Faculty of Science
Entomology Department

Tick-*Borrelia* interaction during reproduction of *Ornithodoros erraticus*, a vector of relapsing fever in Egypt

A Thesis
Submitted for the degree of Ph.D. in Entomology

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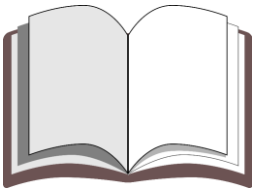

ABSTRACT

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Laboratory reared females of *Ornithodoros erraticus* with high infection rates (95 – 100%) and well defined interrelationships with *Borrelia crocidurae* were used to study effects of borrelial infection on reproduction and involved proteins, in the female tick. Also, dynamics of the spirochaetes in the ovary and associated effects on histology of the ovary and oocyte development were investigated.

Borrelia crocidurae infection affected reproduction of mated engorged female *O. erraticus* by reducing the number of the mean daily egg output and of total laid eggs/oviposition/female (egg production and fecundity) and percent egg hatching and by prolonging the incubation period of the oviposited eggs (egg viability and female fertility).

Changes in the haemolymph and ovaries total protein concentration of mated females uninfected and infected with *Borrelia crocidurae* followed almost the same pattern. However, borrelial infection reduced the level of haemolymph and ovaries total protein during most of the preoviposition period (3 – 9 d.a.f). Also the weight of ovary and number of mature oocytes were lower in the infected than uninfected females on the 5^{th} - 9^{th} and 3^{rd} -9^{th} d.a.f, respectively. Freshly deposited eggs of the infected females had lower total protein concentration than eggs deposited by the uninfected females.

Infection of female *O. erraticus* with *B. crocidurae* reduced the total number and changed the sum of percent concentrations (%amounts) of egg vitellins and vitellogenic protein fractions in the haemolymph (vitellogenins) and ovary (vitellins). The total numbers were reduced from 15 to 9 egg vitellins, 63 to 52 ovary vitellins and 30 to 23 haemolymph vitellogenins in the uninfected and infected ticks. The reduction of the sum of % amounts of vitellogenic fractions was most obvious in the haemolymph and ovary during vitellogenesis (3 – 9 d.a.f).

The reduction in numbers of egg vitellins (EVts) resulted mainly from disappearance of 4 EVts with relatively high MWts, one endogenous EVt of 309.83 and 3 exogenous EVts of 247.76, 192.59 and 137.41 kDa, respectively. However, the existing nine EVts in the egg of the infected female were electrophoretically more or less similar to the corresponding counterparts EVts in the uninfected female. Disappearance of the large endogenous EVt was probably to failure of its synthesis and mainly to disappearance of its Vgs and Vts corresponding counterparts in the haemolymph and ovary of the infected female. However, disappearance of the 3 large exogenous EVts might be attributed to impaired uptake of their existing corresponding haemolymph Vgs, by the ovary, consequently some may accumulate in haemolymph and their corresponding vitellins in the ovary and the egg disappeared in the infected female.

Histological examination of the infected female ovary revealed the five developmental stages of of oocytes as normal. However, *Borrelia* spirochaetes were detected in

the pedicel cells at the points of contact with the oocytes and in the ovarian lumen and outside the ovary adhering to the ovarian epithelium. *Borrelia* spirochaetes were also found penetrating the oocytes and yolk spherules. Also, a reduction of the thickness and disappearance of the chorion were occasionally observed.