A FIRST RECORD OF PARALYSIS OF A DEER BY *Dermacentor andersoni* (STILES) AND NOTES ON THE "HOST-POTENTIAL" OF DEER IN BRITISH COLUMBIA

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Despite the large numbers of records of paralysis of domestic animals and man by *Dermacentor andersoni* Stiles in the northwestern part of its range, the only record of paralysis of native ungulates concerns *Bison bison* (Linnaeus) in Montana (Gregson, 1958). In winter and spring mule deer, *Odocoileus hemionus hemionus* (Rafinesque), frequent lightly timbered or open south-facing slopes, attracted by freedom from snow and presence of browse shrubs (e.g. *Amelanchier, Mahonia*) (Klebenow, 1965). This shrub-growth, which is often associated with rocky or coarse soils, provides food and refuge to rodent hosts of the immature stages of *D. andersoni,* and soil-temperatures on these warm slopes are favourable to the development of the free-living stages (Wilkinson, 1964). Fresh deer signs are frequently seen on heavily infested tick foci, so deer presumably pick up many ticks. As spring is not the hunting season, there are fewer records of *D. andersoni* on deer than might be expected, and it is still unknown whether the tick engorges readily on deer.

Of about 190 records of ticks on mule deer at the Kamloops laboratory only seventeen concern *D. andersoni,* and of these only four of the original specimens are still available for examination. Only one of these (four females and one male from Creston, B.C., 15 April, 1941) contains fully engorged *andersoni* with a note that it was taken from a deer 'nearly dead and covered with ticks.' Cowan (1944), after describing heavy infestations with *Dermacentor albipictus* Packard on deer in Banff and Jasper National Parks, noted that *D. andersoni* was 'of regular occurrence on the deer range' but 'in its present numbers is not known to be detrimental to game.' Bishopp and Trembley (1945) recorded four lots of *D. andersoni* from mule deer of which three lots contained five females ranging from unfed to fully engorged. Cooley (1938) summarising the work of several authors gives *O. hemionus* as a host of *D. andersoni but does not* state the degree of engorgement observed.

Milne (1949), in his studies of *Ixodes ricinus* introduced the term 'host-potential', defining it as the number of the host animals in the study area multiplied by the average number of ticks infesting each animal. This should be qualified by a term to cover the proportion of these ticks maturing to the next instar, or the number of eggs layed by adult female ticks maturing on this host species. since some hosts develop hypersensitive reactions which prevent ticks engorging (Trager, 1939, Riek, 1962, Wilkinson, 1962), or they remove ticks by scratching, rubbing, licking or biting. Where the range of the host animal is considerably greater than the size of the tick focus, a term covering the proportion of engorged ticks returned to the focus would be needed.

Considering situations in North America without domestic animals, if ticks are picked up by deer and fail to engorge, the presence of deer would tend to reduce tick populations. If ticks maturing on deer produce more eggs than if the same ticks had been dependant on alternative hosts such as porcupines, the presence of deer would tend to increase the number of ticks, unless the wide range of the deer caused a large proportion of the engorged

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ticks to fall in places with unsuitable microclimate, or without suitable rodent hosts for the next generation of immature stages.

As part of a program to obtain more information on the 'host-potential' of deer, a bottle-fed male fawn about one month old was infested with 20 male and 20 female *D. andersoni* on 3 July, 1964. The ticks had been taken on 18 March, 1964 by 'flagging' vegetation and had since been kept at 6-10 C over water. The ticks were shaken into a girdle covering the underneath and sides of the belly, and the deer was examined daily between 7 and 11 July. At 9 AM on 9 July there were three females on the head, one on the neck and seven on the side of the chest; a female nearing repletion and weighing 476 mg was removed, so that it would not be lost. At 9 PM paralysis of the hind quarters had developed and female ticks weighing 338, 253 and 150 mg were removed to assist the deer's recovery. On 10 July the paralysis involved the forelegs as well as the rear legs, and a pair of ticks was removed from the neck, the female weighing 470 mg. At 1 PM a movie of the paralysis symptoms was taken and the remaining female ticks, which were in the partly engorged 'tan-coloured' stage, were removed and preserved. On 11 July the deer had recovered.

From this it appeared that if the ticks had not been removed and the deer had not succumbed to paralysis, the majority of ticks would have matured and oviposited. Two engorged ticks placed in an incubator at 25 C produced viable larvae, with a normal percentage of eggs hatching. Tests with ticks fed on sheep have shown that the number of eggs laid is approximately related to the weight of the female (W.F., in mg) by the expression $N=10.5$ (W.F. - 12.5), for ticks weighing between 420 - 750 mg.

To test the ability of ticks to engorge on older animals, and to obtain more information while the fawn was available, it was reinfested on 11 December with 31 male and 24 female ticks taken from vegetation in the spring of 1964, and stored as before. On 20 December an almost replete female weighing 645 mg was removed from the back of the neck. Another female engorged slowly, and a further eight males were added on 21 December in case this was due to a shortage of males. This female tick was removed tightly distended on 31 December, but weighed only 390 mg. The smaller proportion of ticks maturing may be accounted for by the long storage of the ticks and the loss of some of them during the struggles of the deer. An infestation with 10 males and 10 females obtained by sweeping vegetation on 13 March, 1965, and placed on the deer on 25 March yielded a female of 668 mg on 2 April. The fawn did not become paralysed during the December and March infestations.

Considering the repeated observation of engorgement of ticks on the fawn, and the marked paralysis produced by the first infestation, the scarcity of records of paralysis and tick engorgement is surprising. Possibly most fawns are born too late to encounter many ticks, because ticks are commencing aestivation and because deer are migrating to summer feeding grounds, while adult deer in spring may be resistant. Gregson (personal communication) has suggested that immune reactions to *D. albipictus*, with which most B.C. deer are infested from fall to spring, may cause a cross-resistance to the engorgement of *D. andersoni*. The possibility of this cross-resistance should be amenable to investigation on tethered deer and stalled cattle, meanwhile further information is needed on tick infestations of deer in spring.

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REPOSITORIES OF SYMBIOTIC FUNGUS IN THE AMBROSIA BEETLE *Monarthrum scutellare* LEC. (COLEOPTERA:SCOLYTIDAE)

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Introduction

Specialized structures or mycangia that contain symbiotic fungi have been identified by several workers in a number of scolytid ambrosia beetles. Since Francke - Grosmann (1956a) first described structures with this function in *Trypodendron lineatum* Oliv., workers have reported mycangia in other species (Francke - Grosmann, 1956b, 1958; Fernando, 1960; Schedl, 1962; Finnegan, 1963; Farris, 1963; Batra, 1963). Only females of most species possess these structures but in *Corthylus punctatissimus* Zimm. (Finnegan, 1963), *Gnathotrichus retusus* Lec., and *G. sulcatus* Lec. (Farris, 1963) only males have mycangia.

Batra (1963), working with *Monarthrum faciatum* Say and *M. mali* Fitch found mycangia to be enlargements of the forecoxal cavities in the female beetles. Because of this and the previous work of Francke-Grosmann and Batra (Francke-Grosmann, 1963) with these two species of *Monarthrum* it seemed reasonable to suspect that *Monarthrum scutellare* Lec. would possess mycangia in a similar position. This insect attacks logs or weakened trees of the genus *Quercus* from British Columbia south to California (Chamberlin, 1958), its host on Vancouver Island being *Q. garryana* Dougl.

Materials and Methods

Adult beetles were excavated from their host and either kill-fixed in alcoholic Bouin's solution for sectioning or stored alive in a refrigerator for dissecting and culturing later. Specimens for sectioning were dehydrated with tertiary butyl alcohol (Johansen, 1940), embedded with Fisher's "Tissuemat," and serial sagittal sections were cut at 15 and 20 microns on a rotary microtome. The sections were treated with a modified Gram-Weigert stain (Leach, 1940) and counter stained with eosin Y, previously used by Fernando (1960),