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# Serological evidence of antibodies to certain arboviruses in desert rodent sera in Egypt

**Nour El.Din H. Sherif**
Zoology Department , Faculty of Science, Suez Canal University, Ismailia, Egypt

## Abstract

**Introduction** : Small rodents inhabiting the wadis close to St Katherine in the mountains of the Sinai Peninsula, Egypt, were trapped and antibodies to Sindbis (SIN) , West Nile (WN) and Quaranfil (QRF) viruses in their sera were studied.

**Materials and Methods** One mouse had Haemagglutination–inhibition (HI) antibodies against SIN antigen in his serum, 3 mice had HI antibodies against WN antigen in their sera. The titers is low to be of any significance.

**Conclusion:** It seems that natural cycle of transmission of SIN and WN viruses involving rodents does not exist. Seven mice had Complement-fixation (CF) antibodies in their sera against Quaranfil antigen. Conclusion, the CF test results suggest the existence of another mammal vector cycle.

**Keywords:** Sindbis, West Nile and Quaranfil viruses (rodent), HI, CF.

## Introduction

Like several other mammals rodents get natural infection with an arthropod-borne viruses (arboviruses) without showing apparant ill health, and natural infection is detected during surveys accidentally by virus isolation or serologic tests. Rodents act as a subsidiray natural host for the tick-borne group of viruses (Kuceruk , 1963& Webb, 1965) and were thought to play a role in the natural cycle of propagation of Rift valley fever virus (Weinbren and Mason,1957); Bunyamwera virus (Simpson,1965); Venezuelan equine encephalitis virus and group C arboviruses (Jonkers *et al*., 1968). Experimental virus infection of rodents lead to the development of viremia, some animals died while the majority survived and acquired antibodies to the arbovirus used (Simthburn & Haddaw, 1949 Weinbern & Mason , 1957 Simpson, 1965 and ,1966).

In Egypt the prevelant species of rodents (Hoogstraal, 1963) live in close association of human population in the cultivation fields.Their relation to the natural cycles of propagation of arboviruses known to be in active circulation in Sinai, Egypt was not studied. The viruses recognized as endemic in Egypt are mosquito-borne Sindbis (Taylor *et al*., 1955) ,West Nile (Taylor *et al* .,1956), Sandfly (Schmidt *et al*., 1966), The tick borne Quaranfil, Chenuda and Nyamanini viruses (Taylor *et al*.,1966c) .Sandfly virus infects humans only, but the other viruses most probably are mainly zoonosis .

This paper describes antibody studies on desert rodent sera collected in various regions of St Katherine's Protectorat, Egypt, to investigate the occurrence of natural infection of these rodents with Sindbis, West Nile or Quaranfil viruses.

## Materials and Methods

**Study sites:**

The study was carried out in the St Katherine's Protectorate , southern Sinai, an arid montane region characterized by complex systems of dry valleys (Wadis) and plains (Hobbs, 1995; Zalat & Gilbert, 1998; Behnke *et al.*, 2000). Four wadies were choosen: El Arbaein and Tofaha, close to the Suez Canal University Environmental Research Centre (ERC) at St Katherine (Behnke *et al.*, 2000) and Abu Seila and Boqueia, some 5 km to the north across the Plain of El Raha (Barnard *et al.*, 2003b) .

**Collection of rodents :**

Mice were trapped in each wadi during August and September 2001 using Sherman small mammal traps (H.C.Sherman InC., Tallahassee, USA).

**Rodent Sera Collection :**

All traps were brought into the ERC at St Katherine where the animals were removed and identified according to Osborn and Helmy (1980). Trapped animals were culled (40% of the catch by agreement with the St Katherine National Protectorate authorities and blood samples were taken by cardiac puncture. Blood samples were centrifuged and the resulting serum frozen at-20$^{o}$C. until tested.

**Viruses:**

Quaranfil (QRF) virus (strain At 1113) P11, Sindbis (SIN) virus (strain Egypt Ar-339) P39 and West Nile (WN) virus (Strain Egypt 101) P8 were inoculated intracerebrally into suckling mice to prepare virus stocks.

**Preparation of viral antigen :**

For haemagglutination- inhibition (HI) and complement–fixation (CF) tests antigents were prepared by the sucrose-acetone methods (Clarke and Casals, 1958). Except for QRF the antigens were used in HI tests .QRF antigen were done by the CF test.

**Serologic tests:**

**Haemagglutinatien–inhibition test :** serum samples were adsorped with acid–washed kaolin at pH9 to remove non-specific inhibitors (Clarke and Casals, 1958) and then were tested by the microtitration method.

**Complement–fixation test:** The CF was done by the micro- adaptation of the laboratory Branch complement–fixation (LBCT) test (Casey,1965) using four units of complement, the sera were inactivated for 20 minutes at 60$^{o}$C and were used or treated by $Co_2$ dry ice if found to be anticom-plementary (lmam and Alfy, 1966 ) then used.

## Results

**Rodents collected from study sites:**

The following are the numbers and species of animals collected:

*71 Acomys cahirinus dimidiatus, 18 Dipodyllus daosyurus dasyurus, 7 Elicomys quercinus melanurus , 2 sekeetamys calurus calurus, 4 Acomys reuuatus russatus , 1 Mus musculus.*

The *Acomys cahirinus diamidiatus* was the most frequent species of the different mice captured.

**Antibodies to arboviruses:**

The results of serological Haemagglu-tination-inhibition and complement-fixation tests are summarized in Table 1

Only one mouse serum had HI antibodies against Sindbis antigen. Three mice sera had HI antibodies against West Nile antigen Seven mice sera had CF antibodies against Quranfil antigen.

**Table( 1): Arboviruses antibodies in rodent sera**

| Animal | Sera tested | number reactive sera and antibodies titers | | |
|---|---|---|---|---|
| | | HI | HI | CF |
| | | Sindbis | West Nile | Quaranfil |
| *Acomys dimidialus* | 71 | 1 1/10 | 1 1/10 | 5 1/10 |
| *Dipodillus dasyurus* | 18 | 0 | 1 1/10 | 1 1/10 |
| *Eliomus quercinus* | 7 | 0 | 0 | 0 |
| *Sp&eetamus calurus* | 2 | 0 | 1 1/10 | 0 |
| *Acomys ressatus* | 4 | 0 | 0 | 1 1/10 |
| *Mus nusculus* | 1 | 0 | 0 | 0 |

## Discussion

Egypt as a country in the subtropical area, has diverse ecological settings whereby there are haematophagous arthropods which feed upon man and animals. In addition , there are large varieties, of wild free living and migratory birds (Hoogstraal *et al*., 1961, 1963, 1964 & 1968) as well as free living small mammals (Hoogstraal, 1956 & 1963) that are known to act as reservoirs for several arboviruses (Simpson, 1969 and Hoogstraal, 1973) .

There are 31 arboviruses reported from Egypt. Eight of the 31 have been demonstrated, or are believed to be transmitted by mosquitoes , 16 by ticks and 3 by phlebotomus sandflies, the vectors of 4 are unknown (Darwish and Hoogstraal, 1981).

Rodents live in close association of human population in the cultured fields . On basis of information gathered from the current literature, the relation of rodents to the natural cycles of propagation of arboviruses known to be in active circulation in Sinai, Egypt was not studied .

The two main endemic arboviruses in Egypt are the mosquito–borne Sindbis (Taylor *et al*., 1955) and West Nile (Taylor *et al*., 1956).

West Nile (WN) virus was isolated[1.] from patients , birds and mosquitoes in Egypt in the Early 1950's (Melnick *et al.*, 1991 and Taylor *et al*., 1956). The virus was soon recognized as the most widespread flaviviruses.

This study showed that the number of rodent sera with antibodies against WN virus is small and the titer is low to be of any significance . It seems that the natural cycle of transmission of WN virus involving rodents does not exist.

Sindbis (SIN) virus (Togaviridae, alphavirus) was first isolated from Culex mosquitoes (probably *C. univittatus*) and birds from Sindbis village, Qalyubia, Egypt (Taylor, *et al*., 1955).

The results showed only one rodent sera had HI antibodies against Sindbis antigen. Antibodies to SIN virus are almost absent from rodent sera which may be due to that mosquitoes transmitting SIN virus do not bit rodents. The results showed that SIN virus does not naturally affect rodents in Egypt.

Quaranfil (QRF) virus was first recovered from the blood of a febrile child (Taylor *et al.*, 1956) who lived in a Quaranfil village north of Cairo nearby the arboreal rookeries of the common cattle herons also it was isolated from *Argas* ticks (Taylor *et al*., 1966 c). Retrospectively the vector of this virus was identified as the heron *Argas* ticks *Argas arboreus* (Kaiser *et al.*, 1964). Field collections of *A. arboreus* on repeated occasions yielded QRF virus (Kaiser, 1966a) .Ecologically QRF virus appeared as a bird adapted virus (Kaiser *et al*., 1964) transuitted by *A. arboreus*, a restricted vecor (Hoogstraal , 1973).

7 Out of 103 wield–cought rodent sera were founds to have QRF antibodies suggested) that QRF virus among several viruses responsible for rodent infection.

In the present study it would appear that the CF test results obtained with rodent sera suggest the existence of another mammal vector cycle.

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# دليل بالمصول عن أجسام مضادة لفيروسات منقولة بالمفصليات في أمصال القوارض الصحراوية في مصر

**نور الدين حسين صالح شريف**
قسم علم الحيوان – كلية العلوم – جامعة قناة السويس – الإسماعيلية

في هذه الدراسة تم اصطياد القوارض (الفئران) الصغيرة التي تسكن الوديان القريبة من سانت كاترين في جبال شبه جزيرة سيناء – مصر، لدراسة وجود أجسام مضادة لفيروسات السندبيس والوست نيل والقرانفيل في أمصالها.
وأظهرت النتائج أنه باستخدام اختبار تثبيط الهيموجلوبين (HI) وجود أجسام مضادة ضد أنتيجين السندبيس في مصل فأر واحد وأيضاً وجود أجسام مضادة ضد أنتيجين الوست نيل في أمصال ثلاثة فئران، وكانت قدرة تركيز الأجسام المضادة منخفضة وليس لها دلالة إحصائية بينما باستخدام اختبار تثبيت الكومبليمنت (CF) تبين وجود أجسام مضادة ضد أنتيجين القرانفيل في أمصال سبعة فئران.
والخلاصة أن هذه الدراسة تدل على أن دورة العدوى الطبيعية لنقل فيروس السندبيس وفيروس الوست نيل لا توجد في القوارض في مصر ، بينما تدل الدراسة على وجود عائل وسيط ثدي ينقل العدوي في الطبيعة لفيروس القرانفيل.