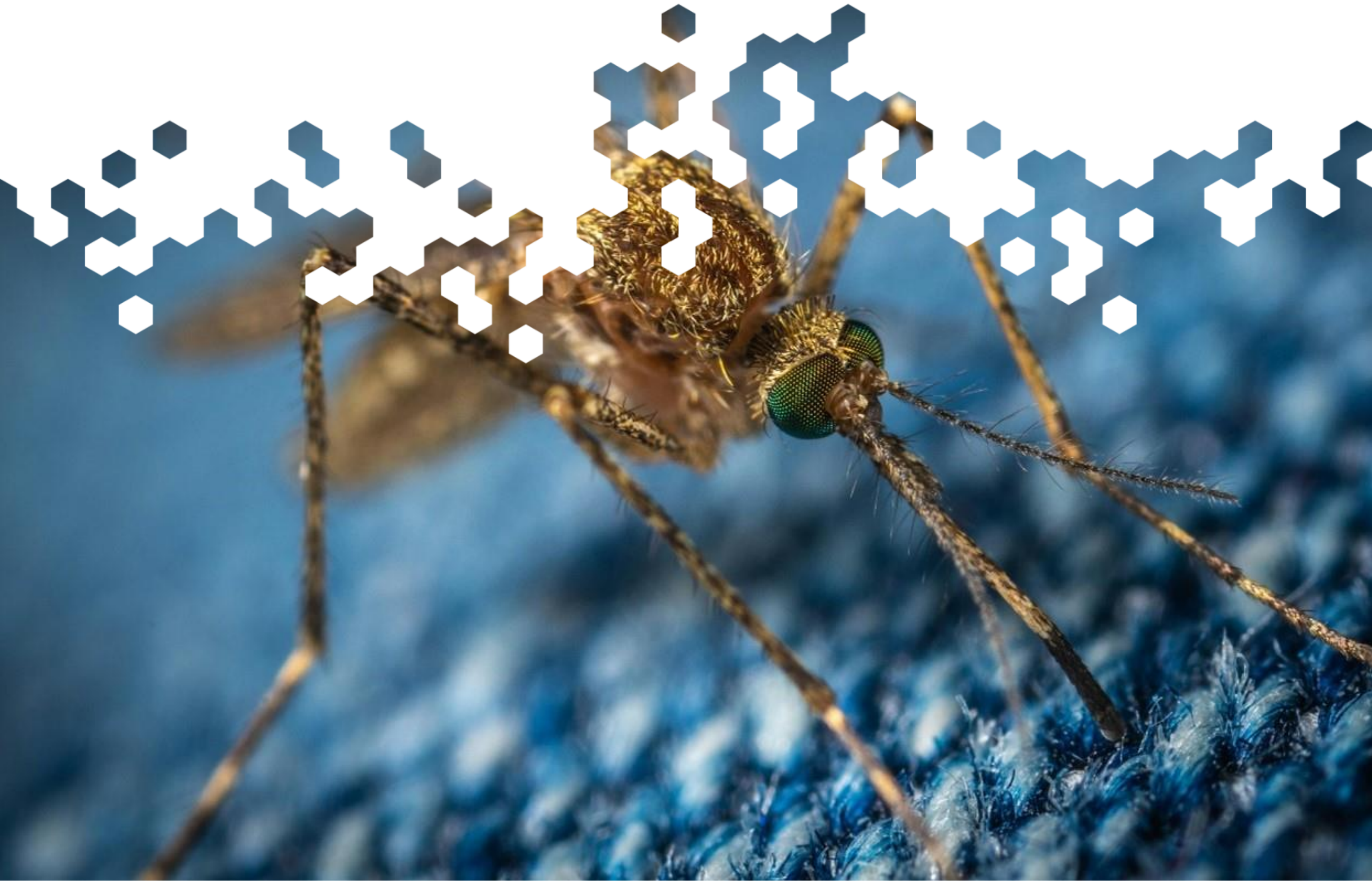
STAR IDAZ
International Research Consortium on Animal Health

Executive Summary of Priority Research Needs for Vector Transmission Control

November 2024



STAR IDAZ IRC is the ‘Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses - International Research Consortium’. It is a global consortium that brings together funders and programme owners for research on animal health to maximise funding for coordinated animal health research. To achieve its aim, STAR IDAZ facilitates networking among funders, researchers, industry experts, policymakers and other stakeholders to collaborate on research and innovation in the field of infectious animal diseases. This document was produced by SIRCAH, the Scientific Secretariat of the STAR IDAZ IRC.

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More information on STAR IDAZ IRC can be found at www.star-idaz.net

Background and Aim

STAR IDAZ IRC is a global initiative to address the coordination of research programmes at an international level in the area of animal health and in particular infectious animal diseases including zoonoses.

The STAR IDAZ IRC has developed roadmaps to highlight priority areas for research to improve global coordination of research funding and accelerate the development of improved control methods. The Roadmap for Vector Transmission Control (VTC) focuses on controlling vector-borne diseases in domestic animals, addressing critical gaps through innovative and targeted research strategies.

Objectives and focus

The control of vector transmission was identified by STAR IDAZ IRC partners as a priority issue for collaborative research efforts. A working group of experts was convened through several workshops held between 2020 and 2023 to identify research priorities and develop the research roadmap. The roadmap is generic and therefore is widely applicable to different species of vector.

The VTC research roadmap is structured around three core approaches targeting specific aspects of vector control and transmission reduction. These are:

- Vector-host interactions: strategies to control vector populations and disease transmission by targeting the host
- Vector biology: direct interventions to disrupt vectors' ability to transmit pathogens
- Vector environment: modifications of the vector’s habitat to reduce populations and their impact.

Each approach includes interconnecting nodes or leads, ultimately leading to action points aimed at controlling or reducing vector populations and their ability to transmit diseases.

Summary of Research priorities

Research priority	Objective	Key challenges	Proposed solutions
Vector-Host Interactions	Enhance host resistance to vectors and reduce pathogen transmission	Understanding host resistance mechanisms, innate immunity, and behavioural factors	Breed or genetically modify animals for resistance; develop effective vaccines and behavioural interventions
Vector Biology	Target vectors directly to disrupt pathogen transmission and reduce vector competence and population size	Identifying effective antigens, addressing acaricide resistance, and understanding vector-pathogen dynamics	Develop vaccines, use genetic engineering, RNA interference, and enhance vector immunity
Vector Environment	Alter vector habitats to reduce populations in husbandry zones	Addressing socio-economic impacts, climate change effects, and ecological impacts of interventions	Habitat management, agro-silvopastoral systems, and push-pull strategies
Host Anti-Vector Resistance	Use genetic or acquired traits to resist vector infestation	Identifying genetic markers for resistance, innate immune responses, and phenotype variability	Breed resistant hosts, develop vaccines targeting specific vectors

Host Treatments	Apply acaricides and insecticides effectively	Managing resistance, reducing environmental toxicity, and improving application methods.	Rotational acaricide use, long-acting treatments, and field studies on treatment effectiveness.
Vector Genetic Control	Genetically modify or sterilize vectors to reduce populations	Ensuring ecological safety and developing efficient genetic modification methods	CRISPR-based sterilization, gene drives, and transgenic mosquitoes
Vector Pathogen Control	Utilize natural pathogens or predators to control vector populations	Identifying safe and effective biological agents, addressing regulatory barriers	Use fungi, bacteria, or parasitoids as vector-specific controls
Predictive Modelling	Anticipate vector population dynamics and disease risks under environmental changes	Data gaps in vector ecology, climate change effects, and socio-economic factors	GIS mapping, ecological modelling, and integrated pest management strategies

Detailed approaches

Vector-host interactions

This approach focuses on managing the host to control vector populations or disease transmission. It comprises:

- Host anti-vector natural resistance (Lead 2a): exploiting the host's genetic potential for innate resistance to vector infestation. Genetic modification or selective breeding of certain breeds aims to enhance natural resistance
- Host anti-vector vaccination (Lead 2b): developing vaccines targeting vector-specific antigens to elicit immune responses that negatively affect vectors
- Host anti-vector treatment (Lead 2c): applying acaricides and insecticides to the host to manage and reduce vector populations, while focusing on preventing resistance through optimized application methods.

Vector biology

This approach directly targets the vector to disrupt its capacity to transmit pathogens or reproduce. Key nodes include:

- Vector immunomodulation of the host (Lead 5): investigating how vectors modulate host immunity and identifying methods to counteract these effects
- Vector modulation of the host pathogen (Lead 6): reducing the vector's ability to harbour or propagate host pathogens
- Vector genetic control and sterilization (Lead 10a): implementing genetic modification or sterilization techniques to reduce vector populations
- Vector pathogens and predation (Lead 10b): leveraging natural pathogens or predators to decrease vector populations.

Vector environment

This approach targets the vector's environment to control its population in husbandry zones. The key focus area is:

- Vector biotope control (Lead 12): Studying and managing the vector's habitat, considering climatic, ecological, and socio-economic factors to alter vector behaviour and reduce its survival.

Conclusion

The STAR IDAZ IRC, as suggested by the expert working groups, recommends targeted research to address the above research gaps in vector transmission control. By focusing on host-vector interactions, vector biology, and environmental modifications, this roadmap provides a strategic framework to reduce the impact of vector-borne diseases on domestic animals.

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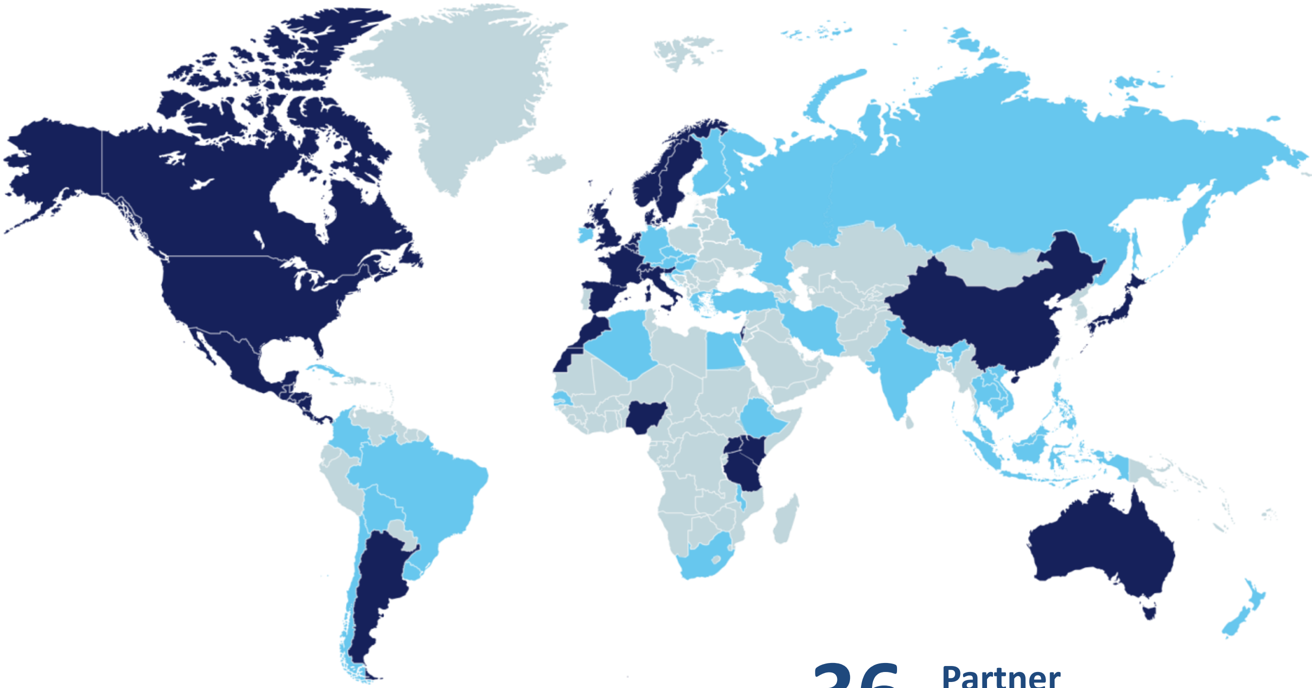

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