CORRELATIONS BETWEEN SOME BIOLOGICAL CHARACTERISTICS OF *HAEMAPHYSALIS PUNCTATA* TICK IN NATURAL CONDITIONS

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Introduction

Reproduction in ticks is not only important for the maintenance of tick populations, but also assumes a serious economic and medical significance in relation to tick transmitted diseases *[8]*. After feeding, engorged females drop off the environment, lay eggs and then die *[5, 6, 8]*. Lack of humidity or temperature variation can kill the eggs. In winter, in temperate areas, the eggs go in quiescent. Generally, the length of embryogenesis is 20-50 days *[3]*.

Materials and methods

The *Haemaphysalis punctata* females were collected from naturally infected sheep. The collection was made in April 2004. The samples of engorged females were chosen through drawing of lots from all the collected ticks; there were selected 12 females. After the samples and identification according to morphological features using the determination keys of Feider (1965) *[7]* and Babos (1964) *[1]*, females were weighed with the analytic balance and were put in test tubes prepared according to Metianu method *[2]*. During the entire period of experiment the test tubes were kept outside the room under the direct action of climatic factors. The test tubes were placed on the ground, under different bushes in order not to be exposed to direct action of sun rises. The temperature was daily registered, on the soil level, at 9 a.m. and 17 p.m., with the minimum and maximum thermometer and the average was made. The relative humidity, at the same hours, was registered, daily.

The biological parameters we had in view were: the engorged females weight, eggs weight, number of eggs, preoviposition period, oviposition period, incubation period, the conversion efficiency index (CEI) and reproductive efficiency index (REI) in natural conditions.

The CEI and REI were calculated for each female. The conversion efficiency index (CEI; Drummond and Whetstone, 1970) *[4]* was used to evaluate the efficacy of a female at converting body weight to egg weight. CEI = (weight of eggs/weight of female) x 100. REI = number of eggs/weight female.

Data were processed with Microsoft Excel, the statistical analysis was carried-oat using SPSS 75 application, procedures to obtain correlations, regressions and ANOVA in order to determine, the temperature and relative humidity effects on some biological parameters of *Haemaphysalis punctata* species.

Results and discussion

The weight of engorged females was between 0,135 and 0,437 g with a mean value of 0,316±2,51g. Females were kept in individual test tubes in order to determine preoviposition, oviposition and incubation periods in extern environment. The correlation between the weight of females and eggs weight was significant (*r = +0,915 at P<0,01).* There is also a positive correlation between the number of eggs laid by each female and their weight (*r = +0,875 at P<0,01).*

The females weight explains 83,81% ($R^2 = 0,8381$) of the variability of eggs weight, the value of multiple correlation coefficient sustaining this statement (see figure 1).

The regression analysis of eggs weight depending on the female's weight has the following equation (1): *Weight eggs/female = -3,67x10^{-2} +weight females (g) x 0,657*

There were found significant statistic associations between females weight and the number of eggs *F = 51,78, P<0,001.*

Therewith, females weight explains 76,62 ($R^2 = 0,7662$) of the variability of the number of eggs laid by females, the coefficient value of multiple correlations sustaining this statement (see figure 2).

The number of eggs regression, depending on the female's weight, has the following equation (2): *Number of eggs/females = -0,1585 + weight females (g) x 16250*

Between the females weight and number of eggs were found significant statistic associations *F = 32,77, P< 0,001.*

The number of eggs laid by *Haemaphysalis punctata* females varied between 947 and 5900 with an average of 3550±466,77 when the temperature value fluctuated between 6^{o}C minimum and 34^{o}C maximum and relative humidity recoded values to 74-100%. Preoviposition length was 13-25 days with a mean value of 18,83±1,06. The oviposition length was 19-55 days, mean value of 43,66±2,72. Incubation period extended to 38 and 59 days, the mean value was 51,41±2,27.

CEI was 34,73-69-43, mean 52,76±2,85. Regarding, REI the minimum value was 5975 and the maximum 15915 with a mean of 10725±878,78.

In this work correlation between the minimum and maximum temperature, relative humidity and the duration of preoviposition, oviposition and incubation of eggs were not found. This does not mean that there were no correlations and these biologically constants are not influenced by temperature and humidity. One explication would be that the sample was not sufficiently large and the second explanation that there were daily temperature and humidity, variations sometimes even significant variations. Ticks were exposed directly under the action of the environment factors, not in laboratory, at constant temperature and humidity values. In this experiment it was observed that females begin to lay eggs during the night then they go on during the whole nychthemera, however more intensely during the scotphase. We observed that temperature from soil level is with 1^{o}C lower then air temperature at the same hour. This must not be neglected knowing that the period of preoviposition, oviposition and incubation of eggs depends on temperature, more exactly on soil temperature, where these phenomena take place, and on humidity.

Figure1
Linear regression analysis of *Haemaphysalis punctata* of weight females and eggs weight

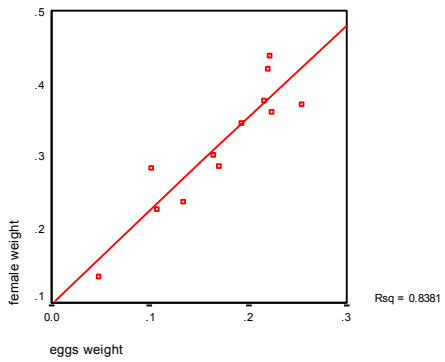


Figure 2
Linear regression analysis of *Haemaphysalis punctata* of weight females and number of eggs

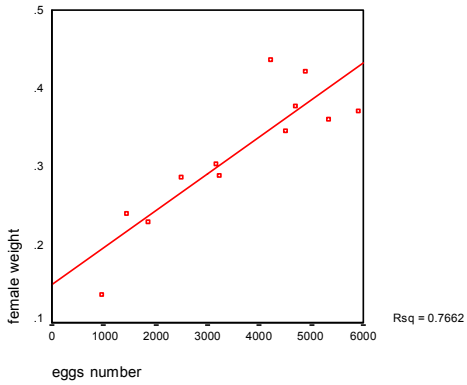
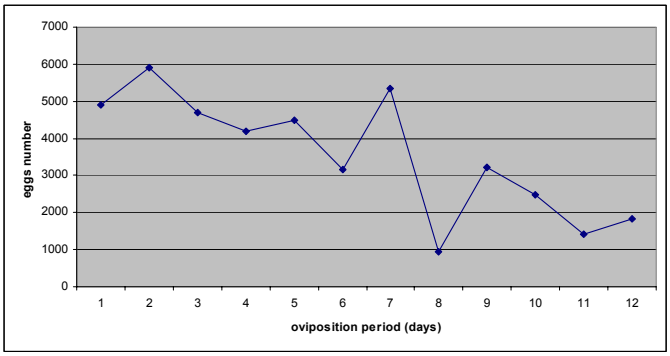


Figure 3. Dynamics oviposition *Haemaphysalis punctata* in natural conditions



Conclusions

-At *Haemaphysalis punctata* there are significant correlations (*P<0,01)* between the engorged females weight, eggs weight and number of eggs; these correlations were observed by other

authors, too; -In natural conditions of temperature and relative humidity the preoviposition period was 13-25 days (mean 18,83±1,06 days), the oviposition was 19-55 days (mean 43,66±2,72 days) and the incubation period was 38-59 days (mean 52,51±2,27 days); -The values of the conversion efficiency index (CEI) were 34,73-68,43% (mean 52,76±2,85%) and reproductive efficiency index (REI) were 5975-15915 (mean 10725±878,78); -It was observed that temperature from soil level was 1^{o}C degree lower than air temperature at 1,5 meter high which is very important for the ixodide biology; -The preoviposition, oviposition and the incubation periods were not correlated to temperature and relative humidity.

References

1. *Babos, S., 1964. Die Zeckenfauna Mitteleuropas. Akademiai Kiado, Budapest.*
2. *Cernăianu, C. C., 1957. Piroplasme şi piroplasmoze. Vol. I, Ed. Acad. RPR.*
3. *Chartier, C., Itard, J., Morel, P. C., Troncy, P. M., 2000. Précis de parasitologie vétérinaire tropicale. Ed. TEC&DOC Paris.*
4. *Drummond, R. O., Whetstone, T. M., 1970. Oviposition of the Gulf Coast tick. J. Econ. Entomol. 62, 934-936.*
5. *Guetard, M., 2001. Ixodes ricinus: morphologie, biologie élevage, données bibliographique. Thèse dr. vet. ENV Toulouse.*
6. *Jongejan, F., Uilenberg, G., 1994. Ticks and control methods. Rev. Sci. tech. Off. Int. Epiz., 13 (4), 1201-1226.*
7. *Feider, Z., 1965. Fauna RPR. Arachnida. Vol., 2, Ed. Acad.RPR*
8. *Mehlhorn, H., 2001. Encyclopedic reference of parasitology. Sec. edition Springer-Berlin, Heidelberg.*