# Distribution and seasonal abundance of mosquitoes (Diptera: Culicidae) in the Najran Region, Saudi Arabia

[Verbreitung und saisonale Häufigkeit von Stechmücken (Diptera: Culicidae) in der Region Najran, Saudi-Arabien]

by

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Abstract

A survey of mosquitoes (Diptera: Culicidae) in Najran Region, Saudi Arabia, was conducted between March 2004 and February 2006. Twenty-eight species of 4 genera were encountered: 4 species of *Aedes*, 10 species of *Anopheles*, 13 species of *Culex* and 1 species of *Culiseta*. Of the species found, *Anopheles culicifacies adenensis* CHRISTOPHERS, 1924 and *Culex arbieeni* SALEM, 1938 are new records for Saudi Arabia. We collected and identified to species a total of 18,768 mosquito larvae. Most of them (10,225 specimens, i. e. 54.48 % of all the specimens collected) belonged to the genus *Culex*, followed by *Anopheles* (6,566 specimens, 34.99 %), *Culiseta* (1,913 specimens, 10.19 %), and *Aedes* (64 specimens, 0.34 %). Values for the salt content (total dissolved salts, TDS) of the water at the different larval breeding sites varied from 60 to 5,542 ppm, pH-values from 6.9 to 9.9, and water temperatures from 16.0 °C in winter to 34.1 °C in summer. Our results suggest that both the salt content and the pH value have no significant effects on the larval distribution of different species. A total of 489 adult mosquitoes were also collected by light traps. Most of the adults (390 specimens, 79.75 %) belonged to the genus *Culex*, followed by *Aedes* (87 specimens, 17.80 %), *Anopheles* (10 specimens, 2.04 %), and *Culiseta* (2 specimens, 0.41 %). Adults were collected throughout the year, but in varying numbers depending on the prevailing climatic conditions. The effects of temperature and rainfall on the seasonal abundance of mosquitoes are discussed. Our study indicates that the Culicidae are species-rich and widespread in Najran Region. Studies on their medical importance, in particular on their capacities to function as vectors of disease agents, are required before large-scale control projects can be considered and implemented.

**Key words** Culicidae, Palaearctic Region, Saudi Arabia, Najran Region, seasonal abundance, distribution

**Zusammenfassung** Zwischen März 2004 und Februar 2006 wurde eine Bestandsaufnahme der Stechmücken (Culicidae) in der Region Najran in Saudi-Arabien durchgeführt. Dabei wurde das Vorkommen von 28 Arten aus 4 Gattungen festgestellt: 4 Arten von *Aedes*, 10 Arten von *Anopheles*, 13 Arten von *Culex* und 1 Art von *Culiseta*. Von den gefundenen Arten sind *Anopheles culicifacies adenensis* CHRISTOPHERS, 1924 and *Culex arbieeni* SALEM, 1938 neu für Saudi-Arabien. Insgesamt wurden 18.768 Stechmücken-Larven gesammelt und artlich bestimmt. Die meisten Larven (10.225 Exemplare, d. h. 54,48 % aller gesammelten Exemplare) gehören zur Gattung *Culex*, gefolgt von *Anopheles* (6.566 Exemplare = 34,99 %), *Culiseta* (1.913 Exemplare = 10,19 %) und *Aedes* (64 Exemplare = 0,34 %). Der Salzgehalt des Wassers (total dissolved salts, TDS) an den verschiedenen Brutstätten der Larven schwankte zwischen 160 und 5.542 ppm, die pH-Werte schwankten zwischen 6,9 und 9,9 und die Wassertemperaturen zwischen 16,0 °C im Winter und 34,1 °C im Sommer. Unsere Ergebnisse zeigen, dass weder der Salzgehalt noch der pH-Wert einen nennenswerten Einfluss auf die Larvalverbreitung der verschiedenen Arten haben. Ferner wurden mittels Lichtfalle 489 Stechmücken-Imagines erbeutet. Die meisten Imagines (390 Exemplare = 79,75 %) gehören zu *Culex*-Arten, gefolgt von *Aedes* (87 Exemplare = 17,80 %), *Anopheles* (10 Exemplare = 2,04 %) und *Culiseta* (2 Exemplare = 0,41 %). Imagines konnten, in Abhängigkeit von den jeweils vorherrschenden Klimabedingungen, in variierenden Häufigkeiten das ganze Jahr über gesammelt werden. Die Auswirkungen von Temperatur und Niederschlag auf die saisonalen Häufigkeiten von Stechmücken werden diskutiert. Unsere Untersuchung zeigt, dass die Culicidae in der Region Najran artenreich und weit verbreitet sind. Studien zur medizinischen

Bedeutung der Arten, insbesondere ihrer Kapazitäten als Überträger von Krankheitserregern, sind erforderlich, bevor großräumige Kontrollprojekte in Betracht gezogen und durchgeführt werden können.

**Stichwörter** Culicidae, paläarktische Region, Saudi-Arabien, Najran-Region, saisonale Häufigkeit, Verbreitung

## Introduction

Several reports on the mosquito fauna (Diptera: Culicidae) of Saudi Arabia are available (Mattingly & Knight 1956, Zaher 1973, Büttiker 1981, Will et al. 1985, Abdullah & Merdan 1995, Jupp et al. 2002, Miller et al. 2002, Abdoon & Al Shahrani 2003, Al Ahmed et al. 2007, Al Ghamdi et al. 2008), but very little information is available on the mosquito fauna of Najran Region. During the past few decades, Saudi Arabia has witnessed tremendous advances in social development and urbanization in all provinces, which presumably have also affected the insect fauna, particularly mosquitoes. Expansion of agricultural projects and development of water resources in Najran Region have led to the creation of permanent and temporary mosquito breeding sites. The present work was undertaken to study the distribution of mosquitoes in Najran Region. An attempt was also made to study the seasonal abundance of adult mosquitoes in the study area.

## Material and Methods

### The study area

Najran Region is situated in the south-western part of Saudi Arabia along the borders with the Republic of Yemen. The study area lies between 16°45'–19°50'N and 43°10'–45°25'E (Fig. 1). The topography of Najran Region is characterized by 3 different regions: The flat region in the middle; the mountainous region in the north and west and the sandy region in the west, which is a part of the Empty Quarter desert. The climate of the region is influenced by the topography. It is hot during summer (average temperature is 32 °C, and may go up to 40 °C) and cold and humid during winter when temperatures may drop to 6 °C. Rainfall is moderate in winter, but heavy in summer, particularly in the mountainous areas.

### Collection of mosquito larvae

This work was carried out for two successive years, from March 2004 to February 2006. The survey covered most of the different ecological systems in Najran Region.

Biweekly field trips to collect mosquito larvae from all potential breeding sites in Najran Region were made. The larvae were collected by a standard mosquito larval dipper with extendable handle, and three to five scoops were taken from each breeding site (about 350 ml each). The collected larvae were transferred to 80 % ethyl alcohol in glass vials with screw caps, labelled and sent to the Entomology Laboratory, College of Food and Agricultural Sciences, King Saud University, Riyadh. Larvae were mounted as described by R. E. Harbach from the Natural History Museum in London (pers. comm.), and identified using standard identification keys (Hopkins 1952, Mattingly & Knight 1956, Harbach 1988, Al Tubiakh 1995). Representative specimens of identified larvae were sent to the Natural History Museum in London for confirmation.