FECUNDITY AND VIABILITY OF SPERM CELLS
OF ORNITHODOROS TICKS

BY

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Copulation in ticks has been studied and described by several authors. The main lines were clarified by Nuttall and Meriman (1911), by Robinson (1942), and by Wagner-Jevseenko (1958). But these authors disagree — and for good reasons — among themselves with respect to some details. It is true that my present communication is not directly concerned with the behavioural aspects of copulation. Nevertheless, I would like to summarise, in a few words, the main points of this most interesting process, although it may be well known to most of you. This will make it easier to understand some of the results of our experiments on fecundity and viability of sperm cells.

At the onset of copulation the male climbs on the back of the female, then he crawls beneath her and folds his legs with those of the female, first pair of male with first pair of female and so on. He then introduces his capitulum into the female genital opening. After 2-3 minutes the male protrudes from his genital opening a spermatophore. He then grasps the spermatophore with the digits of his chelicerae and deposits it on the female genital aperture. Very soon afterwards the contents of the spermatophore is pushed into the female uterus. The empty spermatophore remains attached to the female genital aperture and looks then like a flat bulb. This bulb may remain there for several hours of days.

Immediately after copulation, the uterus contains two capsules full of sperm cells, which are attached one to the other. These capsules eventually separate one from the other, the time of separation depending

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probably on mechanical pressure such as that exerted by subsequent copulations or extention of the caeca by blood. The capsules remain in the uterus full, half full, or empty for months or years, and the number of capsules (divided by two) found in the uterus shows the number of times the female has copulated.

**Copulation**

Both male and female *Ornithodoros* ticks may copulate fed as well as unfed. The male *O. tholozani*, will generally begin to copulate on the fourth day of his life but may sometimes do so on his first day, independently of being starved or fed.

In our experiments with males of *O. tholozani* specimens which were never permitted to feed during their life copulated, on the average, 12 times during their life (the maximum was 21 times). Males of *O. savignyi* are sexually even more active. Starved males of *O. savignyi* copulated, on the average, 18 times (with a maximum of 32).

In order to compare the eagerness of the male to feed and to copulate, we offered to 35 males of *O. tholozani* alternatingly, a host during the day and a mate during the night; 8 out of these 35 copulated before feeding.

But, fed or unfed, the male prefers to copulate with a fed female, although he will copulate with an unfed too. In our experiments, 19 males copulated 44 times with unfed females, but 8 males refused to copulate with unfed females although kept with them for as long as from 9 to 43 days. These males copulated immediately when the unfed female was replaced by a fed one.

Thus females of *Ornithodoros* ticks may copulate before or after their first meal. But if they are fecundated before their first meal they generally start to oviposit only after a feed. In *O. tholozani* they may oviposit exceptionally without a feed. But in general they start ovipositing only after having both copulated and fed, independently of the order.

**Oviposition**

It is accepted by acarologists that females of the genus *Ornithodoros* need a new feed and a new copulation after each oviposition to be able to oviposit again. This is true for *O. tholozani*. Females of this species generally need a new copulation after each oviposition although c. 20% of the females will lay a second batch of eggs after a second feed, without copulating a new. Females which had a second feed, and did not lay
a second batch of eggs were dissected and their genital tract examined; these females contain nevertheless a huge number of viable looking spermiophores in the sperm capsules; but as a matter of fact these spermiophores are not capable to trigger another oviposition.

On the other hand, females of *O. savignyi* lay 4-7 batches of eggs after one mating, if fed a new after each oviposition.

A female of *O. savignyi* was observed to oviposit up to 500 days after copulation. She laid during this time 7 batches of eggs, the last batch was laid after the seventh meal, 500 days after copulation. The percentage of viable eggs decreases with time after copulation and with number of consecutive ovipositions. Out of eggs laid c. 250 days after copulation, on the average only 50% hatch, but in some females 90% of eggs laid after such a delay, yield larvae. Some females may lay eggs up to 500 days after copulation, but such eggs are not viable. This raises the question whether the sperm cells were still viable and the eggs in question were fecundated, or whether oviposition was triggered by another mechanism.

**Viability of sperm cells**

The viability of spermiophores can most conclusively be determined by examining the percentage of eggs from which larvae ultimately hatch.

If a starved female copulates, but feeds only many months later, spermiophores remain alive within the uterus for this lapse of time. Females of *O. tholozani*, which were fed for the first time of their life 6 months after copulation, laid 90% viable eggs after this meal.

The viability of the spermiophores can also be checked by dissecting the females and examining the spermiophores under the microscope. In our experiments, we found in dissected females of *O. savignyi* viable spermiophores in the sperm capsules up to 11 months after copulation, while females of *O. tholozani* showed normal spermiophores up to 6 months after copulation; spermiophores may remain alive longer, but the maximum life span has not yet been determined. There is, however, no doubt that spermiophores of *O. savignyi* show a higher viability, i.e., retain their power to fecundate, longer than those of *O. tholozani*.

Pattern of fertilization and triggers of oviposition seem to be different in the two studied species of *Ornithodoros*. On one hand, females of *O. tholozani* lay mainly one batch of eggs although a large number of viable spermiophores are still present in the sperm capsules. On the other hand, females of *O. savignyi* may lay 7 batches of eggs up to 500 days after copulation, although spermiophores found in the genital tract of such females do not seem to be viable. These experiments are
still going on, and we have examined up to now spermiophores of *O. savignyi* only 1 year after copulation. After that time the sperm capsules contain still a huge number of spermiophores; some are alive and some dead.

**PŁODNOŚĆ I ŻYWOTNOŚĆ PLEMNIKÓW KLESZCZY Z RODZAJU ORNITHODOROS**

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