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NOTES ON THE BIOLOGY OF THREE ARCTIID MOTHS FROM BRITISH COLUMBIA

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Neoarctia brucei H. Edw.

N. brucei is not listed by Jones (1951). It inhabits the southern slopes of alpine meadows in Manning Park at altitudes of about 6,500 feet, and is rare in collections. With a wingspan of 35 mm, this is a moth of striking beauty having black forewings with broad rose coloured grid lines and bright red hindwings with heavy, broad spots, confluent at the outer margins.

After hibernation the small larvae appear in June, at first on bare spots around trees and later mostly along the edges of still remaining snow patches. There, with maximum exposure to the warmth of the sun, they rest in a curled position on the bare ground or walk swiftly, covering considerable distances in search of their favorite food plants: the tender sprouts and shoots of *Senecio,* mountain grass, phlox, and buds of *Vaccinium.* By the time the last snow patches have melted, the larvae have hidden in the thickets of fast-growing alpine flora. They reach maturity before the leaves of the dwarf *Vaccinium* turn dark green. The moth emerges in July after two weeks in the pupal stage. Flight and copula take place at dusk.

The female lays between 80 and 120 eggs in batches. The ovum is spherical and gold coloured. Hatching follows 10 days after oviposition and there are six larval instars. At maturity the larva measures 30 mm, the head is small and black, the body and tubercles are black, dotted with shiny spots, visible in the reflection of light, and with soft tufts consisting of black and white hairs, the white ones more numerous at the sides. The dorsum is adorned with tufts of pale olive green.

The pupa is 17 x 5 mm, with the wingcases translucent reddish, the mobile cremaster dusted with slate blue, the segments blackish and bordered, and the head furnished with inconspicuous bristles. It rests in a light cocoon of plant material.

Caged caterpillars are reluctant to accept substitutes for their native food plants. Taking only mature larvae and presenting them a variety of wild, native plants is critical for successful rearing. The picked plants preserved in tightly closed jars and kept cool, will prove satisfactory. However, a new brood emerging in confinement can be successfully reared on *Taraxacum* if they have not hibernated. Ample space, artificial

heat and adequate moisture are essential. A second brood in the same season may even be partly brought to pupation. Creating conditions similar to those found under a cover of snow, will give modest success with a brood in hibernation. The box used for overwintering should not contain anything of plant origin because of the disastrous effects of moulds and fungi. To induce copulation in captivity, the breeder must use his field observations of the impetuous flight of the male and of the climatic conditions at the time of mating. The provision of cages with ample space for flight, cold air at dusk, and a breeze in the evening will reproduce some of the factors for mating. The male is able to enter more than one copulation.

A tiny parasitic wasp of 2 mm wingspan takes advantage of the conspicuous exposure of resting larvae to reduce the overwintered stock drastically every year.

Apantesis elongata Stretch

This species is listed as No. 1050 by Jones (1951). It was identified in Ottawa after its discovery several years ago in Manning Park. *A. elongata* and *N. brucei* have similar life histories and share the same habitat.

The male, with a wingspan of 30 mm, has black forewings with fine white grid lines which sometimes are partly missing, and the typical "W" at the outer margin. The hindwings are black also with a circular black spot in the discoidal cell bordered by a broad white band. Below the cell a distinct white line extends from the thorax towards the outer margin, its widened end sometimes connected with the aforementioned black spot. The abdomen is black with an ochraceous stripe on both sides. Some males exhibit mutations with broad white grid lines in the discal area. Such aberrant males have completely black abdomens. The white pattern on the hindwings of the male is typical and dominant, but an ochraceous pattern occurs rarely.

The female has forewings like those of the male, but the hindwings are ochraceous with broad black spots at the outer margins, sometimes confluent. The line extending from the thorax into the limbal area is black. Females showing the typical geometrical pattern on the hindwings are quite rare. Mutations, showing black hindwings with only a shade of ochraceous left and forewings with a white broad blotch in the discal area also occur.

In nature the larvae are found associated with *N. brucei* and can be reared in the same way. They are more agile but less exposed and better camouflaged. This may explain why they were parasitised less than the larvae of *N. brucei*. A brood in confinement, unlike *N. brucei,* will not reach maturity without hibernation.

The ovum is spherical, pale yellow and much smaller than that of *N. brucei*. The female produces up to 200 eggs, which are laid loosely and apparently casually.

The mature larva measures 30 mm. The head and body are black, the tubercles black and dotted with tiny white spots reflecting the light; the tufts are rough and short, black on the dorsum, maroon at the sides. The dorsal line is comprised of lines and spots in an alternate pattern of white, brown or ochre. Often the dorsal line is missing.

The pupa is dusted with slate blue, the seams black, the cremaster mobile, the head with short black bristles, more accentuated than in *N. brucei*.

Parasemia (Hyphoraia) parthenos Harr.

This superb Arctiid is distributed throughout the Northern Atlantic States and Canada. Its occurrence in British Columbia is sporadic and apparently restricted to small localities in light, damp forests with underbrush, often hundreds of miles apart. Wherever sighted, the number of specimens appears always very limited. Undoubtedly this moth is rare

and probably permanently endangered by civilization. It should be high on the list of insects to be protected in nature. The moth survives only in undisturbed environment with ideal and balanced conditions.

By the end of June it is on the wing, but only in *even* - numbered years, which indicates a two-year life cycle. Males will come to a light, but not females which appear to avoid any kind of trap. In the course of obtaining breeding material, I have sacrificed many night hours in vain at different places and have never seen a female landing in the vicinity of the light. The number of males appearing never exceeded five, an indication of its scarcity and limited number. On June 30, 1962, near Westbank, B.C., a female was found by accident, resting on a doorstep. On July 1 it laid about 80 eggs in a mass. The eggs were white, dull, and globular, slightly flattened.

In ten days the larvae hatched and were kept in small closed jars with perforated lids, exposed during daylight to artificial heat. Since all known breeding places had abundant growth of *Symphoricarpos,* this shrub was tried as a food plant, and was very successful.

By August 22 in the VIIIth instar, about 70 per cent of the larvae had reached maturity without further loss. Thus one hibernation was eliminated, thanks to artificial heat and adequate moisture in the jars. The mature larvae continued to feed until they refused further food in the very late fall.

Hibernation took place in a box-like container outdoors under a roof. Inside was sterilized moss, which was moistened from time to time. However, most of the larvae died during the winter and early spring until finally only three remained to pupate in late spring. These also perished. The failure was probably caused by uncontrolled moisture which allowed fungi and mildew to grow. Obviously conditions were not equivalent to those in nature.

Extensive search for larvae in the vicinity of breeding places did not produce results, since these feed at night and are well hidden during daylight. The only remaining chance was to watch for mature larvae in late fall when they travel in search of hibernation sites. Occasionally they cross roads in full sunlight. In 1965 ten mature larvae were found in this way, which were fed with leaves of *Symphoricarpos* until they rolled up for the winter. At maturity the larvae were 40 to 45 mm long, with head and body black, hairs long and black, the tubercles greyish white and inconspicuous.

Larvae of this family spend a great part of their lives under a cover of snow, and they have an exceptional need for moisture. But direct moisture seemed to be deadly, producing fungi, particularly on the prolegs. The container for hibernation, consisted of two parts: the upper part covered with curtain fabric with a perforated bottom; the lower part a reservoir for water. The perforated bottom was covered with a layer of cotton fabric and two rocks were placed on it and covered with a double layer of cotton fabric to leave cavelike spaces beneath. The whole assembly was sheltered by an A-frame with an impervious cover and placed outdoors under spruce trees and close to a stump covered with shrubs. The layers of fabric were moistened every two days except in the snow season.

At the end of February, 1966 one larva was found dead, a victim of fungus. In March several more succumbed. Temperature changes in early spring caused frequent interruptions of the winter sleep. At the end of March the remaining three larvae became active and prepared for pupation by emptying their intestines. On April 1 they began to spin loose cocoons, and on April 5 one larva finished its cocoon of mixed silk and hairs, choosing the curtain fabric as a suitable place. Two others spun

cocoons between the rocks under the double layer of fabric. On April 16 a pupa could be seen in the cocoon under the curtain fabric. It was 27 mm long, black and shiny. A female emerged on June 1, after six weeks pupation. A male emerged from a cocoon between the rocks on June 11. The third pupa was killed by mildew. The moths emerged 10 days earlier than those observed in nature, a sign that the hibernation place was too warm and the ambient air too dry. None of the larvae reared was parasitised.

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RECORDS OF TICK PARALYSIS IN LIVESTOCK IN BRITISH COLUMBIA

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ABSTRACT

Reports of 189 outbreaks of tick paralysis in livestock in British Columbia are tabulated with regard to distribution, the kind and number of animals involved, the annual incidence of paralysis, and the dates and sizes of the major outbreaks. The disease is most prevalent in the western half of the interior dry belt where there have been apparent peak years of cases. The recorded totals are in excess of 2010, 1849, 9, and 13 for cattle, sheep, horses, and dogs, respectively. Most of the loss from the disease results from the extra manpower needed to care for affected animals, reduced animal condition, and disuse of otherwise valuable pasture.

Almost every year since its inception in 1928, the entomology laboratory at Kamloops, B.C., has received word of cases of tick paralysis in livestock and humans in this province. Since the published records refer only to 11 out of some 190 outbreaks of the disease in livestock, it is felt that more information should be made available from data in this laboratory's files.

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Tick paralysis was first recognized as a disease in North America when Todd, in 1912, accumulated case histories of the effects associated with tick bites in humans and differentiated the symptoms from those of Rocky Mountain spotted fever. Hadwen (1913) associated the disease with a condition observed in the vicinity of Keremeos, where for three years a farmer had up to 300 of his sheep affected by a form of paralysis. Hadwen proved experimentally that the disease was caused by the bite of *Dermacentor venustus* Banks (=*D. andersoni* Stiles). His theory that a toxin caused the symptoms remains unchallenged.

Other than Bruce's (1920) warning to ranchers of tick paralysis, there are no further references to outbreaks until Bruce's publication in 1922. In this, he records witnessing an outbreak at Vavenby where Moilliet had 300 sheep affected out of a band of 400. Subsequent unpublished references to this rancher indicate that up to 1928 as many as 10% of his flock of 1300 were sometimes paralysed.

In 1928, at the request of the B.C. ranching industry, a laboratory was established at Kamloops for the study