

A research project co-funded by BBSRC and the Department for International Development (DFID) is supporting a unique collaboration between UK and Indian researchers investigating bluetongue virus in India.

The international team of researchers, led by Dr Simon Carpenter from The Pirbright Institute, which receives strategic funding from BBSRC, are investigating the causes of regular damaging 'hyper-endemic' outbreaks of bluetongue in farm animals in India¹. They are also looking at ways to control the *Culicoides* midges that spread bluetongue virus.

The researchers are working closely with various stakeholders in India, including veterinary officers, government officials and farming associations, to develop and refine maps showing areas at risk of bluetongue outbreaks. Their input is also strengthening local expertise in the biology of the *Culicoides* midge. The ultimate aim of the project is to create an early warning system that can be used by Indian state veterinary officers to predict outbreaks and plan bluetongue vaccinations.

The project² was funded as part of the £13M BBSRC-DFID Combating Infectious Diseases of Livestock for International Development (CIDLID) initiative³, which also received funding from the Scottish Government. The CIDLID programme aims to have a long-term impact on issues of global importance by bringing together researchers and stakeholders from around the world.

Alongside the bluetongue epidemiology capability provided by The Pirbright Institute, the project depends on epidemiological modelling expertise from the Natural Environment Research Council's Centre for Ecology & Hydrology (CEH), as well as local experts and researchers from the Indian Council of Agricultural Research.

Stakeholder consultation

Since the project began the researchers have developed preliminary risk maps showing areas at high risk from bluetongue disease. In May 2014 the researchers met with a wide range of stakeholders in India, including state and district veterinary officers, the animal husbandry department, small holder sheep farmer associations, and epidemiologists, to discuss the risk maps. The meetings enabled the researchers to identify specific ways in which their maps would improve bluetongue vaccination planning efforts by state veterinary officials.

For instance, forecasts of the timing of outbreaks could be used by government officials to prepare a vaccination schedule and order vaccines. Such forecasts could also help inform local people about the likely severity of the outbreaks through radio and local TV alerts, pamphlets and daily newspapers. State officials can also use the information to make decisions to close animal markets and restrict animal movements before the bluetongue transmission season began, rather than waiting for the first signs of an outbreak.

Stakeholder input also helped the researchers tailor their risk models appropriately. Local experts with experience of managing outbreaks in the field advised them on the most suitable environmental inputs to their models, and the most useful timescales and geographic resolution for the forecasts and risk maps. The researchers are now working to produce a refined set of maps and forecasts by the end of the project in September 2014 and make these available to stakeholders online and in a bulletin.

IMPACT SUMMARY

BBSRC and DFID co-funding has enabled UK researchers to work with counterparts in India to study the causes of devastating 'hyper-endemic' outbreaks of bluetongue disease. The work builds on The Pirbright Institute's strengths in bluetongue epidemiology research, together with ecological modelling expertise from NERC's Centre for Ecology & Hydrology, and the local knowledge and expertise provided by researchers from the All India Network Programme on Bluetongue.

The researchers are producing maps to predict high risk areas for bluetongue, and working with stakeholders in India to ensure these maps are of use.

They are also providing training for Indian researchers and PhD students to help build capacity to tackle bluetongue in the country.



A sheep in Karnataka state showing clinical signs of bluetongue.
Image: Dr Mudassar Chanda

According to co-investigator Dr Gaya Prasad at the Indian Council of Agricultural Research⁴, the collaboration is also helping to address gaps in the expertise of the All India Network Programme on Bluetongue⁵ (AINP-BTV). “Substantial progress has been made under this [AINP-BTV] programme, including development of a... vaccine based on local strains. One area the All India Network could not address effectively was the [*Culicoides* midge] vector, due to lack of expertise.”

“The joining of [The Pirbright Institute] and other UK experts in the Indian Council of Agricultural Research-funded AINP-BTV has greatly strengthened the bluetongue research programme in India, particularly the vector aspect. The understanding of seasonality, vector density, vector species and other vector-related aspects at rural farm level, and environmental factors contributing to occurrence of the disease will help in developing an effective intervention strategy for this economically very important disease.”

Carpenter was the first UK scientist invited to attend a meeting of the AINP-BTV, which aims to understand bluetongue in India and develop a strategy to control the disease. “Because of the existing network, we can roll out techniques such as the molecular identification of biting midges to other labs across India very effectively and rapidly,” says Carpenter.

Prasad’s local contacts and understanding of the research approval process in India also ensured the project was approved by the Indian Council for Research. “The systems in India are very different to the UK so, without a local contact, getting the project off the ground would have been extremely challenging,” Carpenter adds.

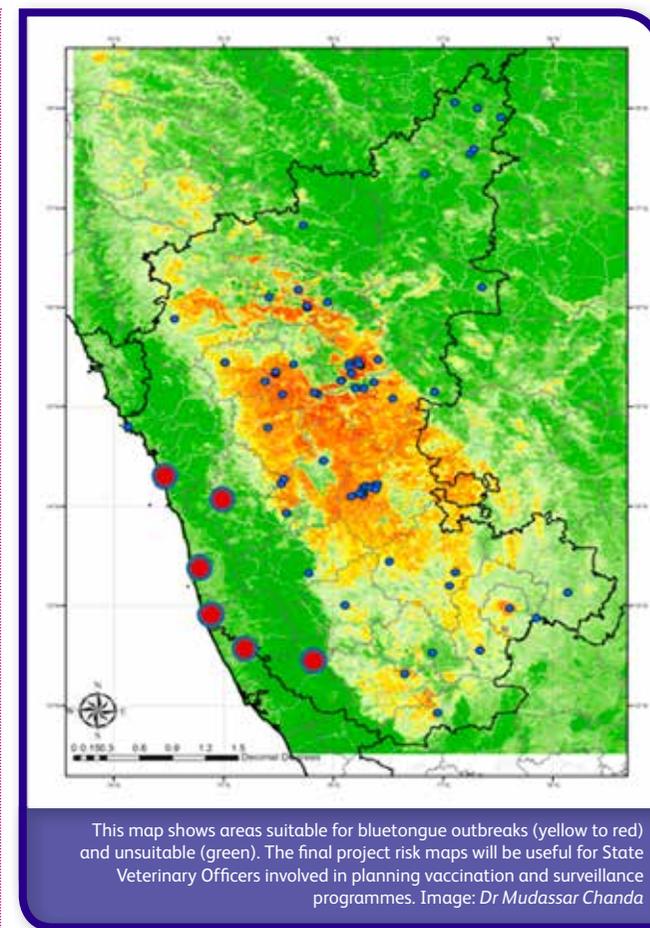
Bluetongue in India

Bluetongue is endemic in India, and some strains of the virus cause substantial damage to the sheep flocks kept by rural subsistence farmers. Regular hyper-endemic outbreaks can also kill 30 per cent of animals in a flock.

The livelihoods of many rural Indian communities depend on their flocks of sheep. “Livestock husbandry is one of the major sources of livelihood for landless and marginal farmers in India. Therefore, multi-host livestock diseases such as bluetongue have serious consequences for livelihood security for resource-poor farmers,” says Prasad.

“The animal husbandry sector has shown high growth in India, and its contribution to agricultural GDP (gross domestic product) has gone up over the years from 13.8 per cent in 1981 to 24.2 per cent in 1999-2000,” says project PhD student Dr Mudassar Chanda.

The loss in productivity caused by the virus has serious health implications for India. “Even though India ranks third in sheep population globally, and it’s one of the important sources of meat along with goat, there is still a 7.71 kg per year per person deficit⁶ as per the dietary requirements guidelines proposed by ICMR (Indian Council for Medical Research),” Chanda explains.



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“One of the important reasons affecting production is infectious diseases of sheep, of which bluetongue is among top five diseases, causing huge economic losses to the farmers, affecting their livelihood, and also a threat to food security of the country,” he adds. Bluetongue virus is endemic in India, and some strains inflict substantial numbers of clinical cases each year. Flocks are also at risk from regular hyper-endemic outbreaks, which the researchers believe could be caused by the annual monsoon. During one of these outbreaks, bluetongue can kill 30 per cent of sheep in a flock.

“We think that these outbreaks may be linked to monsoon conditions, as these determine the availability of *Culicoides* larval habitats and the extent to which grazing livestock are bitten by infected midges” says Dr Beth Purse, an ecological modeller from the Centre for Ecology & Hydrology in Edinburgh and one of the project’s co-investigators.

Although not always fatal, the virus also causes a fever and swelling of an infected animal’s feet, mouth, lips and nasal passages⁷. Those animals that survive the infection lose weight and produce less meat, and the costs of on-going veterinary care can be significant. A vaccine developed by the AINP-BTV will soon be available in India, but it will be used on a voluntary basis as it is likely to be too expensive for some rural subsistence farmers.

High risk areas

Carpenter, Purse and colleagues are investigating the factors that affect the distribution of bluetongue at the farm level, in the landscape around farms and at a regional level. Contact with the AINP-BTV has helped Chanda access local expertise and data which might not have been accessible otherwise. So far, Chanda has collated data on how the patterns of bluetongue in India have changed over the last two decades. The research has already produced preliminary maps to predict high risk areas for bluetongue.

“The knowledge derived through AINP and the BBSRC-funded project is used to advise the resource poor sheep farmers to minimise the impact of bluetongue disease in the hot and humid season from August through November when clinical disease outbreaks occur,” says Prasad.

The project will also help to build capacity in India by providing PhD training and training courses for Indian researchers.

It is expected that risk maps and forecasts for bluetongue derived from the project will be made available on a website in early 2015⁸.

REFERENCES

- 1 Project details: <http://www.bbsrc.ac.uk/pa/grants/AwardDetails.aspx?FundingReference=BB%2fH009205%2f1>
- 2 CIDLID project: <http://www.iah.ac.uk/CIDLID/A648.aspx>
- 3 Project announcement: <http://www.bbsrc.ac.uk/news/food-security/2010/100215-pr-livestock-threat-reducepoverty-increase-food-security.aspx>
- 4 Indian Council of Agricultural Research: <http://www.icar.org.in/animal-science.htm>
- 5 All India Network Programme on Bluetongue: <http://www.ainpbt.com/>
- 6 Figures from the Indian Government Planning Commission 10th Five Year Plan 2002-2007: http://planningcommission.nic.in/plans/planrel/fiveyr/10th/volume2/v2_ch3_3.pdf
- 7 Bluetongue disease facts: <http://www.iah.ac.uk/disease/Bluetongue.aspx>
- 8 For further information on these aspects, please contact Dr Beth Purse, CEH: beth@ceh.ac.uk