

RHIPICEPHALUS SANGUINEUS: VARIATION IN
SIZE AND STRUCTURE DUE TO NUTRITION.

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(With 4 Text-figures.)

PROF. NUTTALL has suggested that I should continue his investigations (1913) on variation in size and structure due to nutrition, using other species of *Rhipicephalus* and species of other genera.

The variation in size obtained with *Rhipicephalus sanguineus*, the species used in this experiment, was not as pronounced as that recorded in the experiment dealing with *Rhipicephalus appendiculatus*, owing probably to the great mortality in both fully gorged individuals and those which had been removed from the host whilst only partially gorged. The only larvae available had been kept three months, and the majority were in a weakened condition; as in other raising experiments the yields from larvae of a similar age have been poor.

However, an examination of the material successfully raised clearly showed that the structural variation produced by malnutrition in *Rhipicephalus appendiculatus* is produced similarly in this species of *Rhipicephalus*, the results of the two experiments being practically identical. Hence it will only be necessary to give the experimental details and summaries of the measurements and points of structural difference between the normal and ill-nourished individuals of the nymphal and adult stages. In order to make this series of experiments as uniform as possible, it has been considered advisable to present the results on the plan of Professor Nuttall's paper.

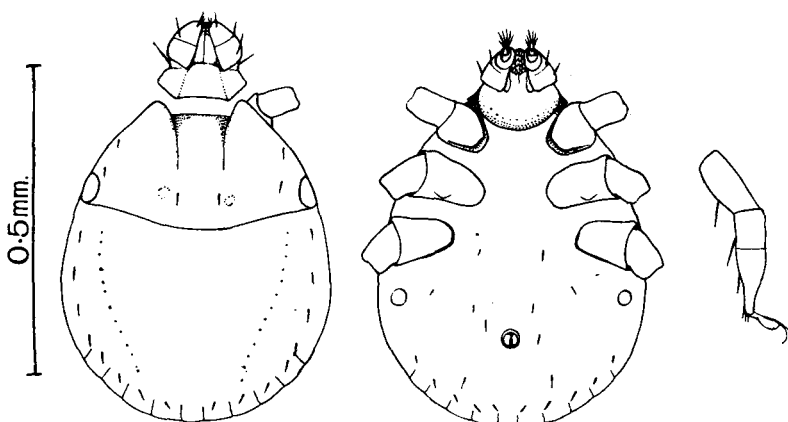


Fig. 1. *Rhipicephalus sanguineus*, unfed larva: dorsal and ventral aspects, and tarsus 3. No. 1932 (8). N. C. del.

Unfed larvae, the progeny of a single female, were placed on a rabbit¹, 8. iv. 13.

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|---|--|--|---|
| A. | | B. | |
| 288 partly gorged larvae were picked off between the 3rd and 15th days; nymphs emerged on 19. iv. 13, metamorphosis lasting 8 days ² , and were placed on the rabbit on 24. v. 13. | | 527 fully gorged larvae dropped off the rabbit between the 2nd and 28th days; nymphs emerged on 18. iv. 13, metamorphosis lasting 8 days, and were placed on the rabbit on 13. vi. 13. | |
| C. | D. | E. | F. |
| 26 nymphs, partly gorged, were picked off between the 4th & 10th days; adults emerged on 9. vi. 13, metamorphosis lasting 12 days. | 11 nymphs, fully gorged, dropped off between the 5th & 15th days; adults emerged on 11. vi. 13, metamorphosis lasting 13 days. | 13 nymphs, partly gorged, were picked off between the 5th & 12th days; adults emerged on 1. vii. 13, metamorphosis lasting 13 days. | 11 nymphs, fully gorged, dropped off between the 5th & 8th days; adults emerged on 2. vii. 13, metamorphosis lasting 14 days. |
| Set I. | Set II. | Set III. | Set IV. |

Variation in Nymphs. Fig. 2.

The measurements of the nymphal scuta were taken and are recorded below. In each case the extreme examples were picked out and examined.

The length of the scutum of the smallest nymph in Set A is only 83% of that of the smallest in Set B. The scutum of the largest nymph in Set A is approximately as long as that of the smallest nymph in Set B. At the same time, it should be noted that the normal

¹ The rabbit was kept in a cage in the laboratory of which the average temperature was about 16° C., and the ticks, during metamorphosis, in an incubator maintained at 30° C.

² In each case, only the minimum period required for metamorphosis is mentioned.

variability in Set B is considerable, the smallest nymph having a scutum only 85 % as long as that of the largest nymph in the same set.

Measurement in mm. of scuta of unfed nymphs which emerged:

A, from partly gorged larvae.			B, from fully gorged larvae.		
No.	Length	Breadth	No.	Length	Breadth
1	0.35	0.42	1	0.42	0.46
2	0.35	0.43	2	0.50	0.55
3	0.35	0.45	3	0.50	0.56
4	0.35	0.46	4	0.51	0.54
5	0.36	0.38	5	0.54	0.56
6	0.38	0.44	6	0.54	0.58
7	0.40	0.45	7	0.54	0.60
8	0.40	0.46	8	0.55	0.56
9	0.40	0.47	9	0.55	0.58
			10	0.56	0.58
Average	0.37	0.44	Average	0.52	0.56

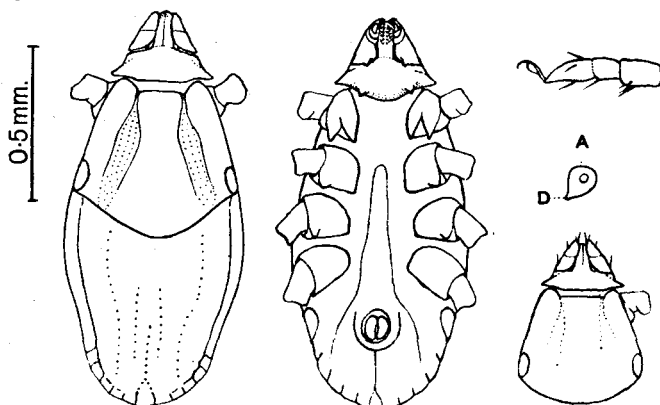


Fig. 2. *Rhipicephalus sanguineus*, nymphs: (1) normally developed unfed individual, dorsal and ventral aspects, spiracle and tarsus 4; (2) capitulum and scutum of nymph which emerged from a partially gorged larva. No. 1932 (8). N. C. del.

Variation in size in adults. Figs. 3 and 4.

Measurement in mm. of scutum of

	Smallest ♂	Largest ♂	Smallest ♀	Largest ♀
Set C. Picked in both larval and nymphal stages	1.20 × 0.70	2.0 × 1.30	0.65 × 0.62	1.0 × 1.10
Set D. Picked in larval stage only ...	2.0 × 1.30	2.50 × 1.60	0.85 × 0.95	1.40 × 1.40
Set E. Picked in nymphal stage only	1.85 × 1.00	2.30 × 1.30	0.80 × 0.80	1.15 × 1.15
Set F. Normal ticks, i.e. ticks which were allowed to gorge fully in both larval and nymphal stages	2.30 × 1.50	2.60 × 1.70	1.15 × 1.20	1.30 × 1.35
Normal first cousins to the ticks of above series (smallest and largest individuals of a large progeny from one female).	1.90 × 1.00	2.60 × 1.55	1.20 × 1.10	1.30 × 1.30

Owing to the amount of material in Set F being very small, it was necessary to utilise the progeny of a sister to the female used in the experiment, in order to gain some idea of the normal variation in size.

The largest and smallest males were selected from a large series of *Rhipicephalus sanguineus* received from Africa, and measured. The scuta of the extremes were found to have the following lengths: smallest male 1.6 mm., largest male 3.3 mm. It will be noticed that the variation in size equals that between the smallest tick of Set C and the largest of Set F, experimental animals.

Summary of structural details in which the ill-nourished individuals differ from the normal individuals.

*Nymphs*¹. (Fig. 2.) Posterior margin of scutum of dwarf nymph is rounded, and the scutum is proportionately shorter; basis capituli is shorter.

Males. The dwarfs are much less chitinised and of a dark straw colour. The scutum is smoother, less punctate and shows practically no traces of either lateral grooves or dorsal furrows. The palps have no dorsal concavity. The basis capituli is shorter and the posterior cornua are much reduced, the lateral salience being less pronounced. The anal plates are reduced in size, rounded posteriorly, the outer angle of the normal form being absent; they do not project beyond the general body surface. Fig. 3 (*W*) shows a type of anal plate intermediate between those of the male individuals figured. The accessory plates are absent in these dwarf specimens. The tarsi are unarmed and resemble those of the nymph. The extreme variability of the spiracle should be noticed.

In Fig. 3 the extremes are represented by *X* (large male) and *Z* (small male), whilst *Y* represents the spiracle of an intermediate form from the same group (Set C) as the dwarf male. The spiracle of the latter tends to approach that of the nymph.

Females. Posterior margin of scutum rounded (without angularity characteristic of the normal female); cervical grooves and lateral ridges greatly reduced. Tarsi unarmed, resembling those of the nymph.

We have only considered the largest and smallest individuals. They are, however, the extreme examples of regularly graduated series, in

¹ The difference in lateral salience of the nymphal basis capituli from that of either larva or adult is remarkable, even in the ill-nourished nymphs.

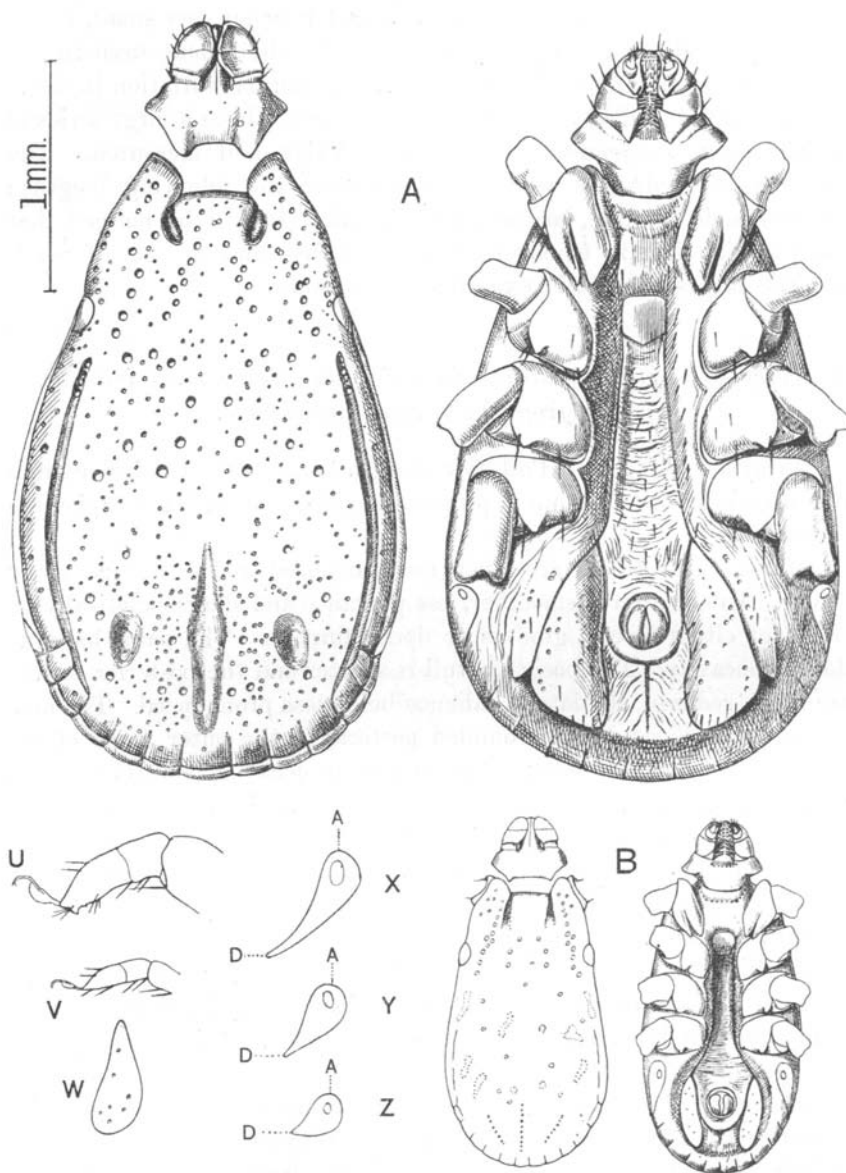


Fig. 3. *Rhipicephalus sanguineus*, males : (A) normally developed specimen, dorsal and ventral aspects, (X) its spiracle and (U) its fourth tarsus ; (B) dwarf male, which was picked off the host before it became fully gorged, in both larval and nymphal stages, (Z) its spiracle and (V) its fourth tarsus ; (W) and (Y), intermediate forms of anal plate and spiracle respectively. No. 1932 (8). N. C. del.

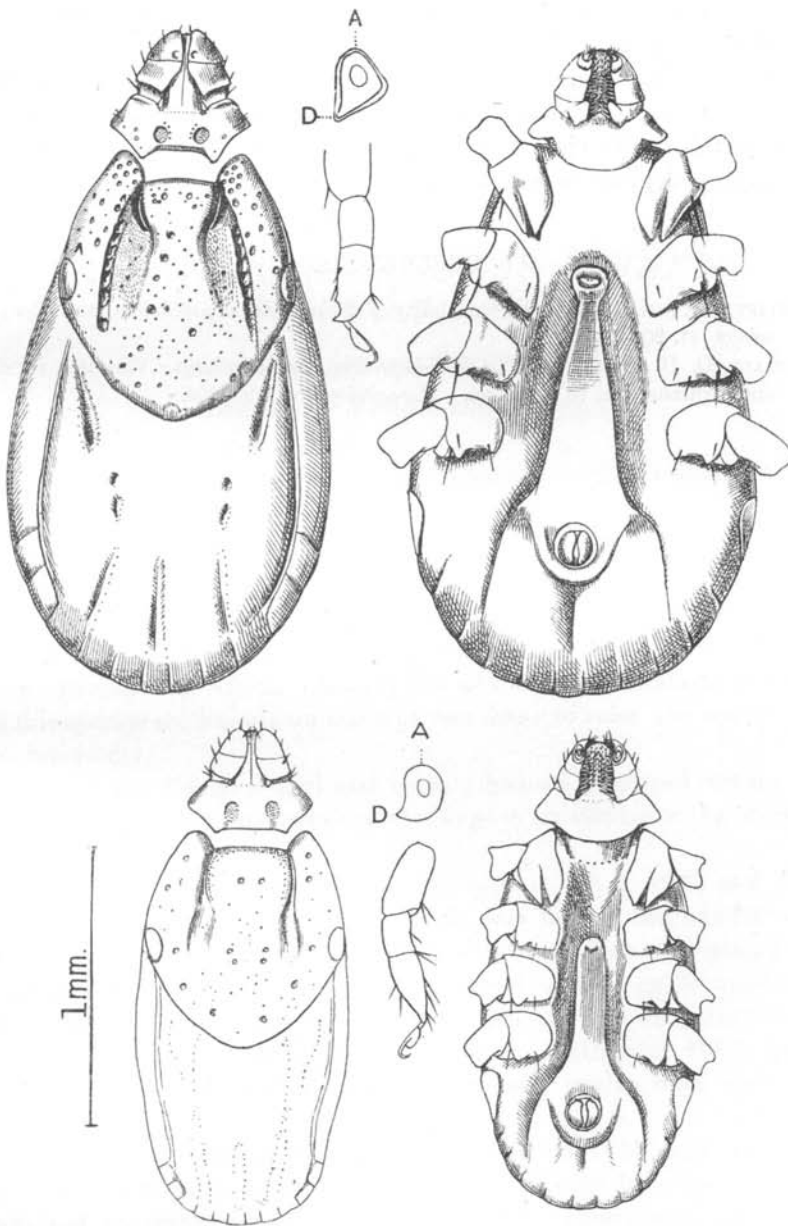


Fig. 4. *Rhipicephalus sanguineus*, females: normally developed specimen, dorsal and ventral aspects, spiracle and tarsus 4; small female, which was picked off the host in both larval and nymphal stages, before it became fully gorged, dorsal and ventral aspects, spiracle and tarsus 4. No. 1932 (8). N. C. del.

which can be traced the growth of the various structural characters mentioned above.

As a similar and equally regular variability is exhibited by the African material, collected in the field, these results again confirm Professor Nuttall's view that variation is due, to a considerable degree, to varying degrees of nutrition.

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