

replant. The water from the washing tub should, of course, be dealt with so that any chance larvae can be destroyed.

I am not prepared, at this stage, to say whether the naphthaline acts as a deterrent, or as an insecticide, but am inclined to think that it kills the larva by acting on its tender skin. That it is effective, I can vouch for, from my own experiments.

Last summer I had a patch of a special variety of strawberry, the soil of which had been well treated with naphthaline. The plants were quite untouched, while just alongside a patch of Alpine Primulas were badly damaged before I, upon returning from one of my trips, discovered the injury and at once took steps to recover my plants by the means just given, which was so sure that in a month's time they were all well established and now promise well for spring blooming.

A Remarkable Simuliid Pupa

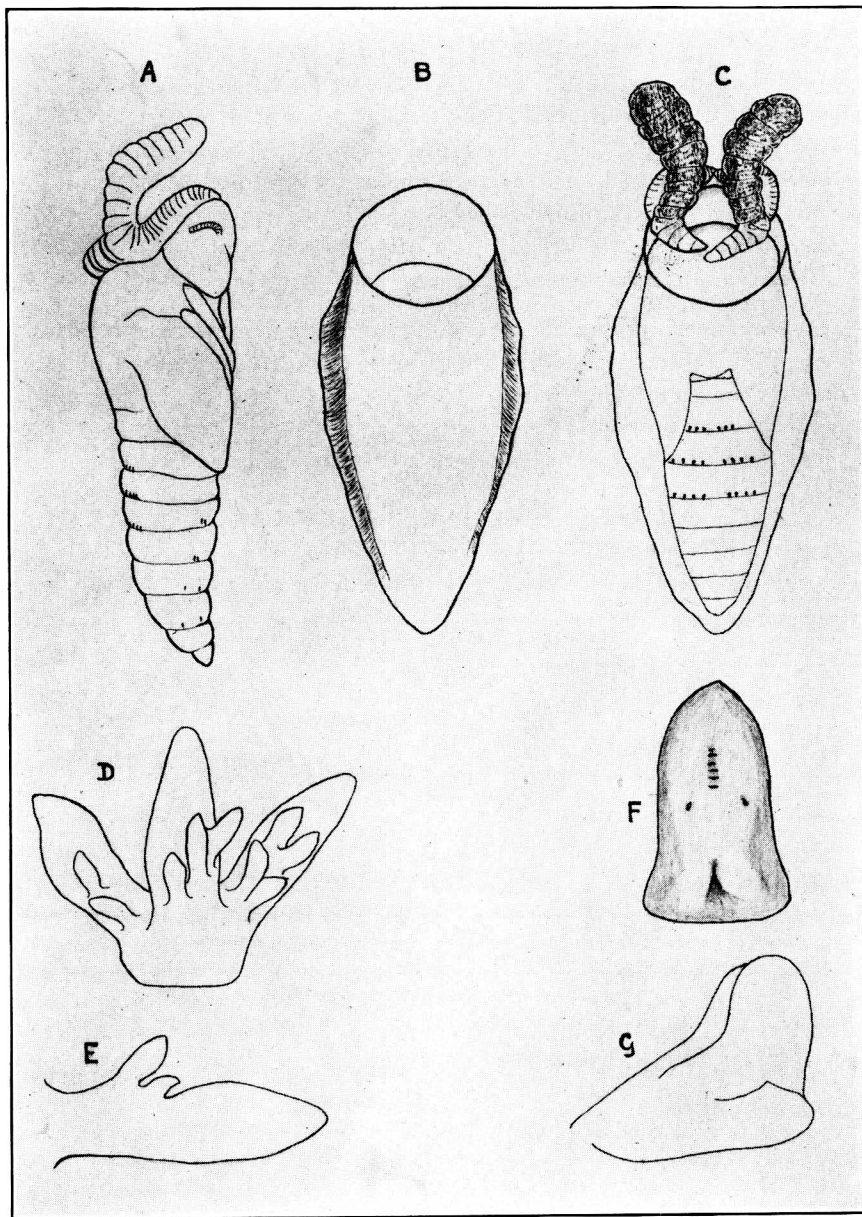
Notes on *Simulium Virgatum* in British Columbia

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Introduction

IN THE spring of 1928 a study of British Columbian black flies was commenced in connection with one of the minor projects of the Kamloops laboratory. Among the first specimens encountered during preliminary collecting of immature stages was a pupa with breathing organs of such an unusual character that we consider it to be the most remarkable form of simuliid in this stage yet recorded. We waited for the emergence of adults from the rearing cages with the keenest interest, and had high expectations that we would be rewarded with a representative of a new genus; but instead the adults proved to be ***Simulium virgatum*** Coquillett. This species has previously been recorded only from Mexico, New Mexico, California, S. Dakota and Texas (1, 2, 3, 4, and 5.) The larva and pupa have hitherto been unknown. Coquillett originally described the species in 1903 from material from New Mexico. Dyar and Shannon (2) have placed Malloch's ***hippovorom*** (5) and Knab's ***rubicundulum*** (4) as synonyms of it. It is known to attack horses, as Malloch's single specimen of ***hippovorom*** was obtained from the ear of a horse in Mexico at 7300 feet elevation. The distribution of this species must be remarkably wide, since, in addition to our Kamloops material, there is a specimen in the Canadian



(a) Pupa of *Simulium virgatum*, lateral view. (b) Pupal case, Dorsal view. (c) Dorsal view of pupa. (d) Anal gills, ventral view. (f) Dorsal sclerite of head capsule, showing maculations. (e) Lateral view of anal gill. (g) Histoblast of pupal breathing organ in larva.

National collection at Ottawa, taken by E. H. Strickland at Jasper Park, Alberta.

A quantity of very interesting material representing a number of other species came to hand during the past season, and we have specimens or records of a total of 16 species from British Columbia. There are records of 13 additional species from adjacent western states and from Alberta and the Yukon Territory. In the present paper, however, remarks are restricted entirely to ***Simulium virgatum***, as we hope to be able to extend our simuliid investigations considerably during the coming season, and plan to discuss the other species and present a check list of known British Columbian forms in a later paper.

Dyar and Shannon (2) record the taking of adult ***S. virgatum*** in Mexico in July and December; in New Mexico in July and August; in California in June, July, August and October, and in Texas in May. The following somewhat fragmentary notes give an indication of the life-history as it occurs at Kamloops, British Columbia.

Notes on Bionomics

On May 5 an examination was made of Peterson creek, a very small shallow stream running through a deep gorge near Kamloops.



Peterson Creek, Kamloops, in May. Typical habitat of *Simulium virgatum*.

This stream has a considerable drop, and there are many stony ripples; and here and there small, steep runs through watercress and grass. The vegetation and stones were found to be covered with large numbers of dark, olive-green larvae, the majority of which appeared to be full grown. Pupae were scarce and were nearly all of one species with peculiarly closed horns in place of the usual respiratory filaments. These and the majority of larvae proved to be **Simulium virgatum**.

On May 14, 84 per cent. of the larvae and pupae examined from this stream proved to be this species; pupation had occurred to the extent of 75 per cent. and empty pupal cases showed an emergence of 15 per cent.

On May 26 a number of **virgatum** pupae were placed in rearing cages in the stream, and by the 29th 54 per cent. of these had emerged. Others also emerged from artificial ripples in the laboratory from May 24 to 29.

The same stream was examined on July 6 and it was found that **S. virgatum** had been replaced by another species. Of 220 larvae and pupae worked over, nearly all proved to be one species, and only a single **S. virgatum** pupa was found.

On August 31 210 pupae were examined from this stream, and the majority of these belonged to yet another species from that dominant in July. Only two **Simulium virgatum** were found among them.

On October 19 a single adult female was taken on the window of a shack at Pinantan lake in a collection of 14 specimens, which included four other species.

Scheidam creek, which is a little more permanent but otherwise has much the same character as Peterson creek, was examined on November 2 and was found to contain large numbers of larvae, which were from half to three-quarters grown. Those developed far enough for determination proved to be **S. virgatum**, as were the few pupae occurring in the stream at this time. An adult was taken in the act of emerging.

By December 7 most of Scheidam creek was covered with fairly deep ice, but stones obtained from the running water under this had many larvae attached to them. These were mainly smaller than those noted in November and none was large enough for accurate determination; but from their colouration and the shape of their anal gills, they appeared to be **S. virgatum**. No pupae could be found.

From the above it is evident that this simuliid winters as partly developed larvae, and is an early maturing form in the spring, pupating



Scheidam Creek, Kamloops, in December. Many larvae on stones under ice.

in the first and second week of May, and reaching a peak of emergence from the middle to the end of the month. Following this, the species becomes very scarce during the summer months, until the streams again have large numbers of larvae in them during the autumn and winter months. A certain proportion are able to complete their development and are on the wing in the late autumn.

Descriptions of Stages

Adult Female—The adults are fairly large and measure about 4 mm. The general colour of the female is grey and the legs are bi-coloured with yellow predominating. The fore coxae are yellow and the colouration of the legs in our specimens agrees with previous descriptions except that they lack the narrow ring near the base of the tibiae. The mesonotum has a faint reddish tinge beneath the grey surface pollen. There are three very distinct black stripes, the central one linear and very narrow, and the lateral ones broad, curved and dilated into pear-shaped spots anteriorly, giving a lyre shaped pattern. The mesonotum is closely and fairly uniformly covered with short, fine, pale yellow hairs. The tarsal claws have a short sub-apical tooth. Descriptions with greater detail are given in the references cited.

Male—The general colour is black, the mesonotum being velvety black with two silvery white pear-shaped spots anteriorly, and golden surface hairs somewhat longer than in the female. The general colouration of the legs is as in the female, but the dark portions encroach over larger areas, and the tibiae are darker in our specimens than in previous descriptions.

Pupa—6 mm. long by 2 mm. wide. Thoracic breathing organs in the form of large, closed, hollow horns, with 3 branches; ringed by numerous constrictions and with fine, irregular, longitudinal wrinklins. The two shorter spurs lie closely appressed to the head and thorax respectively; a short, sharply tapered dorsal spur reaching the median line of the mesonotum; and a more slender, slightly flattened one reaching forward to beyond the middle of the head; the third or main portion of the organ extends up and away from the head in a forward and ventral direction; it is large, club-shaped and rounded at the end, and is smoky-grey, whereas the basal ventral branch is yellow. The stout, dark, blunt spines on the abdominal segments are as follows: third segment, 3 in a row on each side dorsally on apex of segment; on 4th and 5th segments, 4 in a row on each side dorsally; ventrally there are four pairs of spines on each side of the median line; on the 5th and 6th segments these are close together, and on the 7th and 8th are widely separated, the outer two being sub-lateral.

The pupal case is yellow, parchment-like and smooth in texture, and very symmetrical. It is 5 mm. long by 3 mm. wide, and the spherical opening is 2 mm. in diameter. It is slightly flattened at the lateral edges where it is attached to vegetation, stones or other support. In a few pupae examined, a cone-shaped cap of webbing enclosed the orifice of the pupal case and held within it the exuviae of the last larva instar; but in the majority no such protective webbing was observed.

Larva—The full grown larva is 10 mm. in length. The body is very dark olive-green in colour, and the head capsule is a dark mahogany brown, so dark as to appear to be without maculations in many cases. The dorsal sclerite, however, sometimes shows slight maculations in freshly changed specimens. There is a median series of about 6 dark spots anterior of the centre, two lateral spots and a darkening at the base and around the edges. The anal gills are in threes, but there may be a number of small "buds" on them; in some cases as many as four to one branch, but usually less. In a few specimens examined these "buds" were not apparent. The peculiarities of the pupal breathing organs are discernable in the histoblasts in well developed larvae and make determination a fairly easy matter. The forwardly protruding portion of the pupal breathing organ shows as a dark grey patch on the side of the larva.

References to *Simulium virgatum* Coquillett

- (1) Coquillett, Proc. U. S. Nat. Mus., Vol. 25, p. 87, 1903.
- (2) Dyar & Shannon, Proc. U. S. Nat. Mus., Vol. 67, p. 39, 1927.
- (3) Johannsen, N. Y. State Mus., Bul. 68, p. 383, 1903.
- (4) Knab, Ins. Ins. Mens., Vol. 2, p. 178, 1914.
- (5) Malloch, U. S. Dept. Agr. Bur. Ent., Tech. Ser. No. 26, pp. 28 and 57, 1914.

Further Additions to the List of Aphids of British Columbia

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IN Nos. 21 and 22 of these Proceedings, published in 1924 and 1925, respectively, sixty-nine species of Aphididae collected in British Columbia were listed with annotations.

Since then further collecting has been done with the result that forty-eight more species have been determined. These are listed below. During the year 1926 aphids of many species were abundant around Agassiz, sixty collections being made by Mr. H. H. Ross and the writer, which resulted in twenty-five species being added to the previous list. Many of the species found that year for the first time have not been seen since, a peculiarity which has often been noted in aphid collecting here.

The present list brings the number of aphid species up to 117, besides which material representing about forty other species has been accumulated but not identified. As to the total number of species present in British Columbia, this is difficult to say, but probably the known number can be doubled, as so far practically all the collecting has been in the humid transition zone only.

I am indebted to Dr. W. M. Davidson, Dr. A. A. Granovsky and Dr. P. W. Mason for assistance in determining certain difficult species.

Tribe **LACHNINI**

Lachnus juniperi (De Geer). On juniper bushes imported from Holland.