

COVID-19: Bat-born viral outbreaks and its prevention in future using ecological intervention with reference to India.

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Abstract

The (COVID-19) coronavirus disease 19 is a highly transmittable and pathogenic viral infection that is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which has recently emerged in Wuhan province of China and rapidly spread throughout the world. Though the intermediate source of origin and its transfer to humans is not very well known, but the fast human to human transfer has been confirmed widely. There is no clinically approved antiviral drug or vaccine developed so far to be used against COVID-19. In the current review, we summarize and comparatively analyse the deadly virus and how it poses a constant threat to sub continental nations especially India. A number of ecological interventions are also suggested to protect humans and keep the virus carrying bats at a distance.

The planet Earth has come to a stand-still and everyone in any part of the world is under partial or complete lockdown. Such conditions have never prevailed in the history of human civilisation. The deadly Corona virus disease is to blame for. The deadly Coronavirus Disease 2019 (COVID-19) outbreak caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was reported for the very first time in December 2019, in Wuhan province of China (Khan et al., 2020). The COVID-19 after that rapidly spread from its epicentre globally and now is decisively recognised as a pandemic by the World Health Organization (World Health Organization, 2020). It has become a major threat to world health, fauna, economy and environment. The higher transmissibility of the deadly SARS-CoV-2, the lack of proper designated, designed treatment and vaccines, and the unstoppable transmission of infection have now caused a major global health emergency, scared then public, and psychological stress among the people almost in every country of the world. (Cohen and Kupferschmidt, 2020). Similar to SARS-CoV-2, other viruses such as Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV), The dangerous Middle East Respiratory Syndrome Coronavirus (MERS-CoV), The Marburg virus, and the dangerous Ebola virus, have also caused major outbreaks in recent history. A number of deaths have been caused by such outbreaks and its eradication, vaccination and control will cost billions of dollars, worldwide (Allocati et al., 2016; Fan et al., 2019).

Primary source of Virus: Bats are blamed for this deadly disease transmission. Such viruses are reported to have been naturally found in bats, especially coronaviruses (CoVs) which make up approximately, 31% of their virome studies by (Allocati et al., 2016; Afelt et al., 2018). Humans are infected by these viruses either by direct consumption or contact or through even by the intermediate hosts (Chan et al., 2013; Allocati et al., 2016). Their higher diversity in species (over 1400), They have a very high resistance to viral infections, longer lifespan (over 30 years) and also the fact that they migrate makes them a major reservoir for pathogens and therefore their chances to transmit pathogens to other species is very high in large areas (Allocati et al., 2016; Frick et al., 2019; Banerjee et al., 2020). Nearly 5717 bat-associated animal viruses were detected by the year 2016, in a total of 207 bat species, in 77 different countries (Allocati et al., 2016). The nocturnal and solitary species characteristics of bats make them very difficult to study (Frick et al., 2019). It is highly

likely that a number of dangerous and deadly viruses may be present in different bat species which have not been found and studies so far. There is a need for regular and efficient monitoring, studying and surveillance in localities where in human beings and bats share a common habitat.

Destruction of their habitat: There is no denying the fact that bats are very essential for our ecosystem as they maintain the ecological balance in the environment but the the rapid clearing of forests for agriculture, urbanization and for making space for the ever expanding human population have greatly damaged and transformed the natural ecological niche of bats to a great extent (Walsh et al., 2017). There has been an ever increasing growth of our communities, localities, states and country population, year by year our numbers are increasing which ultimately leads to deforestation and land use for infrastructure, housing roads and agriculture. The countries lying in Southeast Asia (SEA) region are undergoing a population explosion and have lost nearly 30% of forest cover only in the previous 40 years. The growth in human population in SEA region is expected to grow to around 250 million coming the year 2030 in comparison to only 130 million from the years 2001 and 2011 in a research by (Afelt et al., 2018).

Bat population in India: One of the most ecologically diverse countries in the world, India is renowned for its majestic wildlife, and studies of its natural history abound, but the bats of India have hardly ever been studied and mentioned, and very little is known about them. Though studied very less but bats are an important part of our biodiversity. With at least 109 species (Mistry, Shahroukh 1995) India has an incredibly vast diversity of bat species. This includes one of the largest bat species in size in the world, the Indian flying fox (*Pteropus giganteus*); one of the most colourful bats in the world, the orange and black colour painted bat (*Kerivoula picta*); and one of the rarest species, Salim Alis fruit bat (*Latidens salimalii*). The habits of India's bats are as diverse as the habitats they live and thrive in. From higher altitudes of the Himalayas, to the dry deserts of the Northwest, to the moist tropical forests of the East and South, there are bats that feed on fruit, nectar, insects, frogs, and even other bats also. In India the majority of bats population are in North Eastern states of the country. The species richness is also confined to the north eastern region.

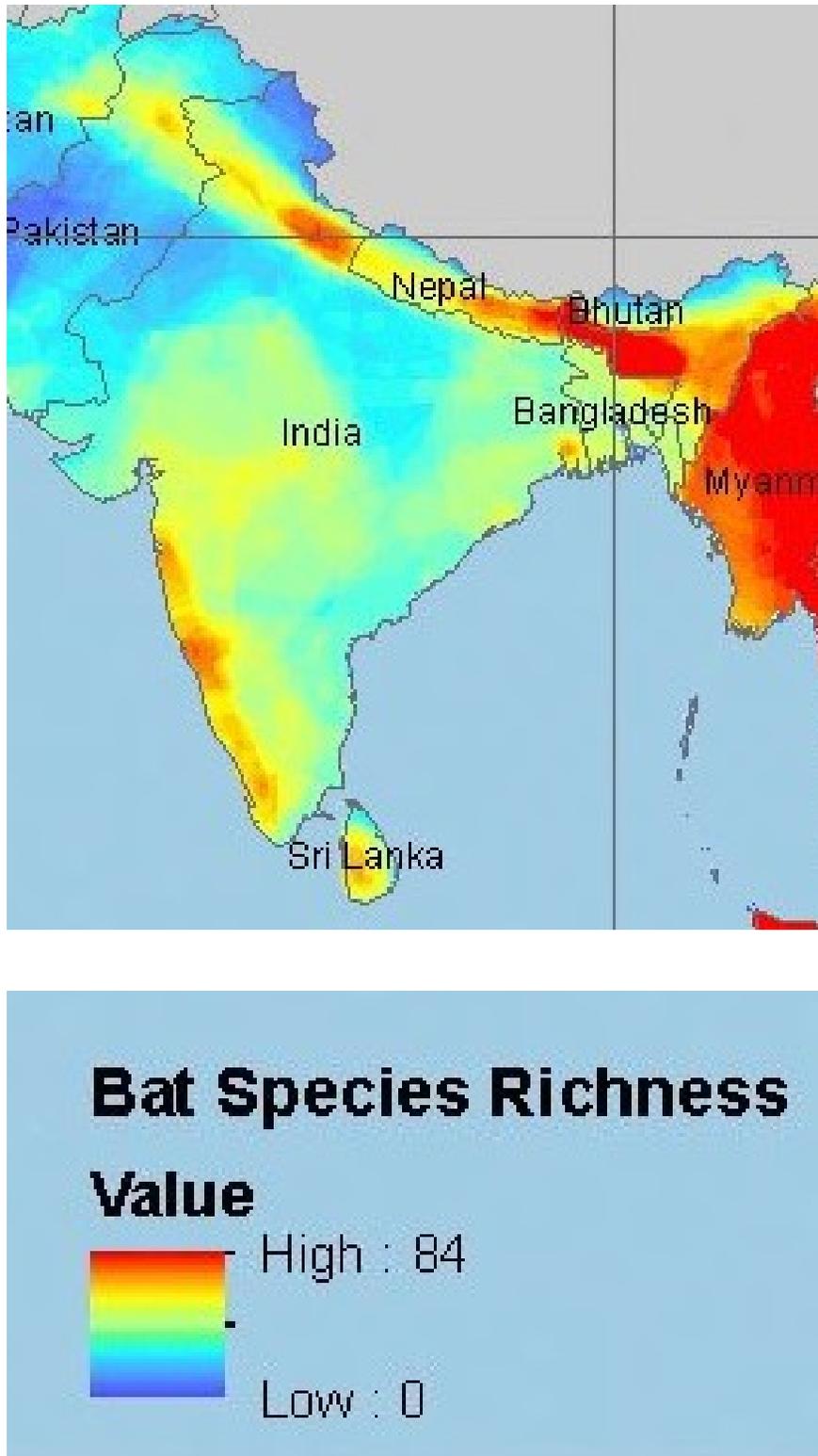


Fig 1: Bat species richness in India, Source:(IUCN,Batsworld.com)

Shifting of Bat colonies near human inhabitation : There has been a shift of bats population over the years. As a result of an ever increasing population, urbanization and deforestation, declining biodiversity, the colonies of bats trying to adapt and nest in the human inhabited village and city settlements and environments, in vicinity of human inhabitation areas (Jung and Threlfall, 2018; Li et al., 2019). Typically diverse environmental conditions are generated close to the human populations due to the above mentioned reasons, these changed environmental conditions makes it suitable for a diverse range of bat species to live and thrive there, not seen there before (Walsh et al., 2017; Jung and Threlfall, 2018), easy access to food could be the reason. Because of this, both the bat species number and the viruses present in bats will automatically increase. The luminous lightings of the houses attract bats in search of insects and pests. Fruit eating bats are attracted towards gardens and fields. The dark areas in the house and barns attract the bats which live in caves.

When a number of bat species interact amongst themselves, their viruses also interact and are passed from one another, these deadly viruses will then be transferred to the human beings through different means such as: direct hands contact, contamination of potable ground water by bat faeces or urine, and infection to domesticated animals (Jung and Threlfall, 2018). Also the characteristics that are very unique and specific in bats such as gathering or assemblage during the roosting process, their feeding practices and a very resilient immune systems help in the continued accumulation and mixing of different viruses in their body that may lead to formation of RNA viruses that are highly dangerous, recombinant, novel mutant, and reassortant (Chan et al., 2013).

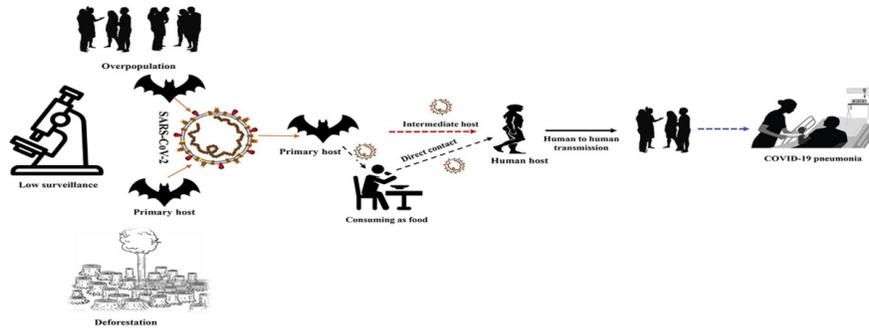
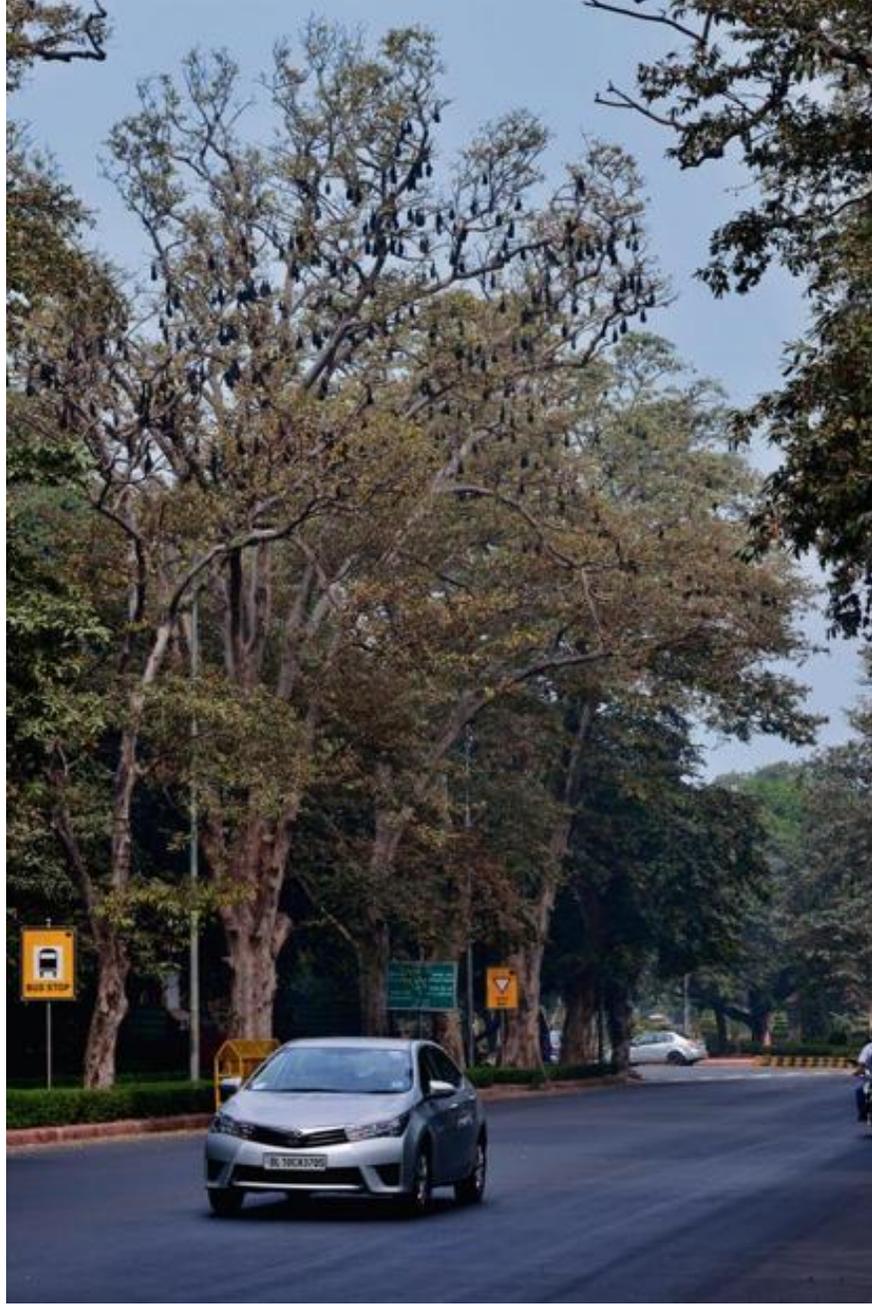


Fig 2: Diagrammatic representation of transmission of COVID-19.

Bats in Delhi: Looking for bats one does not have to go to deep forests or caves but they are right in the National capital of the country. There is a considerable population of fruit eating bats in New Delhi. These fruit bats (*Pteropus giganteus*), commonly known as the Indian flying fox, may be seen on almost all the Arjuna (*Terminalia arjuna*) trees on and around Janpath in New Delhi (Rajlakshmi Mishra). Bats can also be seen on and around the Ashoka trees (*Polyalthia longifolia*) and jamun (*Syzygium cumini*) trees in Motilal Nehru Marg areas and Akbar Road, sharing their abode with some of the biggest political names of the nation, including the Prime minister.





Pic 1&2: Bats hanging from trees in Janpath area (New Delhi).

Given the extremely fast transmission of this viral disease and its lack of vaccination, the only way to combat it is by using ecological intervention. Some of these ecological interventions are discussed below.

1. Habitat preservation: There is an urgent need to preserve and isolate the natural habitats of bats. Deforestation on a large scale has been studied to be related to viral outbreaks throughout the world (Olivero et al., 2017). All practices of deforestation should be stopped immediately, everywhere, and compensatory afforestation should be done to give the habitat back to wildlife. After the outbreak of such viral diseases, millions and crores are spent only to counter the disease, to diagnose, vaccinate the patients, and eradicate the disease. But very little care and focus is given to the basic preventive measures such as afforestation and sustaining the wildlife habitats. Neither our Govt. nor the citizens are concerned in this regard. The world community needs to recognise the importance of respecting the wildlife and its habitats.

2. Bat hunting and consumption: Though bat hunting and consumption is not so common in India, but the rapid transmission of such viral diseases in our neighbouring countries is a major cause of concern. Nearly 56 species of bats are hunted for consumption purposes in Asia (Mildenstein et al., 2016). In addition to that, live killing, and eating of undercooked meat of bats can cause viral infections in humans (Chan et al., 2013; Fan et al., 2019).

3. Controlling human population growth: India is the second most populated nation in the world after China, China being the most populous country has seen three major bat origin COVs epidemics till now (Fan et al., 2019; Khan et al., 2020). According to the research, many bat-related viral infections have been seen and reported in lands with higher population density (Plowright et al., 2015). Human population growth needs to be stabilised and regulated through family planning and legislations, especially of Asian countries.

4. Universal ban of wildlife trade : In spite of all the efforts of world environmental and animal bodies to curb the menace of wildlife trade, it has not decreased but has been increasing each year. New viruses having pandemic potentials emerge largely due to the unorganised and illegal trade of wildlife, as seen in the case of COVID-19 and similarly other outbreaks (Boseley, 2020). Hence, keeping in mind the fatal health problems, biosafety of the nation, universal public health, and economic inflows and outflows, it is high time that we eradicate the menace of wildlife trade.

5. Research, wildlife monitoring and survey : Efficient and effective scientific research is the guiding light to any environmental problem. Universally, it is very important to research and monitor the presence

or absence of wild life carrying viruses. Scientific surveys of bat population, inhabitation and migration may give instant knowledge with regards to the origin, travel and spill overs that may have happened with regards to the virus containing materials associated with the wildlife in any particular area, country or continent.

6. Scientific ecological research : The Government of India has started a nationwide research and development (R&D) initiative to combat corona virus spread and transmission. The Department of Science and Technology - Science and Engineering Board (DST-SERB) has announced several special scientific research projects as early as April 01 2020 within weeks of it's out-break in India. The first sets of 5 projects have been selected for further development into implementable technologies level. These projects were selected only after the peer-review and assessment approval by a Special Expert Committee for CoVID-19 projects and programmes.

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