

West Nile (WN)

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WN is another arthropod-borne viral disease causing febrile illness and occasional encephalitis. In India, presence of antibodies to WN virus in humans was first reported from Mumbai, Maharashtra in 1952. Subsequently, antibodies were reported from different places in south and west India.

Distribution

WN virus is widely prevalent in Africa, Middle East, South Asia, Europe and Americas. In Africa, it is known to be prevalent from South Africa and Madagascar in the extreme south to Morocco, Algeria, Tunisia and Egypt in the north. Its range extends eastward through the Middle East into south Asia, particularly Pakistan and India. It extends northward into southern Russia, and westward through southern Europe. In Americas, WN has spread to many states of USA, Canadian provinces, Mexico, Cayman Islands, Jamaica and Dominican Republic in the Caribbean basin.

India has a peculiar position. Activity of Japanese encephalitis virus is recorded from India eastward and activity of WN virus is recorded from India westward. Within India, western part of the country is known to harbor WN virus and eastern part JE virus. Both viruses are found in central and southern states of the country. Late Dr. T. Work (former Director, NIV) had proposed a hypothesis of zoogeographical interface to describe this distribution.

The disease

WN virus infection in humans causes a spectrum of manifestations from subclinical infection to encephalitis and death. In India, epidemics are not attributed to this virus. It is believed that manifestations are subclinical to mild fever, which generally does not require hospitalization. It causes mortality in horses, domestic and wild birds.



Electron Micrograph of West Nile Virus

The virus

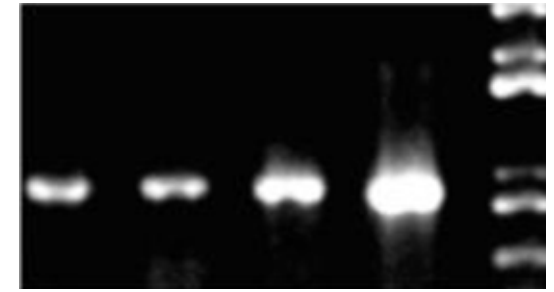
WN virus is a member of genus *Flavivirus* and belongs to Japanese encephalitis antigenic complex under family *Flaviviridae*. Virions are spherical particles containing single stranded positive sense RNA. The genome is approximately 11 kb in size.

Genotyping

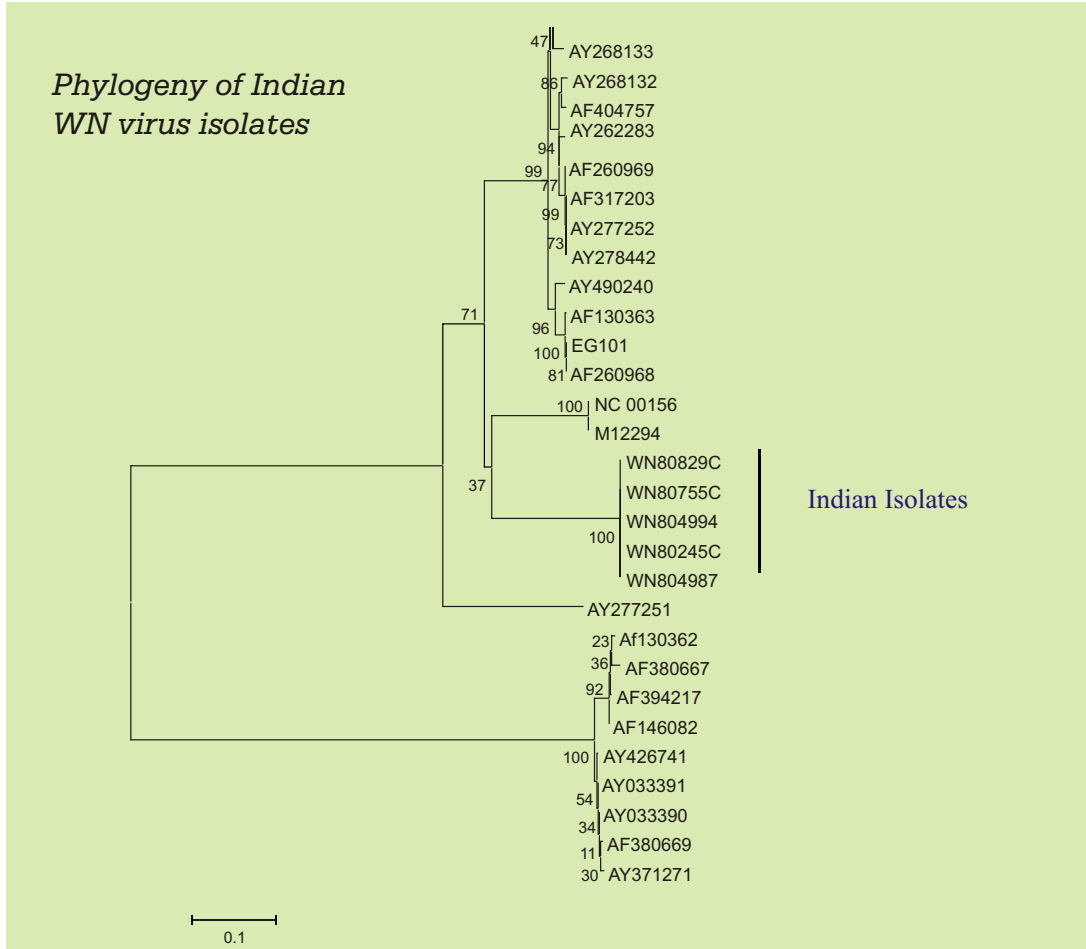
Based on partial sequences of nonstructural protein-1 and envelope gene, Indian isolates are homologous to each other, independent of hosts and show 21% divergence from American and European strains and form a distinct and separate cluster.

Diagnosis

Virus isolation is carried out using infant mice and C6/36 cell line. Confirmation of WN is done by IgM capture ELISA, NT and HI. PCR is useful for genomic detection.



Phylogeny of Indian WN virus isolates



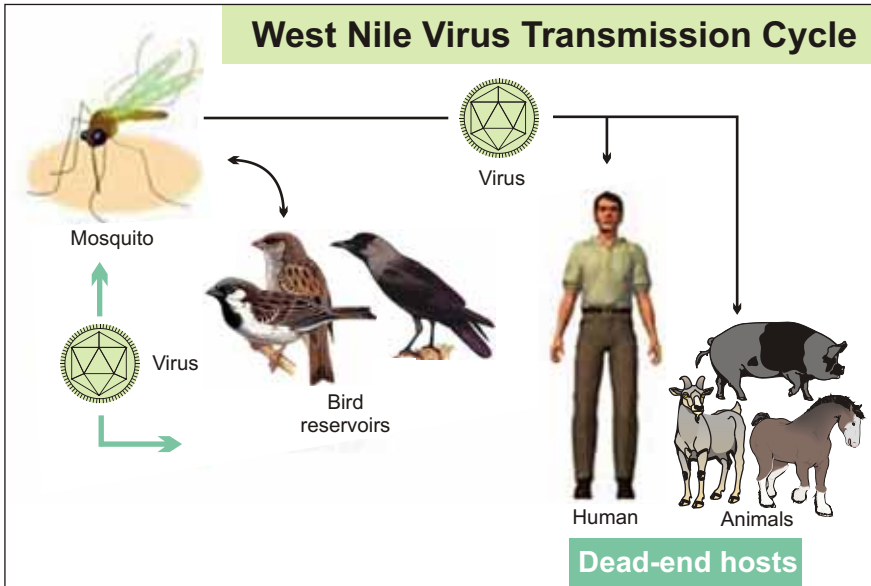
Indian Isolates

Epidemiology and natural cycle

In India, the virus is isolated from humans (5 isolates), mosquitoes (63 isolates), domestic pigs, goat and a frugivorous bat *Rosettus leschenaulti*. Mosquito species that yielded virus

include *Cx. quiquefasciatus*, *Cx. vishnui*, *Cx. tritaeniorhynchus*. Experimental transmission studies have shown that *Cx. tritaeniorhynchus*, *Cx. vishnui*, *Cx. bitaeniorhynchus*, *Cx. univittatus*, *Cx. quinquefasciatus* and *Ae. albopictus* can propagate and transmit virus to the susceptible hosts.

West Nile Virus Transmission Cycle



Transovarial transmission has been demonstrated in *Cx. vishnui* mosquitoes. Several species of birds and domestic animals are shown to have antibodies to WN virus.

Although the virus has been isolated from pigs, experimental studies in pigs have shown that they are poor amplifying hosts for the virus.

Several bird species in different geographical regions have been implicated as vertebrate hosts. In India, neutralizing antibodies were detected in ardeid birds, particularly pond heron (*Ardeola grayii*) and cattle egrets (*Bubulcus ibis*). Data suggest that the virus is maintained in nature through a bird-mosquito-bird cycle.

Immunology

MAbs against WN virus have been generated and strain analysis has been carried out by HI, CF and neutralization tests.

Prevalence of similar antigenic strains and a single heterogenous domain, based on epitope mapping of envelope protein of Indian strains, has been reported.

In mice, it is demonstrated that maternal antibodies, through placenta and colostrum, are protective in nature.

In Bonnet Macaque (*Macacca radiata*), immunization against WN virus reduces the severity of the disease due to JE virus infection. Similarly, immunization against JE virus protects monkeys from WN virus infection.