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## A PRELIMINARY REPORT OF THE LIZARD-TICK RELATIONSHIP ON THE COAST OF BRITISH COLUMBIA

By J. D. Gregson, Courtenay, B. C.

The Coast tick *Ixodes ricinus californicus* (Banks) during the past few years has been becoming of increasing importance in inhabited areas on the Pacific Coast. This fact is noted particularly in British Columbia, where much of the coast land, formerly uninhabited, is now being taken up for summer resorts and residential localities. An idea as to the extent of the tick situation was revealed by investigations made at the coast during the summer of 1933 and the following fall and winter, in continuation of a project of the Dominion Entomological Laboratory, Kamloops, B.C.

The coast tick appears to be distributed over the whole of southern Vancouver Island and coast of British Columbia. Tick bites have been reported as far up as Courtenay, V.I., (lat. 49° 40') where a specimen was taken from the arm of the writer on May 20, 1933. Adults have been taken from deer thirty miles north of here at Campbell River. This is likely the most northerly record for the island, if not for the mainland coast.

The Malahat and Saanich districts of Vancouver Island appeared to be one of the most favourable localities for *Ixodes ricinus californicus*. The climate and geographical nature of both these places is characterized by its areas of dryness and roughness. These appear wherever the bedrock extends through the shallow layer of soil, and in the regions of rugged hills such as Malahat Mt. (3,000 ft.), Mt. Douglas and Mt. Tolmie. Needless to say, since precipitation is relatively light in the summer, and as these sloping hills have only a slight moisture-holding capacity, the humidity falls very low during the daytime.

Since the majority of ticks have been discovered only after they have been carried away from their surroundings, it is difficult to give a detailed description of their specific environment. The account of the habitat of the Coast lizard given later, however, will serve to illustrate further the type of land most suitable for them.

Enquiries made of various doctors and inhabitants of the district surrounding Victoria, B.C., revealed that the majority of people who were in contact with outdoor life had experienced tick bites. Little children had been bitten on several occasions, one incident occurring in the vicinity of Victoria. From all reports there, the ticks were most troublesome only during the winter and early spring months, mainly from the beginning of February on to the end of June. None were apparent in July and August, and berry pickers in the Malahat

district did not seem to be troubled by them. In the same area in the spring, Mrs. E. B. York stated that it was possible to pick up two or three ticks in a single walk.

West Vancouver appeared to be an ideal habitat for the coast tick, and possessed a type of land very similar to the tick-infested areas on Vancouver Island. Drags were made for adults in this vicinity during the hot weather of August, but gave negative results. Later, enquiries were made of Dr. J. M. McIntosh, Medical Health Officer for the City of Vancouver, regarding any trouble experienced in this locality from tick bites. A canvas of the Vancouver Hospital records revealed very little trouble of this description.

The next field trip to West Vancouver was made at the end of a week of warm spring weather on February 18, 1934, and a series of drags were made over dry grass along the P.G.E. railroad grade at Caulfield, the home of large numbers of the lizard. These proved highly successful, and a dozen adult ticks were captured in ten minutes, the number varying from one to three for a twenty-foot drag. Of these twelve, it is of importance to note that there were four pairs in copulation. The remaining four individuals were females. These drags were made at twelve o'clock noon. The sky was cloudy and the temperature registered 48 degrees F. Information obtained from inhabitants in this area revealed the fact that at this time of the year the ticks are particularly troublesome. Dogs suffered most and often had to have the ticks picked from them from day to day. The most satisfactory method of loosening them, according to one lady, was to dampen them with coal oil. Humans were less molested, but bites of these ticks were not uncommon among hikers. Although, in no known cases, have bites of these ticks produced serious results, there are several instances of bad ulcers having been caused by them.

It is thus seen that *Ixodes ricinus californicus* is confined to that part of British Columbia where there is a mild and humid climate. That the local temperature is also an important factor in the abundance of these ticks is indicated by their greater concentration on rocky slopes that receive the full heat of the sun. Whether their presence in such areas is due to the climatic conditions, or whether it is of a secondary nature, due to the relationship of the coast lizard, is not yet certain, and cannot be determined until more is known about the hosts of the early stages. To ascertain this would involve considerable experimental work and shooting of rodents, ground inhabiting birds, game birds and animals, etc., in the infested areas. Nevertheless, it is noteworthy that the habitat of the coast tick is almost identical with that of the coast lizard, and it is known that this lizard (*Gerrhonotus multicarinatus* Blainville) is at least one of the hosts for the larvae and nymphs of *Ixodes ricinus californicus*.

Since the distribution and environment of this lizard practically coincides with that of the coast tick, a description for the former will serve in an attempt to correlate it with that of the parasite.

At Victoria this lizard is very widely distributed, since the majority of the Saanich Peninsula and southern Vancouver Island is typical of its environment. Specimens were observed on the rocky slopes of Mt. Douglas, at a rock garden bordering Esquimalt Harbour, and about protruding rocks at Lakehill. Each of these places was exposed directly to the sun, and the rocks became very hot during the daytime. Vegetation was scarce about these areas, of which the dryness permitted only the growth of xerophytic vegetation. It may be noted, with reference to this, that on the coast the habitat of the arbutus is typical for that of the lizard and, in most cases, the tick.

The district where the lizards appeared most abundant, and where the writer did most of his collecting, was at West Vancouver. On any hot day individuals might be seen about the rocky regions extending along the north shore of Burrard Inlet, from West Vancouver to Point Atkinson. They were particularly plentiful along the disused grade of the P.G.E. Railway. This track leaves the shore level at West Bay, and from there to Caulfield, a distance of about two miles, it skirts along the foot of Hollyburn Ridge, some 200 feet above the sea. Its grade is made on a steep slope which is covered in the damper places by a luxuriant growth of coniferous trees, maples and ferns, but is also interspersed with bald rock prominences. In many places a cutting has been made through the latter, leaving a jagged wall of weathering rock on the north side of the track. This proved to be an ideal home for large numbers of lizards, who made their abodes in crevices in the wall of loose and cracked rock at the edge of the track. These cuttings were probably much more suitable than any districts on the island in that, besides possessing the desired heat, they were also kept continually moist by seepage from the hills above.

Frequently these lizards were found in forests and comparatively damp regions. The occasional one could be heard scurrying into ferns from the side of the highway at West Vancouver, and many could be heard among the salal and underbrush on Baby Mt. in the same district. One specimen was captured in the damp woods near the outlet of Shawnigan Lake, V.I. At Comox, a colony has been observed for several years living under driftwood on a sandy beach.

The parasitism of the Pacific Coast lizards by the coast tick was first brought to attention by Dr. W. L. Jellison of the U.S. Public Health Service. While engaged in field studies relative to the occurrence of Rocky Mountain spotted fever virus in California ticks, during March and April, 1932, he made numerous collections of *Ixodes ricinus californicus* in Madera, Monterey, San Benito, Santa Barbara, Santa Clara

and San Luis Obispo counties. Unfed adults were secured from vegetation in considerable numbers and also were found infesting dogs, horses and man. The hosts of the immature ticks he found to be the alligator and blue-bellied lizards, except in one instance when an engorged nymph was taken from a dog.

The early stages of these ticks attack themselves to the host from a position inside the lateral cervical pouch, where they remain concealed and protected until they have engorged. This external ear is situated halfway between the eye and base of the forelimb, and is in the form of a pit  $1\frac{1}{2}$ mm. in diameter, extending about 2mm. into the body. Across the bottom extends the thin tympanic membrane. The lower portion of this external ear is covered by a fold of skin bearing small convex scaly grains, so that there is an internal pocket or "cervical pouch" which is considerably larger than the opening. This orifice is bordered in front and above by the projecting temporals, and behind by loose granular skin. It is to the interior caudal portion of this pocket that the ticks attach themselves. Microscopic sections of this area reveal very few blood vessels, contrary to what would be expected, and it is possible that lymph, instead of the large reptilian blood cells, are absorbed by the parasite. In no cases that have come to the writer have ticks been attached to any other portion of the body than that mentioned.

Inspections of *G. multicarinatus* have revealed the presence of *I. ricinus californicus* as a larval and nymphal parasite, although in no large numbers at the time and place where the studies were made. Two lizards captured and examined at Mt. Douglas, Victoria, and at Shownigan Lake in the latter part of August were free from ticks. However, a specimen received from Victoria on October 15th had two engorged nymphs in one ear and one in the other. No ill effects were shown on the part of the host. Out of fifty-nine specimens examined from West Vancouver, only one was infested by a tick. This was observed on October 4th. It engorged until October 15th, when it dropped off. This date was undoubtedly late in the season for nymphal ticks, and it is probable that earlier in the season many more cases of parasitism would have been present. Certainly the number of adult ticks and lizards in the same area at West Vancouver would suggest this, particularly as there are few other animals in that area that would serve as hosts.

Dr. Jellison, in considering the same suggestion as to the importance of lizards to the immature forms of ticks states that "in a restricted area south of Monterey high school, Monterey county, where tick-infested lizards were numerous, over 250 adult ticks were collected from the vegetation in a few hours. In this area no rodents or other small animals that might serve as hosts to the immature ticks were seen, although they might have been present in limited numbers."

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So far, the writer has been aware of no cases of lizards being infested by adult coast ticks. Experiments are being carried out in this respect to see if this is possible. The natural conditions appear suitable, since the lizards are known to appear out on the rocks during the early spring days. This is the time when the adults are most abundant.

Parasitism of lizards in Europe by *I. ricinus* is recorded by Nuttall and Warburton (l.c.) and by Neumann (1911). Dr. Brumpt, professor of parasitology of the University of Paris, has also used lizards for the rearing of *I. ricinus*.

I wish to acknowledge the assistance of officers of the Dominion Entomological Branch, particularly the late Mr. Eric Hearle, for data regarding *I. ricinus californicus*, and my thanks are due to Dr. Jellison for his kind permission to use information contained in his paper on "The Parasitism of Lizards by *Ixodes ricinus californicus*" which was read at the twelfth annual meeting of the Great Plains International Conference of Entomologists at Edmonton, Alta., in August, 1932.