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Consortium on
Animal Health

Short Summary of the STAR IDAZ Tick Vaccine Workshop

17 June 2024

Sala Coral, Rebouças Convention Centre, São Paulo, Brazil



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

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STAR IDAZ IRC Workshop: Shaping the future of livestock tick vaccines

Introduction

The [STAR IDAZ International Research Consortium](#) (IRC) workshop, 'Shaping the Future of Livestock Tick Vaccines', was held on 17 June, 2024, in São Paulo, Brazil, to enhance coordination of research and development efforts for effective tick vaccines. The workshop fostered collaboration among a diverse group of experts, encompassing researchers and industry representatives, focused on mitigating the impact of ticks and tick-borne diseases (TBD) on livestock health and productivity.

Key objectives included critical evaluation of existing experimental designs, discussion of recent advancements in tick vaccine research, and collaborative development of a Scientific Target Product Profile (S-TPP) for cattle tick vaccines. This S-TPP serves as a guiding framework for future research and development (R&D) initiatives, integrating insights and contributions from participating researchers and experts.

Session Summaries

Session 1: Collaborative efforts and scientific foundations for tick vaccine

Chair: Isabel Kinney Ferreira de Miranda Santos, University of São Paulo

Welcome address and overview of STAR IDAZ IRC

Speaker: Latifa Elhachimi, SIRCAH / Kreavet

The workshop began with a welcome address by Isabel Kinney Ferreira de Miranda Santos, who emphasized the importance of collaborative research in overcoming the challenges posed by ticks and tick-borne diseases. Latifa Elhachimi provided an overview of the STAR IDAZ IRC, highlighting its role in coordinating global research efforts and the significance of the workshop in shaping the future of tick vaccine development.

State of tick vaccine research

Speaker: Isabel Kinney Ferreira de Miranda Santos, University of São Paulo

Isabel Kinney Ferreira de Miranda Santos presented a comprehensive review of the current state of tick vaccine research. The presentation highlighted the following key points:

- Over 173 published trials have tested more than 20 antigens across seven tick genera, with BM86 and subolesin being the most studied. Other antigens include glycine-rich proteins, ferritin, and lipocalin, all of which play roles in tick physiology and immunity.
- The VRDC@UCI platform was discussed as a valuable resource for antigen discovery. However, the complexity of tick-host interactions, such as the immunosuppressive effects of tick saliva and the challenge of 'hidden' tick antigens, complicates vaccine development.
- The review stressed the importance of standardizing vaccine trials to account for variability in host responses, environmental conditions, and tick burdens. This includes considerations such as the breed and gender of test animals, prior tick exposure, and the choice of adjuvants.

STAR IDAZ IRC Roadmaps on Vector Transmission Control

Speaker: Bruno Goddeeris, UGent

Bruno Goddeeris presented the STAR IDAZ IRC roadmap for vector transmission control. Although the [roadmap](#) was available for review, key elements that were discussed included the integration of vector control strategies with vaccine development and the need for global coordination in R&D efforts.

Opportunities for R&D regarding tick resistance

Speaker: Alejo Menchaca, PROCISUR

Alejo Menchaca's presentation focused on the growing problem of tick resistance to acaricides. Key points included:

- Resistance to one or more chemicals is widespread, with approximately 66% of ticks showing resistance to 1-3 chemicals, and 33% resistant to more than three.
- The need for alternatives to chemical acaricides, such as fungal biocontrol agents, phytotherapies, and next-generation vaccines, was emphasized. Menchaca also discussed the potential of CRISPR-based technologies and gene drives as innovative solutions.

Session 2: Challenges for vaccine standardization

Chair: Isabel Kinney Ferreira de Miranda Santos, University of São Paulo

Vaccine efficacy and trial design

Speaker: Halid Kirunda, NARO

Speaker: Maxime Madder, Clinglobal

This session explored the challenges in designing and standardizing vaccine trials. Key discussions included:

- Standardizing trial design is critical to ensure that results are comparable across different studies. Variables such as host breed, sex, and prior tick exposure must be carefully controlled. The use of tick-naïve hosts and randomization based on innate tick load were recommended practices.

- Maxime Madder presented the CATVAC project, which highlighted the variability in tick burdens across different hosts and the need for robust experimental designs. The importance of using susceptible breeds and considering the coefficient of variance (CV) in tick counts when determining sample sizes was discussed.

Industry perspective: BM86 immunomodulator for biological control

Speaker: Suman Mahan, Zoetis

Suman Mahan provided insights into the development and application of the BM86 immunomodulator, which targets one-host ticks like *Rhipicephalus microplus*. The product, used in conjunction with acaricides, has shown significant reductions in acaricide-resistant tick populations as well as ticks in general, particularly in regions like Puerto Rico and Texas. The presentation also discussed the regulatory challenges associated with classifying the product as an immunomodulator rather than a traditional vaccine.

WOAH minimum requirements for vaccine evaluation

Speaker: Jim Roth, Iowa State University (Pre-recorded Presentation)

Jim Roth's presentation outlined the minimum requirements set by the World Organisation for Animal Health (WOAH) for the evaluation of tick vaccines. The importance of meeting these requirements to ensure the safety and efficacy of vaccines in different regions was emphasized.

Session 3: Integrated control and future directions

Chair: Vish Nene, ILRI, WSU

Genetic approaches: The Oxitec Friendly™ Cattle Tick Program

Speaker: Mattia Poletto, Oxitec Ltd.

Mattia Poletto introduced the Oxitec Friendly™ Cattle Tick Program, which utilizes gene drive technology to control tick populations. The program involves the release of genetically modified male ticks that carry a self-limiting gene, leading to the suppression of local tick populations. The presentation highlighted the potential of this technology to complement traditional control measures and reduce the reliance on chemical acaricides.

The evolution of tick vaccinology

Speaker: Jose De La Fuente, IREC (Pre-recorded Presentation)

Jose De La Fuente's presentation traced the evolution of tick vaccinology, from early efforts to the latest advancements in antigen discovery and vaccine development. The discussion highlighted the importance of ongoing research and the need for continued innovation in the field.

Discussion and development of a Scientific Target Product Profile (S-TPP)

Facilitator: Vish Nene, ILRI, WSU

The workshop concluded with a collaborative discussion on the development of a S-TPP for cattle tick vaccines. This profile aims to serve as a guide for future R&D efforts, ensuring that new vaccines meet the necessary criteria for efficacy, safety, and practical application.

Draft Scientific Target Product Profile (S-TPP) for cattle tick vaccines

1. Target product indication:

- Control and reduction of *Rhipicephalus microplus* and other economically significant tick species in cattle.
- Integration with other control measures such as acaricides and genetic approaches.

2. Target population:

- Cattle of various breeds and ages, including tick-naïve and previously exposed animals.
- Consideration of geographical regions with varying tick burdens and acaricide resistance profiles.

3. Efficacy requirements:

- Minimum efficacy of 70% reduction in tick counts under standardized trial conditions.
- Demonstrated efficacy across multiple tick life stages (larvae, nymph, adult).
- Long-term impact on tick populations when used in conjunction with acaricides or other control measures.

4. Safety profile:

- Minimal adverse reactions in vaccinated cattle, including those in different physiological states (e.g., pregnancy, lactation).
- No significant impact on milk production, meat quality, or other commercial traits.

5. Immunogenicity:

- Induction of a strong, durable immune response, with measurable antibody titers and cellular immunity markers.
- Evaluation of antigen-specific responses and their correlation with protection against tick infestation.

6. Dosing and administration:

- Two-dose primary series administered intramuscularly, with potential for annual boosters.
- Consideration of delivery methods that minimize stress and maximize compliance in field settings.

7. Regulatory compliance:

- Adherence to WOAHA minimum requirements for vaccine evaluation.
- Compliance with local regulatory bodies in target markets, including any additional safety and efficacy requirements.

8. Monitoring and surveillance:

- Post-market surveillance to monitor vaccine performance, including the potential for resistance development.
- Integration of vaccine use with acaricide application and other control strategies to prevent resistance buildup.

9. Research and development priorities:

- Continued investigation into novel antigens and adjuvants to enhance vaccine efficacy.
- Exploration of combination vaccines that target multiple tick species or pathogens simultaneously.
- Development of field-applicable diagnostic tools to assess vaccine efficacy and monitor tick populations.

10. Collaboration and knowledge sharing:

- Establishment of a global network for sharing data, best practices, and research findings related to tick vaccine development.
- Encouragement of collaborative research projects that address key challenges in tick control, including acaricide resistance and the impact of climate change on tick distribution.

Next steps and call for input

The draft S-TPP presented above is intended as a starting point for ongoing discussions and refinement. Participants and other stakeholders in the field are encouraged to provide their input, suggestions, and additional data to enhance the profile. The finalized S-TPP will serve as a critical tool for guiding future research and development efforts, ensuring that new tick vaccines are both effective and practical for use in diverse global contexts.

As part of these efforts, it was suggested to engage with the FAO Tick and Tick-Borne Disease Community of Practice and share the outcomes of this meeting. This collaboration would help align activities and foster joint action in controlling ticks and TBDs, which is fully in line with the STAR IDAZ vision of uniting global efforts to drive innovation and impact in animal health.

Conclusion

The STAR IDAZ Tick Vaccine Workshop has been a significant milestone in the collaborative effort to control tick populations and the diseases they transmit. The finalized Scientific Target Product Profile (S-TPP) will serve as a critical tool for guiding future research and development. By engaging a broad range of stakeholders and fostering global collaboration, we can achieve sustainable solutions that protect livestock and enhance animal health worldwide.

Acknowledgments

The STAR IDAZ IRC workshop on anti-tick vaccines was made possible through the invaluable contributions of our dedicated presenters, chairs, and engaged participants. We extend our deepest appreciation to the following experts for their valuable contribution and leadership:

- **Isabel Kinney Ferreira de Miranda Santos** (University of São Paulo), for her leadership in opening the workshop and her comprehensive overview of tick vaccine research.
- **Bruno Goddeeris** (UGent), for presenting the STAR IDAZ IRC roadmap on vector transmission control and highlighting key areas for coordination.
- **Alejo Menchaca** (PROCISUR), for sharing innovative perspectives on overcoming acaricide resistance and exploring next-generation control strategies.
- **Halid Kirunda** (NARO) for his presentation and thoughtful discussion on vaccine trial design and standardization challenges.
- **Maxime Madder** (Clinglobal), for his in-depth analysis of vaccine trial variability and his presentation.
- **Suman Mahan** (Zoetis), for sharing an industry perspective on immunomodulators and their role in biological control of ticks.
- **Jim Roth** (Iowa State University), for outlining the WOAHS requirements for vaccine evaluation and helping align efforts with global standards.
- **Mattia Poletto** (Oxitec Ltd.), for presenting novel genetic control strategies through the Oxitec Friendly™ Cattle Tick Program.
- **Jose De La Fuente** (IREC), for sharing the historical and ongoing evolution of tick vaccinology and the importance of continuous innovation.
- **Vish Nene** (ILRI, WSU), for expertly facilitating the collaborative development of the Scientific Target Product Profile (S-TPP) and guiding the group toward a shared vision for the future of tick control.

We are also grateful to the numerous participants from diverse institutions and backgrounds, whose active engagement and contributions enriched our discussions. Together, our efforts are helping to address the pressing challenges in tick management and advance animal health worldwide.

Annex – Workshop Agenda

Introduction

Welcome to the STAR IDAZ IRC scientific workshop on tick vaccines! The aim is to share experiences on livestock tick control and share recent research results. Specific focus will be given to the need for standardization of tick vaccine trials, experimental models and integrated control through combination with other approaches including genetic and acaricide approaches. The workshop is targeted at researchers, tick control decision makers, research funders and industry to jointly unravel the complexities of this critical field and work towards sustainable solutions. There will be plenty room for discussion and the aim is to develop a scientific target product profile (S-TPP) for the ultimate cattle tick vaccine and discuss how we can standardize tick vaccine trial. A draft S-TPP will be shared after the workshop with participants to comment on prior to publication.

Session 1: Collaborative efforts and scientific foundations for tick vaccine

Chair: Isabel Kinney Ferreira de Miranda Santos (University of São Paulo)

8:45 - 9:00 Working together for tick vaccines

- Welcome address – Isabel Kinney Ferreira de Miranda Santos (University of São Paulo) (10 min)
- Introduction to STAR IDAZ IRC – Latifa Elhachimi (SIRCAH / Kreavet) (5 min)

9:00 - 9:45 The state of tick vaccine research – Isabel Kinney Ferreira de Miranda Santos (University of São Paulo)

9:45 - 10:00 STAR IDAZ IRC roadmaps on vector transmission control – Bruno Goddeeris (UGent)

10:00 - 10:15 Opportunities for R&D regarding tick resistance – Alejo Menchaca (PROCISUR)

BREAK

Session 2: Challenges for vaccine standardization

Chair: Isabel Kinney Ferreira de Miranda Santos (University of São Paulo)

10:45 - 12:00 Challenges for vaccine standardisation

- Challenges in vaccine efficacy and trial design – Halid Kirunda (the National Agricultural Research Organisation (NARO) (15 min)
- One-host Tick Challenge Models – Maxime Madder (Clinglobal) (15 min)
- Industry Perspective: Development of Bm86 Immunomodulator for Biological Control of One-Host-Ticks – Suman Mahan (Zoetis) (15 min)
- WOH minimum requirements for vaccine: WOH Collaborating Centre for Vaccine

- Evaluation in the Americas – Jim Roth, pre-recorded presentation (15 min)
- Discussion

LUNCH

Session 3: Integrated control and future directions

Chair: Vish Nene (ILRI, WSU)

13:30 - 14:30 Integrated control

- Genetic approaches: The Oxitec Friendly™ Cattle Tick Program - Mattia Poletto (Oxitec Ltd.) (15min)
- The evolution of tick vaccinology - Jose De La Fuente, (IREC, pre-recorded presentation (15 min)

BREAK

Facilitator: Vish Nene, ILRI, WSU

15:00 – 15:50 Discussion: making a scientific target product profile for cattle tick vaccine

15:50 - 16:00 Closing Remarks – Isabel Kinney Ferreira de Miranda Santos (University of São Paulo)

PRACTICAL INFORMATIONS

Registration: free but need to register before 10th of June 2024.

https://docs.google.com/forms/d/e/1FAIpQLSdTpMbbFw5PCC940KmYvuO1WBIE7pEzOi6iyfulM19q57OS1g/viewform?usp=sf_link

Posters:

A0 format. You will be notified if your poster is selected for presentation shortly after registration.

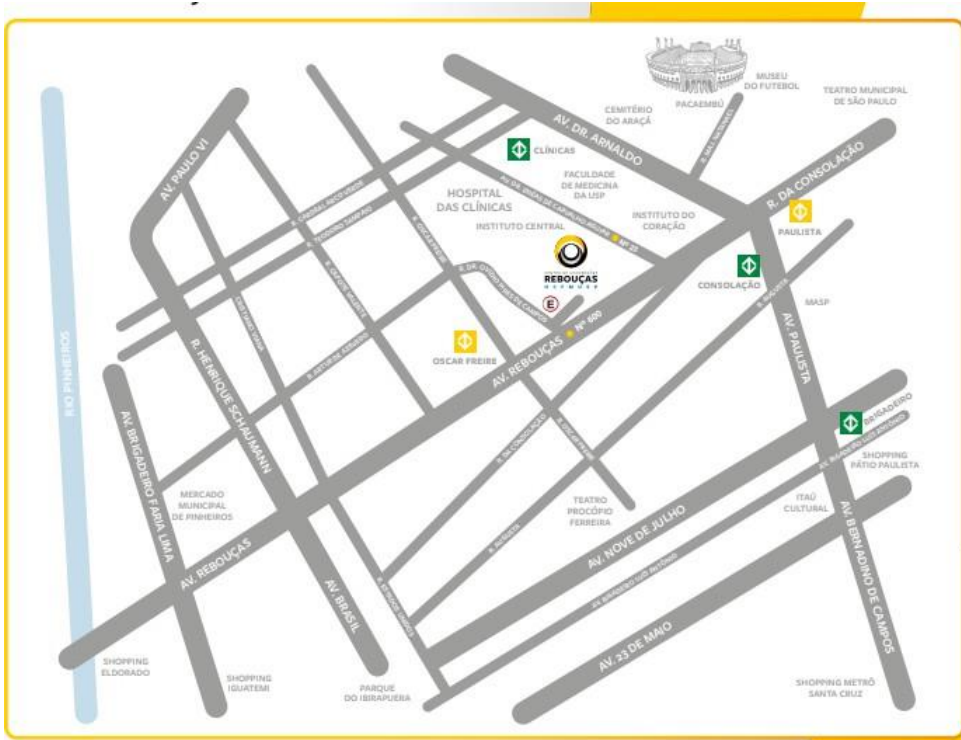
Location:

Rebouças Convention Centre, São Paulo, Brazil Dr Enéas de Carvalho Aguiar Avenue, 23

<https://www.convencoesreboucas.com.br/ccr/portal/>

How to get there?

Subway: Clínicas – 300 m or Oscar Freire – 500 m Car parking: Rebouças Avenue, 600



Nearby hotels

- [Mercure São Paulo Pinheiros](#). Discount is available for access via Internet Explorer and Google Chrome using the promotional code "**CONGR1**".
- [Hotel WZ Jardins](#)