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# Hyperparasitism in the seabird tick *Ornithodoros amblus* (Acari: Argasidae)

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Hyperparasitism is displayed by argasid (Argasidae) and less frequently ixodid (Ixodidae) ticks and occurs when engorged ticks are parasitized by conspecifics in order to obtain a bloodmeal (Moorhouse & Heath 1975; Ntiamoa-Baidu 1986; Labruna *et al*. 2007). This behaviour has been described in eight species of *Ornithodoros* ticks namely *Ornithodoros erraticus* (Helmy *et al*. 1983), *Ornithodoros hermsi* (Williamson & Schwan 2018), *Ornithodoros verrucosus* (Skrynnik 1939), *Ornithodoros parkeri* (Davis 1941), *Ornithodoros puertoricensis* (Endris *et al*. 1991), *Ornithodoros tartakovskyi* (Londoño 1976), *Ornithodoros tholozani* (Bhat 1969), and *Ornithodoros turicata* (Beck *et al*. 1986).

The tick *Ornithodoros amblus* inhabits Pacific Ocean shores of Peru and northern Chile, and sustains its life cycle parasitizing seabird, such as *Larus* sp., *Pelecanus thagus*, *Phalacrocorax bougainvilliorum*, *Phalacrocorax gaimardi*, *Spheniscus humboldti, Sula neuboxi,* and *Sula variegata* (Clifford *et al*. 1980). While feeding behaviour of this tick has never been observed *in situ*, laboratory results point that adults engorge in 20–145 min on avian hosts (Khalil & Hoogstraal 1981). As hyperparasitism events have never been documented in *O. amblus*, the objective of this study was to report a related case for this species.

During January and February of 2005, 472 adult ticks were collected in the Pan de Azúcar National Park, Chile (26° 9'27.17"S, 70°41'7.63"W). All ticks were taken from the soil underneath rocks near *S. humboldti* nests. In the laboratory, 265 females and 207 males were identified as *O. amblus* following Clifford *et al*. (1980). In order to perform observations on developmental traits (results not described in the current study), females were allowed to feed in *Gallus gallus* for obtaining subsequent ovipositions. To ensure fertilization, 36 couples composed by laboratory-engorged females and males with different engorgement degrees were placed in plastic vials inside a dark incubator at 24ºC and 75% of relative humidity. Daily checks after the disposition of couples inside the incubator were performed to determine the day of oviposition. Twenty-two days after, a male was observed attached on the anterior dorsal idiosoma of a fully engorged female (Figure 1A). The removing of the male with tweezers resulted into a bleeding wound that clotted seconds after, leaving a dark scar on the dorsum of the female (Figure 1B). The male was placed with the female again. Minutes later, another event of hyperparasitism was observed, but this time the male attached itself to the posterior region of the idiosoma (Figure 1C). The parasitized female and the male were then prepared for scanning electron microscopy. Micrographs showed that the cuticle of the female regenerated after the first event of hyperparasitism without a mammillated pattern, resulting into a marked scar (Figure 1D). Engorged male (Figure 1E) and female examined in the current study were deposited in the tick collection "Colección del Departamento de Ciencia Animal (CDCA)" of the Facultad de Ciencias Veterinarias, Universidad de Concepción, Chile, under the following accession number Or.am.CDCA-54.3 and Or.am.CDCA-54.4.

This is the first case of hyperparasitism reported for *O. amblus* and the ninth event of this nature documented in ticks of the *Ornithodoros* genus. Moorhouse (1966) and Ntiamoa-Baidu (1986) suggested that hyperparasitism in ticks may play a significant role in their life cycle as an alternative feeding strategy. However, it is also possible that this behaviour rose in some ticks as a consequence of enduring long periods of starvation rather than a specific adaptation to increase survivability (Gray *et al*. 2013). For example, in *O. erraticus* this hypothesis seems to be supported by the fact that part of unfed ticks maintained under laboratory conditions parasitize on well-engorged ticks (Helmy *et al*. 1983). Particularly, it is possible that hyperparasitism in *O. amblus* could represent an opportunistic strategy to maximize it life span during starving periods when seabirds are away from their colonies.

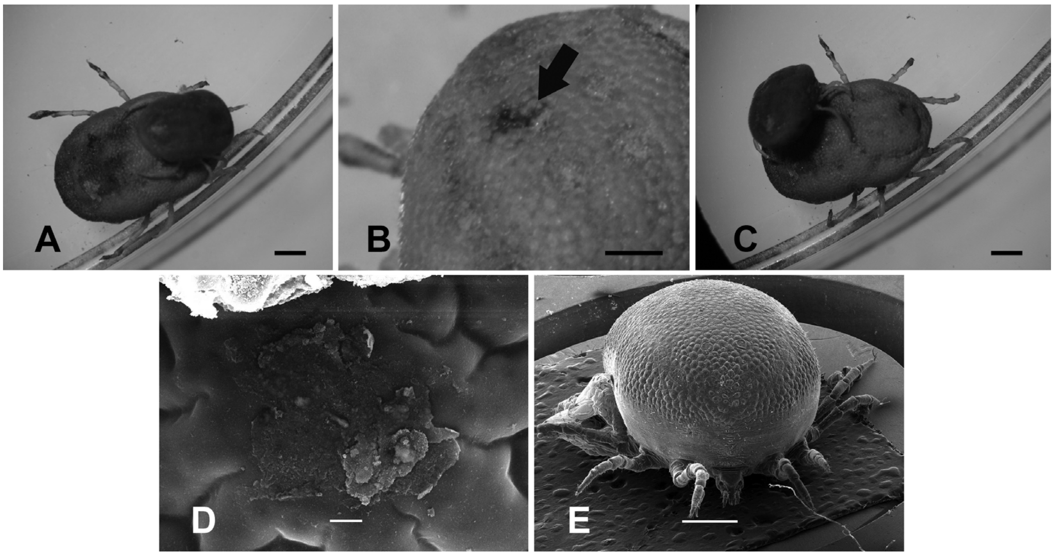


**FIGURE 1.** Events of hyperparastism observed under light microscopy and scanning electron micrographs of the parasitized female. A. *Ornithodoros amblus* male attached to the anterior dorsal idiosoma of a conspecific engorged female. B. View of the dark-colored scar on the female's dorsum (arrowed) after manually detaching the male. C. Second event of hyperparastism on the same female tick. D. Scanning electron micrograph of the scar on female's dorsum after the first episode of hyperparasitism. E. Scanning electron micrograph showing the engorged male of *O. amblus* observed in this study. Dark bar = 1 mm, white bar = 1 mm.

On the other hand, hyperparasitism has been suggested as an alternative mechanism for transmission of microorganisms between ticks (Labruna *et al*. 2007). In the case of *Ornithodoros* spp., laboratory tick-to-tick transmission has been observed even while ticks are on the host (*i.e.*, *O. erraticus*, Helmy *et al.* 1983), which could increase pathogen dissemination between conspecific ticks. This fact was further supported by Williamson and Schwan (2018), who demonstrated that events of hyperparasitism in *O. hermsi* resulted in the transmission of *Borrelia hermsi* between adult and nymphal stages. Noteworthy, some populations of *O. amblus* have been described to harbor *Orbivirus*, *Nairovirus*, and *Coxiella*-like endosymbionts (Clifford *et al*. 1980, Hoogstraal 1985, Duron *et al*. 2015). Whether it is reasonable to suggest that hyperparasitism would represent a transmission route for these agents in *O. amblus*, this hypothesis still remains unsolved for this tick species and requires further assessment.

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## References

Beck A.F., Holscher K.H. & Butler J.F. (1986) Life cycle of *Ornithodoros turicata americanus* (Acari: Argasidae) in the laboratory. *Journal of Medical Entomolology*, 23, 313–319.
https://doi.org/10.1093/jmedent/23.3.313

Bhat V.K.M. (1969) Parasitism of males of *Ornithodoros* (*Pavlovskyella*) *tholozani* var. *crossi* (Laboulene & Megnin 1882) Argasidae: Ixodoidea, on fed nymphs and females of the same species. *Journal of the Bombay Natural History Society*, 66, 401–403.

Clifford C.M., Hoogstraal H., Radovsky F.J., Stiller D. & Keirans J.E. (1980) *Ornithodoros* (*Alectorobius*) *amblus* (Acarina: Ixodoidea: Argasidae): Identity, marine bird and human Hosts, virus infections, and distribution in Peru. *Journal of Parasitolology*, 66, 312–323.
https://doi.org/10.2307/3280825

Davis G.E. (1941) *Ornithodoros parkeri* Cooley: Observations on the biology of this tick. *Journal of Parasitology*, 27, 425–433.
https://doi.org/10.2307/3272629

Duron O., Noël V., Mccoy K.D., Bonazzi M., Sidi-Boumedine K., Morel O., Vavre F., Zenner L., Jourdain E., Durand P., Arnathau C., Renaud F., Trape J.F., Biguezoton A.S., Cremaschi J., Dietrich M., Léger E., Appelgren A., Dupraz M., Gómez-Díaz E., Diatta G., Dayo GK., Adakal H., Zoungrana S., Vial L. & Chevillon C. (2015) The recent evolution of a maternally-inherited endosymbiont of ticks led to the emergence of the Q fever pathogen, *Coxiella burnetii*. *PLoS Pathogens*, 11, e1004892.
https://doi.org/10.1371/journal.ppat.1004892

Endris R.G., Haslett T.M., Monahan M.J. & Phillips J.G. (1991) Laboratory biology of *Ornithodoros* (*Alectorobius*) *puertoricensis* (Acari: Argasidae). *Journal of Medical Entomology*, 28, 49–62.
https://doi.org/10.1093/jmedent/28.1.49

Gray J., Estrada-Peña A. & Vial L. (2013) Ecology of nidicolous ticks. *In*: Sonenshine, D.E. & Roe, R.M. (eds) *The Biology of Ticks 2nd edition*. New York, Oxford University Press, pp. 49–50.

Helmy N., Khalil G. & Hoogstraal H (1983) Hyperparasitism in *Ornithodoros erraticus*. *Journal of Parasitology*, 69, 229–233.
https://doi.org/10.2307/3281305

Hoogstraal H. (1985) Argasid and nuttalliellid ticks as parasites and vectors. *Advances in Parasitology*, 24, 135–238.
https://doi.org/10.1016/S0065-308X(08)60563-1

Khalil G. & Hoogstraal H. (1981) The life cycle of *Ornithodoros* (*Alectorobius*) *amblus* (Acari: Ixodoidea: Argasidae) in the laboratory. *Journal of Medical Entomology*, 18, 134–139.
https://doi.org/10.1093/jmedent/18.2.134

Labruna M.B., Ahid S.M.M., Soares H.S. & Suassuna A.C.D. (2007) Hyperparasitism in *Amblyomma rotundatum* (Acari: Ixodidae). *Journal of Parasitology*, 93, 1531–1532.
https://doi.org/10.1645/GE-1277.1

Londoño I.M. (1976) Transmission of Microfilariae and infective larvae of *Dipetalonema viteae* (Filarioidea) among vector ticks, *Ornithodoros tartakowskyi (*Argasidae), and loss of Microfilariae in coxal fluid. *Journal of Parasitology*, 62, 786–788.

Moorhouse D.E. (1966) Observations on copulation in *Ixodes holocyclus* Neumann and the feeding of the male. *Journal of Medical Entomology*, 3, 168–171.
https://doi.org/10.1093/jmedent/3.2.168

Moorhouse D.E. & Heath A.C.G. (1975) Parasitism of female ticks by males of the genus *Ixodes*. *Journal of Medical Entomology*, 12, 571–572.
https://doi.org/10.1093/jmedent/12.5.571

Ntiamoa-Baidu Y. (1986) Parasitism of female *Ixodes* (*Afrixodes*) *moreli* (Acari: Ixodidae) by males. *Journal of Medical Entomology*, 23, 484–488.
https://doi.org/10.1093/jmedent/23.5.484

Skrynnik A.N. (1939) On the biology of the tick *Ornithodorus verrucosus* (In Russian). *Trudy Voenno-Meditsinskoi Akademii Krasnoi Armii Imeni S.M. Kirova*, 18, 43–50.

Williamson B.N. & Schwan T.G. (2018) Conspecific hyperparasitism: An alternative route for *Borrelia hermsii* transmission by the tick *Ornithodoros hermsi*. *Ticks and Tick Borne Diseases*, 9, 334–339.
https://doi.org/10.1016/j.ttbdis.2017.11.009

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