NOTES ON THE BIOLOGY OF *CRAMPTONOMYIA SPENCERI* ALEXANDER (DIPTERA: CRAMPTONOMYIIDAE)

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ABSTRACT

Adults of **Cramptonomyia spenceri** were abundant in the lower Fraser Valley, British Columbia, from late February to early April of 1973. Eggs, larvae and pupal skins were found on or in dead fallen stems of **Alnus rubra**. Wing frequency measurements of both sexes indicate that auditory stimuli are not involved in finding of mates.

Cramptonomyia spenceri Alexander 1931 was described from a female collected in Vancouver, B.C. on 30 March, 1930 by the late professor G. J. Spencer. Alexander referred it to the family Bibionidae, but thought that it might belong to the family Pachyneuridae, a family with the single Palaearctic species *Pachyneura elegans* Zetterstedt. In 1965 Alexander referred *Cramptonomyia* to the Pachyneuridae. Hennig (1969) proposed a family Cramptonomyiidae for *Cramptonomyia* and the Japanese species *Harukea elegans* Okada. Krivosheina and Mamajev (1970) described the larva, pupa, male and female of *Pergratospes holoptica*, a third species of the family Cramptonomyiidae and the first of which the immature stages were known. The larvae were found under bark of dead but standing *Maackia amurensis* trees (Leguminosae) in the Ussuri district, Maritime Territory, Siberia. In my opinion all four genera mentioned above are closely related and should be referred to the family Pachyneuridae.

Additional specimens of *C. spenceri* were collected in the University of British Columbia (UBC) Forest, Vancouver by J. K. Jacob, at Langley Prairie, B.C. by K. Graham (Jacob, 1937), and in the campus forest in 1942 by R. E. Foster (UBC collection). Alexander (1965) recorded the species also from Washington and Oregon. He told me (in *litt.*) that he has no record of the Washington locality, but the Oregon specimens were taken by K. E. Fender in northwestern Oregon at Wallace Bridge, 31. III. 1948 and near the coast at Castle Rock, on the Grande Ronde-Hebo highway, 31. III. 1949.

From 28 February to 6 April, 1973 I collected about 400 adult *Cramptonomyia* in the lower Fraser Valley of British Columbia. They were taken mostly at Point Grey (Vancouver), but also on Mt. Seymour (North Vancouver), at Hope and at White Rock, at altitudes from sea level to 400 m. They were taken in moderate numbers in mixed conifer and deciduous forest (Fig. 1) at all these localities, but in large numbers in an almost pure stand of young red alder, *Alnus rubra*, along Chancellor Blvd. on the UBC endowment lands on Point Grey (Fig. 4). The largest numbers were taken here on 20 March which indicates either considerable longevity or a prolonged emergence period. The number of adults at this locality declined rapidly after this date; extensive sweeping on 6 April yielded one male. A woodland where the species was not found was a mixture of *Betula* and *Pinus contorta* on Lulu Island in the Fraser River delta. Twenty min-

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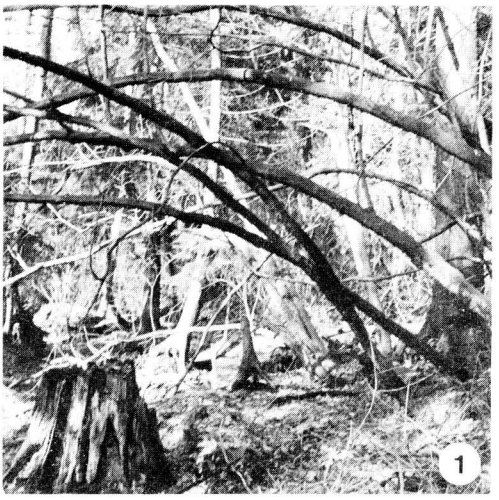
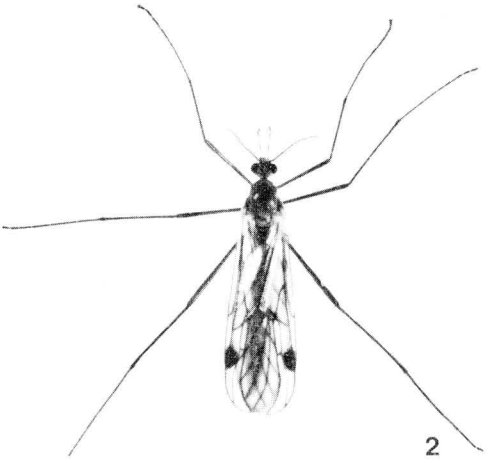
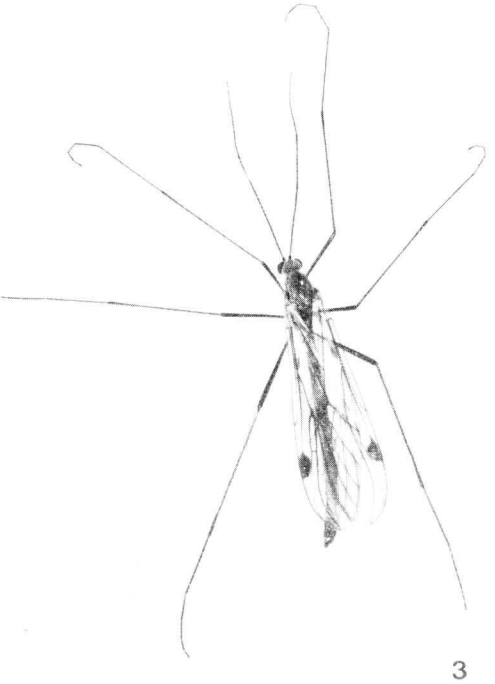






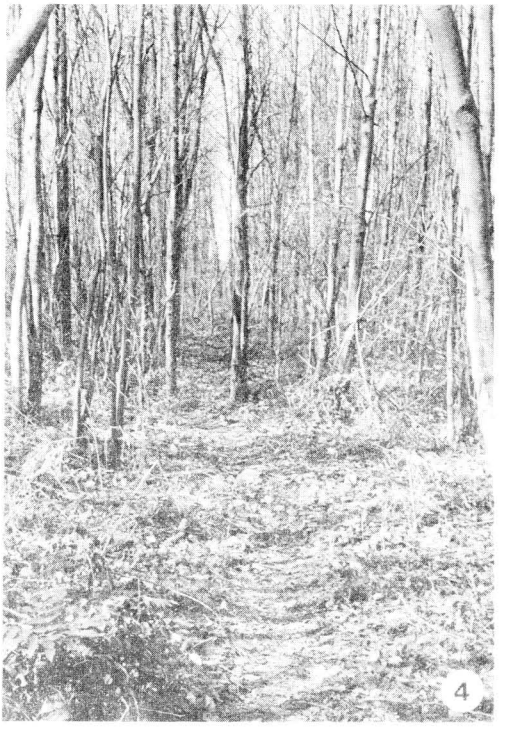


Fig. 1. Mixed conifer and deciduous forest, UBC endowment lands, Point Grey, Vancouver.
Fig. 2. Female of **Cramptonomyia spenceri.**
Fig. 3. Male of **C. spenceri.**
Fig. 4. Pure stand of young red alder, **Alnus rubra,** UBC endowment lands, Point Grey, Vancouver.

utes of sweeping in early March produced no specimens.

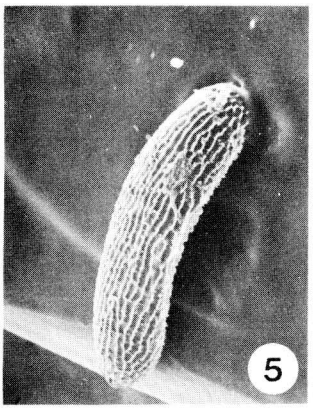
After these collections were made I learned that Mr. William Dean, of Simon Fraser University (SFU), Burnaby, B.C. has for several years taken specimens of *Cramptonomyia* on the windows of the university buildings. He thought the insects were more abundant in 1973 than in previous years. The SFU campus is surrounded by second growth alders but these are mostly several hundred meters away so it appears that the flies sometimes leave the forested areas where they breed.

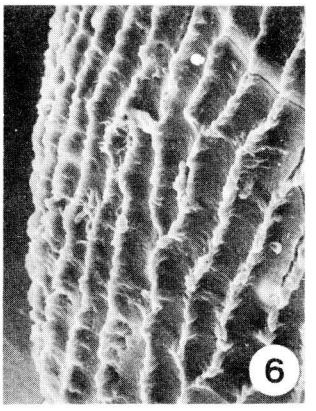
Females confined in vials with pieces of rotten wood laid from one to 66 eggs each. Fallen alder stems, referred to here as logs, from the stand on Chancellor Blvd. were found to have many eggs on the surface. The logs varied in diameter from 3 to 12 cm. Eggs occurred on all surfaces of the logs; most were in crevices or along the edges of broken pieces of bark, but some were on bare wood or on unbroken bark. The logs ranged in condition from quite hard to rather soft and rotten. The eggs were laid singly but the density varied considerably. The greatest abundance observed was 54 on one log 35 cm in length and about 5 cm in diameter. Four dead standing trunks were examined but the single egg found was about 3 cm above the ground. Eggs (Figs. 5-7) are orange-brown, 0.95 mm long and 0.25 mm in greatest width. The surface is very strongly sculptured.

A first instar larva (Fig. 8) was found on 29 April on a log stored at 6°C for about one month. By 8 May logs from the field had approximately 90% of the eggs hatched; one hatched on that date while the log was being examined. The age of the eggs was not known but since they were abundant in late March the incubation period under field conditions is probably at least six weeks. Larvae could usually be found near empty egg shells either in a shallow burrow under nearby bark or, if no bark was present, in a burrow about 1 mm below the surface of the wood. On 18 June empty egg shells and larvae, apparently still in the first instar, were found on field-collected logs.

In late March two larger larvae, 11.8 and 12.2 mm long, were found in alder logs. The position in the logs was not determined. These larvae were about the same length as the adults. Mature larvae of the Siberian *Pergratospes* are about twice as long as adults, so these *Cramptonomyia* larvae were probably about half grown. It seems probable therefore that the life cycle takes at least two years.

During late March and early April empty pupal skins were found protruding from alder logs. The two larvae mentioned, and the pupal skins, are almost identical with those described for *Pergratospes* and are therefore undoubtedly those of *C. spenceri*. About the anterior third of the pupal skin protrudes from the tunnel, which runs parallel to the surface of the wood and about 2 mm below it. The tunnel is clear for about 2 cm and is then packed with frass. At the outer end of the frass the head capsule and sometimes the cast larval skin of the last instar can be found. Pupal skins were found only in logs soft enough to be broken easily by hand. Dr. R. S. Smith, Western Forest Products Laboratory, Department of the Environment, Vancouver, examined several of these and estimated that they had been on the ground for at least three and possibly four years. Pupal skins were found in logs ranging from 3.1 to 11.3 cm in diameter.





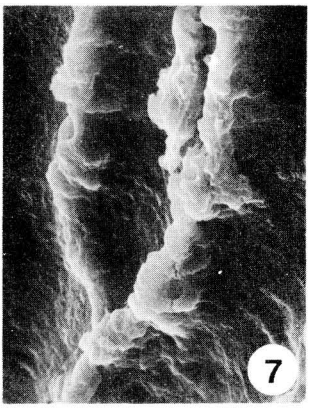


Fig. 5. Egg of **C. spenceri** (stereoscan photograph, X 55).
Fig. 6. Surface of egg of **C. spenceri** (stereoscan photograph, X 275).
Fig. 7. Surface of egg of **C. spenceri** (stereoscan photograph, X 1100).
Fig. 8. First instar larva of **C. spenceri** in opened burrow.

Almost all adults taken were swept from vegetation up to about 1 m above the ground. A few were seen flying slowly at heights up to about 2 m. Consistently more males than females were collected; the most marked imbalance was 113 males and 7 females collected on 20 March. However, the pupal skins of 23 males and 19 females were found, so it is probable the sexes are produced in about equal numbers.

Mating was not observed. The antenna of the male (Fig. 4) is very much longer than that of the female (Fig. 3). I thought it possible that the male antenna might function as

an auditory organ which would respond to the sound produced by the female during flight. Dr. Peter Belton, Department of Biological Sciences, SFU, determined the wing frequency of two specimens of each sex. He gave me the following information:

Sound was recorded with a Sony ECM condenser microphone and a Sony 355 tape deck at a temperature of 21 ± 1°C. Owing to the low frequency of the wing beat, sound pressure showed above the noise level only when the insects were within about 2 cm of the microphone (±56 db SPL). Frequency of individuals varied about 5% during flight. Males and females flying together could not be distinguished by an experienced human ear. Three readings for each of the four specimens gave the following averages: male 1, 74 Hz; male 2, 52 Hz; female 1, 60 Hz; female 2, 56 Hz. In those Diptera Nematocera (e.g. some Culicidae, Chironomidae, Ceratopogonidae) in which males respond to auditory stimuli produced by the females, the wing frequency of the sexes is markedly different. It is therefore very unlikley that the males of *Cramptonomyia* respond to auditory stimuli from the females.

In *Pergratospes holoptica* the eyes of the male are much larger than those of the female and visual recognition in flight is probably involved in the finding of a mate. The eyes of both sexes of *Cramptonomyia* are of about the size of those of the female of *Pergratospes* so it is unlikely that the male recognizes the female in this manner.

The long male antennae may carry chemoreceptors which respond to a pheromone produced by the female. The female palpi are about twice as long as those of the male, an unusual and possibly even unique condition in the Nematocera, but their function is unknown. Further observations are required to determine the reasons for the marked sexual dimorphism in the length of antennae and palpi.

Acknowledgements

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