

# Geographic Translocation of Dog Rabies by Tourism

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## ABSTRACT

Rabies is endemic in Israel. Stray dogs (*Canis familiaris*) form the main reservoir and transmitter of the disease in the country. Since 2004, the genetic strain V7 rabies virus that has been found to be transmitted by stray dogs has emerged in Northern Israel. Because of the close contact between dogs and humans, this new V7 strain is considered to possess a serious zoonotic threat. In this communication we report the translocation of canine rabies between different geographic regions in Israel through tourism.

**Key words:** Rabies, Stray dogs, Geographic Translocation, Diagnosis, Post exposure vaccination.

## INTRODUCTION

Rabies is enzootic throughout the Middle East, including Israel. Stray dogs (*Canis familiaris*) form the main reservoir and transmitter (1). Dog-mediated rabies and several cases of wildlife rabies have been currently reported in Turkey (2). Rabies is also a serious enzootic disease in Jordan, Syria, Lebanon and Iran, where stray dogs maintain rabies virus circulation, with frequent spillover to wildlife, including jackals, squirrels, stone-martens, foxes, monkeys and wolves (3, 4, 5). Since 2004, and up to the present, the State of Israel has been forced to cope with a rabies strain that is novel to the country, designated V7 (1, 6). Because dogs are in close contact with humans, this new strain circulating in Northern Israel is considered to pose a serious zoonotic threat.

Geographic rabies translocation between regions can occur in several ways, including adoption of a rabies-infected dog during the incubation period of the disease, a situation that occurred in Israel in year 2003 (7), and via tourism, in cases when owners travel with their unvaccinated pets to rabies-endemic areas. In the present report, a tourism-type of rabies translocation is described, in which a family from Jerusalem traveled to Northern Israel with their unvaccinated dog.

## CASE REPORT

On December 19<sup>th</sup> 2011 a dog was diagnosed positive for rabies by a direct fluorescence assay (DFA) on the brain tissue, performed by the Israeli National Rabies Laboratory, Kimron Veterinary Institute (KVI), Bet Dagan, Israel. A case investigation revealed that on December 13<sup>th</sup> 2011, a 3-year old male, mixed Golden Retriever belonging to a family from Jerusalem presented with inappetence, hypersalivation and incoordination. This dog had been vaccinated twice against canine distemper virus and canine parvovirus (Duramune Max<sup>®</sup>, Fort Dodge, Iowa, USA) but not against rabies.

Two days previously, the dog had been presented to a local veterinary clinic in Jerusalem. The physical examination revealed that although alert, the dog's responses to external stimuli seemed exaggerated and were interpreted as hyper-responsive. The mucous membranes capillary refill time and thoracic auscultation were normal and there was no abdominal pain on palpation. The rectal temperature was 39.5° C and melena was observed. The dog was estimated to be 5% dehydrated. Neurological examination revealed locomotion characterized by small steps and hypermetric movements. The left eye appeared sunken, miotic with ptosis, and no palpebral reflex was observed bilaterally. The mouth was partially open and the tongue was laterally extruded. There was

no extension reflex on the left forelimb and right hindlimb. There were accentuated reflexes on the remaining limbs. The dog showed no clinical symptoms of aggression during the period of illness. Blood samples for complete blood count and serum chemistry were obtained, and were unremarkable.

The initial main differential diagnosis included canine distemper. The dog received intravenous fluids Lactate Ringer Solution, antibiotics (Enrofloxacin, Bayril, Bayer, Germany, and Metronidazol, Metrogyl, Teva, Israel), vitamin K (Phytomenadione, Konakion MM, Roche, Switzerland) prednisone (Rekah, Israel), an H2-receptor blocker (Ranitidine, Zantab, Teva, Israel) and an anti-emetic (Metoclopramide, Pramin, Rafa laboratories, Israel) and was discharged.

A day later the dog showed severe clinical deterioration with convulsions and unconsciousness, and was treated with diazepam (Assival, Teva, Israel). Two days later (December 18<sup>th</sup>), with no improvement, the dog was euthanized and was sent for examination to the KVI.

A DFA was positive for rabies, and this was confirmed by virus isolation in tissue culture, and its inoculation into suckling mice (8). Reverse transcriptase - PCR and direct sequencing were applied to a 469 base-pair (bp) G-L intergenic region fragment, and to the entire 1350 bp of the nucleoprotein gene (6, 9). A phylogenetic tree was constructed by the neighbor-joining method, with the distance calculated using the Kimura-2 parameter with the computer program MEGA, version 3.1 (10). The reliability of the phylogenetic groupings was evaluated using bootstrapping with 1000 replicates. The molecular analysis showed that the viral sequence obtained from this dog belonged to the V7 genetic variant, which was known to have circulated in Northern Israel at that time.

Questioning the dog's owner revealed that on October 19<sup>th</sup> to 22<sup>nd</sup>, approximately two months previously, the family, with their dog visited the eastern coast of the Sea of Galilee and Northern Israel and had camped in a tent on the beach, while the dog slept nearby, outside of the tent. During that same period, it

was reported that a rabid stray dog had bitten domestic dogs on Kibbutz Haon and Kibbutz Tel-Katzir located nearby, situated on the eastern side of the Sea of Galilee. On October 25<sup>th</sup>, this stray dog was found dead at Kibbutz Ashdot Ya'akov Meuhad. It was examined at the Rabies Laboratory, KVI, and was found rabies positive on 27<sup>th</sup> October.

A molecular analysis of the G-L intergenic region and the nucleoprotein gene showed a 100% homology between the rabies virus sequences of this rabid stray dog and the rabid dog from Jerusalem (Figure 1). The sequences described here have been deposited in the Genbank database (accession numbers JQ671335, JQ671336, JQ671337 and JQ671338). As a consequence of this rabies diagnosis, post-exposure vaccination was administered to the two owners, two veterinarians and an additional 18 people, who had come into contact with the dog in Jerusalem.

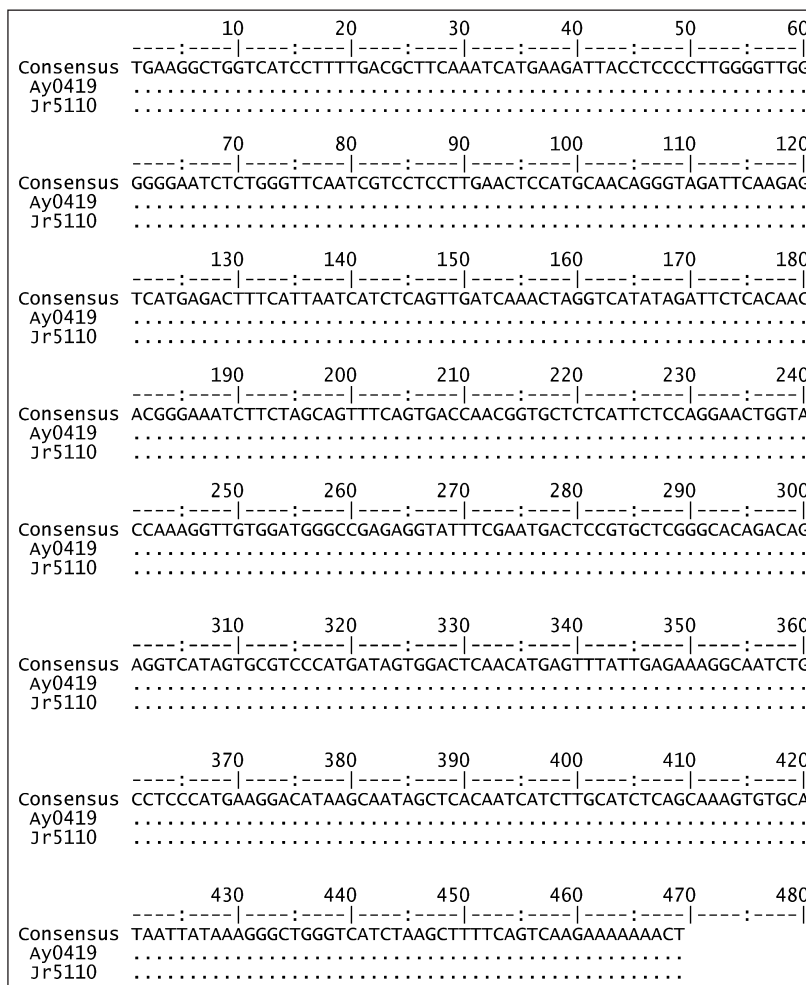


Figure 1: Comparison between of 469 base pairs of the G-L intergenic fragments from the sequences of the Jerusalem dog JR5110 and of the northern stray dog AY0419.

## DISCUSSION

The dog in this case report was likely bitten by the rabid stray dog during this period in the vicinity of the Eastern coast of the Sea of Galilee. This is supported by the chain of events described above and the identical molecular findings in both dogs.

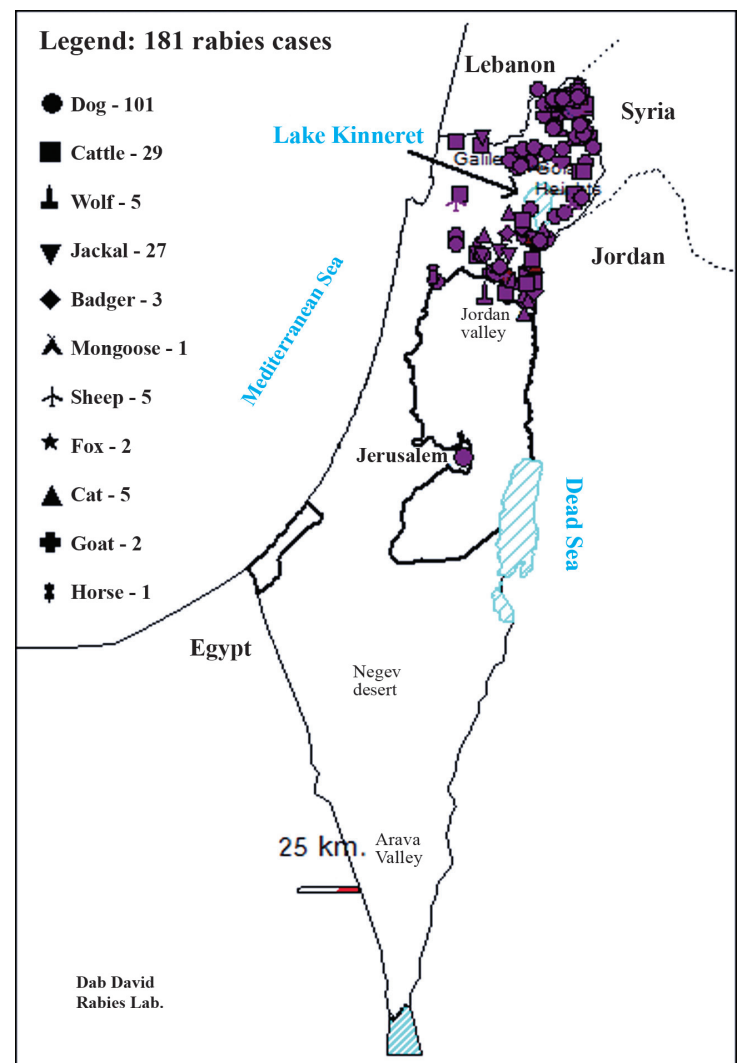
The dog's rabies virus isolate was the only example of the V7 genetic variant that was never isolated from an animal in Central Israel, over during the period of 2004 to 2011. During this period 181 rabies virus isolations belonging to V7 genetic variants were made and identified from rabid animals in Northern Israel (Figure 2).

Because this dog, which originated from Jerusalem, was unvaccinated, it was clearly unprotected. It was only after a 2-month incubation period that the clinical symptoms appeared, when the dog already was back at its home in Jerusalem. This case exemplifies the importance of current rabies vaccination for dogs in rabies endemic areas such as Israel, and the potential hazard of translocation of the disease between geographic areas through travel with unvaccinated animals.

Various sanitary measures needed to be implemented in Jerusalem as result of this case, such as reinforcement of measures against stray animals, boosting of domestic dogs' vaccination and quarantine of unvaccinated dogs. All these measures resulted in high costs and labor. Because domestic animals can serve as a bridge between wildlife rabies reservoirs and humans, their vaccination is greatly effective as a public health tool which can safeguard human health and is mandatory in the State of Israel.

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**Figure 2:** Map of Israel showing the area of northern Israel where 181 rabies cases of rabies belonging to the V7 genetic variants were isolated during 2004 to 2011 the rabid dog isolated in Jerusalem.