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Molecular screening for *Midichloria* bacteria in hard and soft ticks (Acari: Ixodida).

A. Cafiso^{a, *}, V. Serra^a, O. Plantard^b, C. Bazzocchi^{a, c}^a Department of Veterinary Medicine, University of Milan, Via Celoria 10, 20133 Milan, Italy^b BIOEPAR, INRA, Oniris, Route de Gachet, 44307 Nantes, France^c Joint Research Center for Epidemiology and Molecular Surveillance of Infections, University of Milan, 20133 Milan, Italy**Abstract**

Ticks can harbor complex and highly variable microbial communities. Among these microorganisms, there are important pathogens of humans and animals that can be transmitted through the blood meal. Less is known about the other members of the microbial community of Ixodida, those that do not cause overt diseases. Among these, *Midichloria mitochondrii*, symbiont of the tick *Ixodes ricinus*, is the first described member of the family *Midichloriaceae*, order Rickettsiales. This bacterium is present in 100% females and is vertically transmitted (Sassera, 2008). The possibility of horizontal transmission is suggested by serological and molecular analyses showing positivity of mammalian blood and sera to *M. mitochondrii* (Mariconti, 2012; Bazzocchi, 2013). However, its role is still unknown. Recent reports are expanding the view of this family, now including bacteria of great biological and medical interest, indicating a widespread distribution with an increasing range of hosts, with ticks being strongly represented (Epis, 2008).

Here we present a molecular screening of 17 tick species (for a total of 92 individuals), detecting and quantifying bacteria closely related to *M. mitochondrii* in seven of them, including the first report of a midichloriaceae in a soft tick species, *Ornithodoros maritimus*. Based on sequence identity and phylogenetic analysis we propose that these bacteria could constitute the genus *Midichloria*. The performed screening highlights different prevalence levels in different tick species including one, *Ixodes aulacodi*, where the bacteria is present in all examined individuals, like in *I. ricinus*. This result prompts us to hypothesize different roles of *Midichloria* bacteria in different tick species.

References

- Bazzocchi, C., Mariconti, M., Sassera, D., Rinaldi, L., Martin, E., Cringoli, G., Urbanelli, S., Genchi, C., Bandi, C., Epis, S., 2013. Molecular and serological evidence for the circulation of the tick symbiont *Midichloria* (Rickettsiales: Midichloriaceae) in different mammalian species. *Parasit Vectors* 6, 350–56.
- Epis, S., Sassera, D., Beninati, T., Lo, N., Beati, L., Piesman, J., Rinaldi, L., McCoy, K.D., Torina, A., Sacchi, L., Clementi, E., Genchi, M., Magnino, S., Bandi, C., 2008. *Midichloria mitochondrii* is widespread in hard ticks (Ixodidae) and resides in the mitochondria of phylogenetically diverse species. *Parasitology* 135, 485–94.
- Mariconti, M., Epis, S., Gaibani, P., Valle, C. dalla, Sassera, D., Tomao, P., Fabbi, M., Castelli, F., Marone, P., Sambri, V., Bazzocchi, C., Bandi, C., 2012. Humans parasitized by the hard tick *Ixodes ricinus* are seropositive to *Midichloria mitochondrii*: is *Midichloria* a novel pathogen, or just a marker of tick bite? *Pathogens and Global Health* 106, 391–396.
- Sassera, D., Lo, N., Bouman, E.A., Epis, S., Mortarino, M., Bandi, C., 2008. “*Candidatus Midichloria*” endosymbionts bloom after the blood meal of the host, the hard tick *Ixodes ricinus*. *Appl Environ Microbiol* 74, 6138–40.