The reservoir of Marburg virus identified in a species of fruit bat

October 5 2007

The Marburg virus, like its fearsome cousin Ebola, belongs to the Filoviridae family. It carries the name of the German town where it was first detected in 1967, after a mysterious epidemic had hit employees of the Behring laboratory.

The workers had been contaminated as they took organ samples from green monkeys imported from Uganda. Up to the end of the 20th Century, rare cases of violent haemorrhagic fever attack linked to Marburg virus were subsequently registered, essentially in East Africa: (in Kenya, Zimbabwe, parts of South Africa). However, in 1998, a more extensive epidemic affected 149 people near Durba, a town in the North-East of the Democratic Republic of Congo (DRC). More than 80% of these people succumbed to the haemorrhagic fever the virus caused. In 2005, a second epidemic that broke out in Angola infected over 252 people, 227 of whom died - a mortality rate of nearly 90%. That was the most severe epidemic of Marburg haemorrhagic fever (MHF) known to date.

Between 2005 and 2006, scientists from IRD working in conjunction with CIRMF and CDC conducted a research campaign with the aim of detecting Ebola virus among species of fruit bat (mammals of the order Chiroptera). In the context of this study, five trapping sites were set up in the tropical rainforest of Gabon and the North-West of the Democratic Republic of Congo. The 1138 specimens of fruit bat collected belong to 10 different species. At the same time, Angola, about 800 km from the study area, experienced a severe outbreak of MHF.

However, the natural reservoir of this virus was still unknown. In addition to the search for Ebola in each of the chiropteran specimens caught, the researchers looked for the presence of its cousin in their tissues. A series of analyses were performed on the bats captured: detection of viral RNA in the liver and spleen by various methods of nucleotide amplification; a search for Marburg virus-specific antibodies in the blood; phylogenetic characterization of amplified genomic fragments.

The analyses detected antibodies directed against Marburg virus in the serum of just one of the 10 species caught, the Egyptian rousette, Rousettus aegyptiacus, (in 29 out of 242 individuals tested). This is a migratory species whose distribution range includes all parts of the African continent situated South of the Tropic of Cancer. The search for viral genome fragments on 283 specimens of R. aegyptiacus showed the liver and spleen of four of them to contain RNA sequences belonging to 3 different Marburg virus genes. Blood serum of three out of the four specimens also contained Marburg virus-specific antibodies. The simultaneous presence of specific antibodies and viral RNA fragments strongly suggested this bat species' role as a non-symptom developing carrier of the virus, indicating R. aegyptiacus to be the natural reservoir.

Previous research on Ebola virus showed that human infection comes about through the intermediary of infected great ape carcasses. The viral transmission to primates occurs in the dry season, a period when food resources become increasingly scarce. The great apes then come into competition with bat species for fruit supplies when foraging and can be infected notably by blood or by placental fluid that escapes when bats give birth. The mode of contamination by Marburg virus appears to be different, however. It does not appear to need any intermediary to be pathogenic for humans, as foreseen from data of the latest two epidemic outbreaks. In one outbreak, which raged in the north-east of DRC in 2000, most people infected worked in a goldmine, which turned out to

be the refuge for a large colony of Egyptian rousettes. During the second epidemic, in Angola, the first victims were children who had gathered fruit from trees where a large population of this species of fruit bat roosted. Other evidence was the fact that the capture sites chosen for this study were all located near caves harbouring sizeable groups of these bats. Moreover, the discovery of such bats that were carriers of Marburg virus in Gabon, a country where no clinical case has yet been recorded, gives an incentive for setting up surveillance and prevention measures in regions where no MHF virus epidemic has ever occurred.

The findings should be useful in the future for defining more accurately the geographical areas potentially affected by Marburg virus. They could also help in extended studies, particularly in West Africa, a significant region for migration of Rousettus aegyptiacus. This identification of the virus's natural reservoir should also favour the development of public health measures and prevention strategies involving local people which could minimize the infection potential of possible MHF epidemics to come.

Source: Institut de Recherche Pour le Développement