Pathogen prevalence in ticks parasitizing humans

Rahel Ackermann-Gäumann[1,2], Aurélie Scherler[1*], Werner Tischhauser[3], Silvan Haelg[4], Christian Beuret[4], Sarah Ryter[4], Gilbert Greub[2,5], Onya Opota[2,5], Sébastien Aeby[5], Marie-Lise Tritten[1,2] & Reto Lienhard[1,2]

1. Microbiologie, ADMED Analyses et Diagnostics Médicaux, La Chaux-de-Fonds, Switzerland, 2. Swiss National Reference Centre for Tick-Transmitted Diseases, Switzerland, 3. A&K Strategy GmbH, Winterthur, Switzerland, 4. Spiez Laboratory, Federal Office for Civil Protection, Spiez, Switzerland, 5. Institute of Microbiology, University Hospital Center and University of Lausanne, Lausanne, Switzerland
*Presenting author: aurelie.scherler@ne.ch

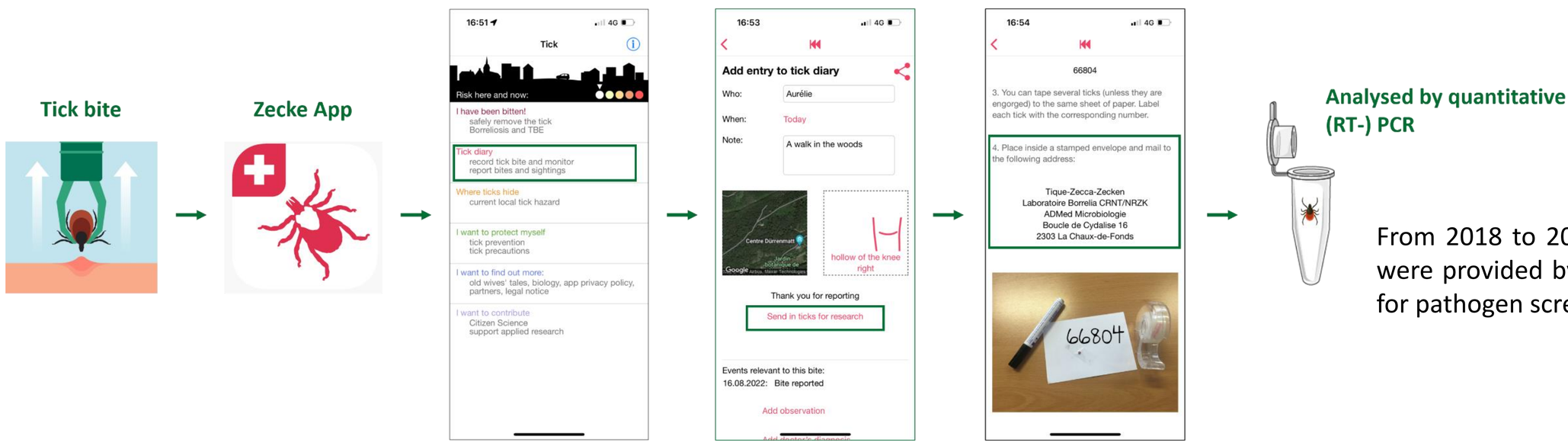
1. Introduction & Aims

Tick-borne diseases represent major public and animal health issues worldwide. In Europe, ***Ixodes ricinus*** is the most frequent tick species and serves as a vector for numerous human pathogens of bacterial, viral, or protozoic origin of medical and veterinary importance[1,2]. Its life-cycle includes three developmental stages: **larvae** hatching from eggs, **nymphs**, and **adult males** or **females**.

To date, only few studies on pathogen prevalence in ticks parasitizing humans have been performed in Switzerland. In this study, we **investigate the prevalence of the following pathogens in *I. ricinus***:

- ***Borrelia burgdorferi* sensu lato**: Causing agent of Lyme Borreliosis, includes 19 *Borrelia* species
- ***Candidatus* Neoerlichia mikurensis**: Only few human diseases cases described with fever, septicemia, malaise or weight loss
- ***Borrelia miyamotoi***: May cause a febrile illness or severe disease in immunocompromised patients
- ***Babesia* spp.**: Flu-like symptoms or hemolytic anemia
- ***Francisella tularensis***: Ulcero-glandular tularemia with localized lymphadenopathy and cutaneous ulcer at infection site
- **Tick-borne encephalitis**: Symptoms ranging from subclinical infections to severe disease including central nervous involvement or death

2. Methods



From 2018 to 2020, **1'254 ticks** were provided by the app users for pathogen screening.

3. Results

1 Pathogen prevalence in different areas of Switzerland

			B. burgdorferi s.l.		*Ca.* N. mikurensis		*B. miyamotoi*		*Babesia spp.*		*F. tularensis*		TBEV	
Regions	Cantons	Ticks	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*
West	GE, VD, NE, FR, VS	186	20.4	38	5.9	11	3.2	6	1.6	3	0	0	0	0
West Central	BE, JU	220	14.1	31	3.6	8	1.4	3	0.9	2	0	0	0	0
East Central	LU, NW, OW, SZ, UR	85	17.6	15	5.9	5	2.4	2	2.4	2	1.2	1	0	0
East	AI, AR, GL, GR, SG, SH, TG, ZG, ZH, (+FL)	440	17.7	78	5.7	25	1.4	6	1.8	8	0	0	0	0
North	AG, BL, BS, SO	204	13.7	28	4.4	9	2.9	6	2.0	4	0	0	0	0
South	TI	99	13.1	13	4.0	4	1.0	1	0.0	0	0	0	0	0
/	No geolocalisation information	20	15	3	0.0	0	0.0	0	5	1	0	0	0	0
	Total	1'254	**16.4**	206	**4.9**	62	**1.9**	24	**1.6**	20	**0.8**	1	**0**	0

2 Pathogen prevalence in the different tick developmental stages

		B. burgdorferi s.l.		*Ca.* N. mikurensis		*B. miyamotoi*		*Babesia* spp.		*F. tularensis*		TBEV	
Stage	Ticks	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*		
Larva	88	4.5	4	1.1	1	1.1	1	1.1	1	0	0	0	0
Nymph	1021	17.1	175	5.4	55	1.9	19	1.7	17	0.1	1	0	0
Adult ♀	119	17.6	21	4.2	5	3.4	4	1.7	2	0	0	0	0
Adult ♂	14	35.7	5	7.1	1	0	0	0	0	0	0	0	0
Unknown	12	8.3	1	0	0	0	0	0	0	0	0	0	0

Infected *I. ricinus* larvae suggest transovarially transmission

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At least one pathogen was found in **20.4%** of all analysed ticks. Carriage of multiple pathogens was observed in **4.3%** of ticks.

4. Conclusions

- Carrier rates in this study are similar to those previously observed in Switzerland[2,3,4,5,6].
- **Absence of TBEV** in analysed ticks might be due to the **low virus prevalence** in Switzerland, between 0 and 0.46% as previously published[1,3], or to the **RNA degradation** during the sample storage.
- Presence of different pathogens in larvae suggests a **transovarially transmission from female tick to larva**[7]. This implies that larval bites on human might cause tick-borne diseases.
- Carriage of multiple pathogens occurs in 4.3% of the ticks suggesting a **possible co-transmission of pathogens to humans**.

5. Perspectives

- Assess the prevalence of other ticks pathogens such as ***Anaplasma phagocytophilum*, *Rickettsia* spp.**
- Investigate transovarially transmission by analysing additional larvae
- Study the impact of altitude on the pathogen prevalence in the collected ticks

References

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