



## Mapping of the infectious risk linked to tick bite exposure in France to improve prevention: contribution of participatory research data

Principle investigator: Pascale Frey-Klett, UMR Interactions Arbres/Micro-organismes (IAM)

LabEx partners: Annick Brun-Jacob, UMR Interactions Arbres/Micro-organismes (IAM)

Collaborations :

- Gwenaël Vourc'h, UMR INRAE VetAgro Sup « Epidémiologie des maladies animales et zoonotiques », INRAE Clermont-Auvergne-Rhône-Alpes
- Sara Moutailler, UMR INRAE ANSES ENVA « Biologie Moléculaire et Immunologie parasitaires, ANSES Maisons-Alfort

Action(s) thématique(s) concernée(s) : WP5 et WP6

**Context** — The prevention and control of tick-borne pathogens is a real health challenge for Western societies, as ticks are the primary vector of human and animal diseases in Europe. These diseases, including Lyme borreliosis, are the subject of much debate and controversy, particularly given the lack of current knowledge about the pathogens carried by ticks that can be transmitted to humans in France. It is to respond to the concerns of citizens that the Ministry of Health and Solidarity wished in 2016 to develop a plan to fight Lyme disease and tick-borne diseases, called "Plan Lyme". The first strategic axis of this plan aims to improve vector surveillance by federating projects to map the risk and distribution of ticks in France. In parallel to this initiative, drawing on its experience as a facilitator of participatory research projects and eager to support new projects that put citizens at the heart of the research process, Labex ARBRE launched the CiTIQUE participatory research program in 2017 with researchers from INRAE. This program allows citizens and researchers to work together to better understand the ecology of ticks and the pathogens they transmit, thanks in particular to (i) the "Signalement TIQUE" application, which allows citizens to report and georeference any tick bite on humans or animals, and (ii) the tick library, which collects all the ticks sent by participating citizens. These tick bites, which were previously inaccessible to researchers, now allow for an unprecedented study of the spatial variability of infectious risk related to exposure to tick bites.

**Objectives** — The objective of our study is to establish a fine mapping at different scales (region, forest vs. garden) of the infectious risk for humans related to tick bites in France.

**Approaches** — From tick samples archived in the CiTIQUE program tick library, we will:

- Describe the diversity of human biting tick species in France at the scale of territories (regions) and ecosystems (forests vs gardens)
- Evaluate the proportion of human biting ticks carrying pathogens at the scale of territories (regions) and ecosystems (forests vs gardens),
- Determine the diversity of pathogens present in human biting ticks at the scale of territories (regions) and ecosystems (forests vs. gardens).

**Preliminary project highlights** —

- *Ixodes ricinus* is the tick species that bites most humans in France
- 30% of the biting ticks analyzed carry at least one pathogen for humans.
- There is a significant geographical variability in the pathogen content of human-biting ticks across regions
- *Borrelia*, the bacterium responsible for Lyme disease, is present in human-biting ticks throughout metropolitan France
- 15% of human biting ticks tested are carriers of *Borrelia*

**Main conclusions including key points of discussion** — There is an infectious risk for humans linked to tick bites in all regions of France. This result has been communicated to the citizens via the CiTIQUE website and shared with the different Ministries concerned by the problem of tick-borne diseases.

**Perspectives** — Further analysis is underway, particularly to better characterize the proximity infectious risk in public parks and private gardens, compared to forest environments.

**Valorization** —

Durand J., Galon C., Lapie C., Carravieri I., Palin B., Vourc'h G., Moutailler S., Brun-Jacob A., Cosson J-F., Frey-Klett P. (2021) Evaluation de l'exposition humaine aux pathogènes transmis par les tiques en France grâce à des données de science participative, GDR Tiques et Maladies à Tiques, On-Line, 22 Mars 2021 (Lyon)

**Leveraging effect of the project** — CARTOPICTIQ is part of the "Zoonotic risk prevention services" action of the Des Hommes et des Arbres project, winner of the "Territoire d'innovation" investment program. This project, led by the Metropolis of Nancy in partnership with the Metropolis of Epinal, brings together more than a hundred players, including INRAE and the Labex ARBRE. CARTOPICTIQ has also had a leverage effect in obtaining fundings of the National Environment-Health-Work Research Program (PNR EST), in partnership with the ANSES rabies and wildlife laboratory in Maxéville.