

ARTIFICIAL PARTHENOGENESIS IN TICKS.

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THE occurrence of parthenogenesis in ticks was referred to by me in a preliminary note (*Parasitology*, VI. pp. 139–140), wherein it was stated that I had observed it in *Rhipicephalus bursa* under experimental conditions. The following protocols relate to two attempts to raise the parthenogenetic offspring of several females. In both experiments the fed females and eggs were maintained at 30° C. until the females had died and the larvae had been given ample time (97–104 days) in which to emerge from the eggs. We failed, however, to raise the offspring beyond the larval stage.

Experiment 1.

Wherein 20 ♀s (1st generation) were placed upon a ram on 18. II. 1913. Only 1 ♀ was lost.

♀ No.	No. of days ♀ stayed on host	Date when ♀ dropped off host	No. of days before ovipos. began	No. of days oviposition lasted	No. of days ♀ survived after ovipos.	No. of eggs laid per ♀	No. of days larvae emerged after	No. of larvae which emerged	No. of days sterile ♀s lived after dropping from host
1	25	15. III. 1913	5	17	33	1990	—	0	—
2	25	"	4	15	21	1680	18	2	—
3	30	20. III.	5	14	29	2160	12	10	—
4	52	11. IV.	—	—	—	0	—	—	3
5	54	13. IV.	9	10	14	1008	9	1	—
6	57	16. IV.	—	—	—	0	—	—	42
7	57	"	—	—	—	0	—	—	27
8	57	"	9	11	13	+s	—	0	—
9	57	"	8	9	9	+s	—	0	—
10	57	"	—	—	—	0	—	—	70
11	57	"	—	—	—	0	—	—	3
12	57	"	—	—	—	0	—	—	42
13	69	28. IV.	—	—	—	0	—	—	42
14	69	"	—	—	—	0	—	—	36
15	69	"	—	—	—	0	—	—	33
16	80	9. V.	—	—	—	0	—	—	36
17	84	13. V.	—	—	—	0	—	—	49
18	90	19. V.	—	—	—	0	—	—	38
19	91	20. V.	—	—	—	0	—	—	16

+s denotes that an undetermined number of eggs were laid which subsequently shrivelled up.

The 10 larvae, progeny of ♀ 3, were placed on a ram 31 days after they emerged, but none of them were recovered.

None of the 19 unfertilized ♀s became as fully gorged as did fertilized ♀s; their bodies were *all flattened* dorso-ventrally when they abandoned the host. In only 4 ♀s (Nos. 1, 2, 3, 6) did the length × width approach that of fertilized fully gorged ♀s. The measurements of 12 such ♀s are appended in the following table for comparison. The two sets of measurements do not show the main difference which is in the dorso-ventral direction.

Size attained by 19 unfertilized and by 12 fertilized ♀s, the latter chosen at random from a large stock:

Unfertilized ♀s.			Fertilized ♀s.		
♀ No.	Length × breadth in mm.	No. of days ♀ fed on host	♀ No.	Length × breadth in mm.	No. of days ♀ fed on host
4	6.5 × 4.0	52 days	1	13.5 × 9.0	4-12 days
15	7.5 × 5	69 "	2	14.5 × 9	"
19	8.5 × 5	91 "	3	14.5 × 9.5	"
12, 14	9.5 × 6	57, 69 days	4	15.0 × 10	"
11, 17, 18	10 × 6	57, 84, 90 days	5	15.0 × 10	"
10, 13, 16	11 × 7	57, 69, 80 "	6	15.0 × 10	"
9	11.5 × 8	57 days, oviposited	7	15.0 × 11	"
7, 8	12 × 8	57, 57 days, one oviposited	8	15.5 × 10	"
5	12 × 8.5	54 days, oviposited	9	16.0 × 10	"
6	13 × 8	57 days	10	16.0 × 10	"
1, 3	13 × 9	25, 30 days, both oviposited	11	16.0 × 10	"
2	15 × 10	25 days, oviposited	12	17.0 × 11.5	"

It appears from the foregoing table, that unfertilized ♀s require to reach a certain size in respect to engorgement before they will in most cases lay any eggs. The length of stay on the host exerts no influence; the essential factor is the amount of blood which the tick has succeeded in imbibing.

Experiment 2.

Wherein 65 ♀s were placed on a ram on 8. VII. 1913; 15 ♀s were lost.

♀ No.	No. of days ♀ stayed on host.	Date when ♀ dropped off host.	No. of days before ovipos. began	No. of days ovi- position lasted	No. of days ♀ survived after ovipos.	No. of eggs laid per ♀	No. of days larvae emerged after	No. of larvae which emerged	No. of days sterile ♀s lived after dropping from host
1	15	23. VII. 1913	3	14	1	4-30	29	64	—
2	34	11. VIII.	—	—	—	0	—	—	17
3	36	13. VIII.	5	14	1	+s	—	0	—
4	38	15. VIII.	4	13	2	2340	30	51	—
5	"	"	4	8	1	+s	—	0	—
6	"	"	8	14	8	+s	—	0	—
7	"	"	8	11	9	+s	—	0	—
8	"	"	8	9	9	+s	—	0	—
9	"	"	—	—	—	0	—	—	23
10	"	"	10	9	5	+s	—	0	—
11	"	"	5	10	27	676	29	90	—
12	"	"	—	—	—	0	—	—	60
13	"	"	10	12	4	+s	—	0	—
14	"	"	8	11	9	+s	—	0	—
15	"	"	—	—	—	0	—	—	85
16	"	"	12	5	22	+s	—	0	—
17	"	"	17	7	1	+s	—	0	—
18	"	"	6	9	24	+s	—	0	—
19	"	"	8	14	17	500s	—	0	—
20	"	"	8	14	17	+s	—	0	—
21	"	"	10	14	15	+s	—	0	—
22	"	"	10	7	10	+s	—	0	—
23	"	"	12	10	17	+s	—	0	—
24	"	"	12	5	7	100s	—	0	—
25	"	"	13	11	8	+s	—	0	—
26	"	"	13	5	15	12s	—	0	—
27	"	"	15	10	7	+s	—	0	—
28	"	"	19	8	7	+s	—	0	—
29	"	"	—	—	—	0	—	—	62
30	"	"	—	—	—	0	—	—	71
31	"	"	—	—	—	0	—	—	71
32	"	"	—	—	—	0	—	—	72
33	"	"	—	—	—	0	—	—	ca. 73
34	"	"	—	—	—	0	—	—	"
35	"	"	—	—	—	0	—	—	"
36	"	"	—	—	—	0	—	—	"
37	"	"	—	—	—	0	—	—	"
38	"	"	—	—	—	0	—	—	"
39	"	"	—	—	—	0	—	—	"
40	"	"	—	—	—	0	—	—	"

The 's' in the seventh column denotes that the eggs shrivelled up; the + sign denotes that the eggs laid were not enumerated in these cases.

The 64 larvae, progeny of ♀ 1, were placed on a ram 23 days after they emerged, and the 90 larvae, progeny of ♀ 11, were placed on a ram 60 days after they emerged, but in neither case were any recovered gorged.

These observations show a marked contrast in the behaviour of fertilized and unfertilized females. Whereas all females placed with males upon the host dropped off gorged in 4–12 days (minimum and maximum periods), females in the absence of males remained upon the host for 15–38 days (Experiment 2) or 25–91 days (Experiment 1). Even after this long period of feeding, none of the unfertilized females became nearly as fully gorged as those which had been fertilized. Owing to the different temperature conditions under which the unfertilized and fertilized females were maintained (30° and 18–24° C. respectively), the duration of the pre-oviposition and oviposition periods cannot be compared. In the unfertilized females, all of which were maintained at 30° C., oviposition began after 4–9 days (Experiment 1) or 3–19 days (Experiment 2), the process lasting 9–17 days (Experiment 1) or 5–14 days (Experiment 2); the period of egg-laying might be equally shortened in fertilized females maintained at 30° C. Whereas 10 fertilized females laid roundly 4960–6890 eggs apiece, the 10 unfertilized females in our two experiments laid respectively 12, 100, 500, 676, 1008, 1680, 1990, 2160, 2340, and 4830 eggs apiece. Whilst only 2 out of 29 females to which males had had access died without ovipositing, of the unfertilized females there died 13 out of 19 (in Experiment 1) and 16 out of 40 (in Experiment 2) without ovipositing.

In my short note on parthenogenesis in ticks, to which reference has been made, it was stated that it was observed in *R. bursa*. I laboured under the impression that it was a normal though perhaps rare occurrence, but I am now convinced, as a result of repeating the experiment, that *the parthenogenesis observed was artificially induced by the manipulations accompanying the enumeration of the eggs*.

The method devised by me for enumerating the eggs laid by ticks is described in Part I (*Parasitology*, vi, pp. 73–74): “When enumerating by this method, we separate the eggs composing the mass by *immersing them in normal salt solution and rubbing them about gently* with the aid of a camel’s hair brush”...etc. (not italicised in the original).

In the protocol of Experiment 1 it is stated that the eggs of four unfertilized ♀s were enumerated, and that the larvae emerged from three out of the four batches of eggs as follows:

Out of 1990 eggs there emerged	0 larvae
1680	2
2160	10
1008	1
—	—
Totals 6838	13

Three ticks laid eggs which were not enumerated and from which no larvae emerged.

In the protocol of Experiment 2, it is stated that the eggs of six unfertilized ♀s were counted, and that larvae emerged from three out of six batches of eggs as follows:

Out of 4830 eggs there emerged	64 larvae
2340	51
676	90
500	0
100	0
12	0
—	—
Totals 8458	205

Eighteen ticks laid eggs which were not enumerated and from which no larvae issued.

Therefore out of a total of 15,296 enumerated eggs there issued 218 larvae. To repeat, it was only a few of the eggs subjected to the manipulations consequent upon counting which yielded larvae, all the other eggs failed to hatch, although they were kept under observation up to the 97th–104th day after they were laid. Unfertilized eggs, in the great majority of cases, shrivelled up not long after they were laid, as is usually observed in such cases. Unfortunately failure attended the efforts which were made to raise the artificially produced offspring, but it is proposed to repeat shortly the experiment. I am not aware that artificial parthenogenesis has as yet been induced in Arachnoidea.