study at the same time, with the extension of the study to include the mosquitoes inside and outside of the houses. Introducing advanced molecular vector diagnosis tools like PCR for better mosquito classification, training of personnel responsible for entomological investigations about the up-to-date methods of collection and classification of mosquitoes are indicated.

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