

the average wood-boring Buprestid. It lives in the wood as a larva for two or three years and pupates and transforms to the adult in a pupal cell in the wood. Pupation takes place from July to October and the transformation to the adult in a few weeks afterward. The adult then rests over the winter in the pupal cell and emerges from the wood the next spring or summer, from March to September. Adults have been collected flying or crawling in the forests from March 20 to August 24.

During the past fifteen years *Chrysophana placida* has been taken by members of the Branch of Forest Insects, Bureau of Entomology, United States Department of Agriculture, in the localities and host trees listed herewith.

DISTRIBUTION

California: Fallen Leaf, Pyramid Ranger Station, Placerville, Markleeville, Shingle Springs, Sterling, Yreka, Tallac, Lake Valley Ranger Station, Echo Lake, Meyers, Wrights Lake, Monumental, Vade. *Colorado*: Florissant. *Oregon*: Sumpter, Waldo, Ashland. *Utah*: Panguitch Lake, Kamas. *Washington*: Des Moines.

HOST TREES

Mountain, white or silver pine (*Pinus monticola* Dougl.), sugar pine (*Pinus lambertiana* Dougl.), single leaf pinon (*Pinus monophylla* T. & T.), yellow pine (*Pinus ponderosa* Laws), rock pine (*Pinus scopulorum* Engelm.), jeffrey pine (*Pinus jeffreyi* Oreg. Com.), lodgepole pine (*Pinus murrayana* Oreg. Com.), digger or gray pine (*Pinus sabiniana* Dougl.), knobcone pine (*Pinus attenuata* Lemmon), black hemlock (*Tsuga mertensiana* Carr.), Douglas spruce (*Pseudotsuga taxifolia* Britton), Alpine fir (*Abies lasiocarpa* Nutt.), white fir (*Abies concolor* Parry), red fir (*Abies magnifica* Murr.), giant arborvitae or western red cedar (*Thuja plicata* Don.).

CONTRIBUTION TO THE LIFE-HISTORY AND HABITS OF THE SPINOSE EAR TICK, ORNITHODOROS MEGNINI

By WILLIAM B. HERMS, *University of California*

The spinose ear tick presents a problem of considerable importance to the animal husbandryman in nearly all of the southern half of California, particularly in the Imperial Valley where calves become seriously infested and die from what the ranchers call tick fever. Experiments and field observations on this species have been carried on more or less continuously by the University of California Laboratory of Parasitology during the past three or four years. From our records it would seem that few if any warm-blooded animals coming within the reach of this tick are exempt from attack. Calves evidently are most liable and suffer most severely, many dying from the effects.

Infested calves shake the head vigorously, become emaciated, often race about madly until completely exhausted. The ears become inflamed and the secretion of wax is greatly stimulated. Deafness is said often to result in infested horses and mules.

The following account is by a man whose ear was inhabited by a tick of this species. This account is worthy of note because the course of events is here rather accurately given, together with the sensations aroused and other matters of interest. Mr. L., writing from Lancaster (California), states: "I left Berkeley with a horse and wagon on the 3d of September (1915) and drove about four hundred miles to Lancaster, Los Angeles County. I slept on the ground every night except one, arriving here on September 15. Some of my camping places were in, others along-side of, cattle ranges or pastures. One of the places I discovered before morning to be a regular camp for twenty or thirty cattle of all sizes. This is where I did not sleep on the ground. The cattle came in after I had made camp about dark and it was too late for me to find another place, so I moved my bed into a small shack, near the barn with old straw on the floor, which was about a foot above the ground. Still I was right among the cattle. This was the night of September 5, at Corral Hollow, east of Livermore. The last night out, September 15, I slept on land that is used only for grazing and have been working on similar ground ever since; however, there are only a few cattle on the range. My other sleeping places were mostly along the roadside, and sometimes cattle were around. At other places there were none and I think there have been no cattle near the house I live in for several years, or perhaps a few passing near it once in a while." Our records show that Mr. L. went through territory where the spinose ear tick occurs. In his first letter, dated December 10, 1915, he says "I am sending you . . . a bug . . . which came out of my ear, and which was living there probably six or seven weeks. . . . About six or eight weeks ago I began hearing unusual noises in my left ear. Sometimes hours would pass without hearing them; sometimes every few minutes, either day or night. The noise would saw awhile without any regularity as to time or duration. I could feel no movement in my ear like anything alive. Finally I thought I had better have it examined, so went to a local physician and told him I thought something was in my ear. He examined it and said 'Yes, there is something in there. I'll see what it is and what I can do for it.' After prodding around awhile he asked, 'What do you suppose that thing is in there?' I replied that I did not know. 'Well, it is a live bug, but I killed it.' He pulled out what looked like a clot of good red blood, about the size of a small pea, mixed with small bits of soft membrane. Then he

washed the ear with peroxide and gave me the syringe and a bottle of peroxide and told me to wash it a couple of times a day for two or three days. . . . I used the peroxide as directed, but the noises did not seem to stop and soon I concluded that they were about as before. . . . Finally I made up a dose of peroxide as hot as my ear would stand and about the third or fourth shot with the syringe this ugly thing came tumbling onto the ground, and the ear has been apparently alright ever since. This was last Tuesday, December 9, nine or ten days after the doctor did his job."

The above letter furnishes evidence to the effect that the tick entered the ear of the man while sleeping on the ground sometime between the third and fifteenth of September. From what is already known of the habits of the species, the tick almost certainly entered his ear as a larva. The specimen which left the ear of the patient December 9 was a full grown female. The time was, therefore, about nine weeks. This specimen remained alive without food in a small shell vial on the writer's desk until about December 1, 1916, nearly a year, during which time there were no further molts.

OVIPOSITION

In order to ascertain the exact time expiring between the last molt and the deposition of eggs, a number of females previous to the final molt, were placed in Petri dishes with one or more males and kept in an insectary at 26°±3° C. except female No. 3 (see table) which, after about 60 days, was subjected to temperature as low as 0° C. The following table shows the result of this experiment.

TABLE I.—SHOWING TIME REQUIRED BETWEEN FINAL MOLT AND OVIPOSITION, ALSO DATE OF COPULATION, NUMBER OF OVA

No.	Date Molted	Date Placed with Male	Date of Copulation	Date of Oviposition	No. of Ova Deposited	Days between Copulation and Oviposition
1	10/22/15	10/23/15	10/23/15	11/ 6/15 11/ 8	10 } 54 44 }	14
2	10/24/15	10/27/15	Not observed	11/24/15	186	28(?)
3	10/24/15	10/27/15	10/27/15	11/27/15 12/ 2 12/ 3 12/ 4 12/ 6 12/ 8 12/20 3/24/16 4/13 4/30	7 12 19 5 88 94 43 166 103 25 } 562	31
4	10/19/15	10/21/15	Not observed	12/ 5/15	7	37(?)
5	10/23/15	10/23/15	10/25/15	12/ 6/15 4/16/16 4/27	117 Not counted Not counted	42
6	10/24/15	10/30/15	11/ 5/15	3/15/16 4/1	25 Not counted	100
7	10/20/15	10/30/15	Not observed		No ova	—

An examination of Table I shows that copulation took place readily within a day or two after the last molt, and that in six cases egg deposition began in from 14 to 42 days after copulation or from 15 to 44 days after the last molt, with the number of ova ranging from 7 to 562. The longest period of oviposition noted was 155 days or 189 days after molting.

INCUBATION PERIOD

Unfortunately a careful record of all egg layings was not kept, but the records made in this connection are of interest nevertheless (see Table II).

TABLE II.—SHOWING INCUBATION PERIOD FOR OVA OF *ORNITHODOROS MEGNINI*

Date of Oviposition	Date Hatched	Incubation Period	Temperature
11/ 8/15	12/1/15	23 days	Room temperature 21° C.± (steam heat regulated by thermostat)
11/24/15	12/11/15 to 12/14/15	18 to 21 days	Ditto
12/ 2/15	12/22/15 to 12/24/15	20 to 22 days	Ditto

The above table though based on few observations shows that it is possible to secure oviposition during the winter months (November and December) and that the eggs hatch in a room temperature of about 21° C., requiring from 18 to 23 days incubation.

LONGEVITY OF LARVÆ

In a series of experiments in which the larvæ were kept in darkened receptacles at room temperature, during the months of November, December and January it was found that the range of longevity was from 19 days, the shortest, to 63 days, the longest, with an average of 44 days. This series included seven sets of larvæ hatching during a period of 32 days.¹

CONCLUSIONS

The spinose ear tick, *Ornithodoros megnini*, enters the ears of both man and beast causing losses particularly in calves.

Oviposition and emergence of larvæ may take place during the winter months, November, December and January, under laboratory conditions. It should be borne in mind that under field conditions this takes place during the summer and autumn months.

The adult female may live 355 days without food in a glass vial at room temperature.

¹The writer wishes to acknowledge the assistance of Mr. M. H. Ray, a student in parasitology, who deserves much credit for his patience and care.

Copulation takes place within a day or two after the final molt.

Oviposition occurs in from 14 to 42 days after copulation with a maximum period of oviposition of 155 days.

The number of ova per female ranged from 7 to 562.

The incubation period at room temperature ranged from 18 to 23 days.

The longevity of larvæ ranged from 19 to 63 days with an average of 44 days.

A FLY CONTROL EXHIBIT

By C. W. HOWARD

In the autumn of 1915 it fell by lot to the writer to prepare for the State Fair, the major portion of the exhibit of the Division of Economic Zoölogy, of the Agricultural Experiment Station. The task seemed difficult, for in years past we had nearly exhausted the possibilities of preparing a new and interesting display of destructive insects. But as we have been trying for some time to impress upon our rural and farming population, certain facts about house-fly control, this seemed to be the opportunity to press home some of these facts in a telling way.

In preparing the exhibit, we had in mind the fact that fly elimination on the farm is extremely difficult, and that especial attention must also be given to sanitary arrangements, as well as to actual fly control in order to prevent disease transmission. Sanitation has been sadly neglected on most Minnesota farms, but the more progressive farmers are awakening to its necessity and are ready for suggestions.

The exhibit was called, "The Flyless Farm." A farmstead about 10 x 15 feet was laid out. The Division of Farm Management was called upon to advise as to the proper relation of the buildings, and the Division of Engineering for plans for the buildings. The entire exhibit was, therefore, correct in every detail and in accordance with the recommendations which the Experiment Station is sending out to farmers.

For the actual construction of the buildings, etc., we were fortunate in securing the services of one of our students, who is unusually apt at mechanical work. "Compo-board" served admirably as constructive material. The buildings were so made as to be collapsible and easily packed for transportation. They were of large size, built to a scale of one-half inch, the house for example being 14 x 15 inches, and the horse barn 18 x 25 inches, so that every detail could be practically perfect. This accuracy of details fixed the attention of many observers. A large green painted canvas covered the table on which the exhibit was placed, with the roadways marked out in gray.