Effect of the parasite Wohlfahrtia vigil on Microtus townsendii populations

RUDY BOONSTRA
Institute of Animal Resource Ecology, University of British Columbia, 2075 Westwood Place, Vancouver, B.C., Canada V6T 1W5

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This paper gives the first record of W. vigil parasitizing a wild species in Canada. The incidence of parasitism of the voile M. townsendii was at a maximum from August to mid-September. Of 199 voles observed during this time, 5.4% were parasitized, and all age-classes were equally susceptible. Parasitism by W. vigil appeared to be facilitated by the presence of botflies (Cuterebra spp.). Survival of voles parasitized by W. vigil was severely affected, with only 5% living 2 weeks later.


Cet article a pour objet de montrer pour la première fois qu'il se trouve des W. vigil parasitant une espèce sauvage au Canada. Le parasite est à son paroxysme chez M. townsendii, du début d'août au milieu de septembre. De 199 campagnols examinés à ce moment, on a trouvé des parasites chez 5.4%; toutes les classes d'âge sont également susceptibles d'être parasitées. Le parasite par W. vigil semble être favorisé par la présence d'anisés (Cuterebra spp.). La survie des campagnols parasités par W. vigil se trouve fortement altérée puisque seuls 5% des individus affectés vivaient encore après 2 semaines.

During a study of the dynamics of Microtus townsendii populations in the Vancouver area, voles parasitized by the grey flesh fly (Wohlfahrtia vigil Walker) were caught. This digerous fly causes cutaneous myiasis in a number of animals, particularly in domesticated species such as mink, fisher, ferrets, fox, rabbits, dogs, and cats (Kingscote 1935; Strickland 1949; Lopushinsky 1970) as well as in man himself (Walker 1931; Haupe and Nelson 1957; Stabler et al. 1962). Little is known about the natural hosts of this fly, and this paper presents the first record of an infestation in a wild species in Canada. The only previous observation of such parasitism of wild animals is of nesting cotton-tails in Pennsylvania (Bezue 1940). Records of W. vigil parasitism have been obtained throughout southern Canada and northern United States (Faust et al. 1975). Although incidents of parasitism by the fly have not been published for the Vancouver area, the Spencer Entomological Museum at the Univer-

Identification was made from two reared adults by B. Cooper, Biosystematics Research Institute, Ottawa.
<table>
<thead>
<tr>
<th>Grid</th>
<th>July 21-31</th>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>7 (328)</td>
<td>19 (866)</td>
<td>21 (1058)</td>
<td>3 (342)</td>
</tr>
<tr>
<td>Inrbc</td>
<td>1 (196)</td>
<td>18 (318)</td>
<td>25 (545)</td>
<td>2 (192)</td>
</tr>
<tr>
<td>Ershorn</td>
<td>1 (121)</td>
<td>2 (110)</td>
<td>10 (330)</td>
<td>1 (100)</td>
</tr>
<tr>
<td>Femile</td>
<td>1 (118)</td>
<td>8 (225)</td>
<td>8 (354)</td>
<td>0 (140)</td>
</tr>
<tr>
<td>Total</td>
<td>10 (996)</td>
<td>47 (1742)</td>
<td>82 (2287)</td>
<td>3 (674)</td>
</tr>
<tr>
<td>%</td>
<td>1.0</td>
<td>2.7</td>
<td>2.7</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Two of three animals were caught with larvae twice during August within 1 week of their initial capture.

Table 1. Number of *M. truncatula* infected with *W. sigil* in 1975 on Westham Island, British Columbia. Total catch, which includes recaptures, is shown in parentheses.

Parasitism by larvae of *W. sigil* were brought back to the lab and either autopsied or placed in plastic containers, where the larvae completed their development and pupated.

Although incidences of parasitism were recorded from three different trapping areas around Vancouver, only the data collected in 1975 at Westham Island will be analyzed in detail. The earlier data are inaccurate because the voles were simultaneously parasitized by bottlenecks (*Cricetulus sp.*), which produce subcutaneous lesions similar to appearance to those produced by *W. sigil*. A distinction was not always made between the two parasite species, with most incidences of infestation being ascribed to the more frequent bottly parasite. The earliest seasonal date of parasitism by the grey mouse fly was June 12, 1975; all other cases occurred between July 22 and October 14. In other studies, June and July were the main months of parasitism, and in no case was infestation ever reported as late as October (Lopushinsky 1970). The incidence of infestation was at a maximum during August and the first half of September.

I allowed all larvae which came from voles killed by *W. sigil* to pupate to verify species identification when the adults emerged. Of those which emerged in the same year that the vole had been parasitized, the average length of the pupal stage at room temperature was 20.6 days ± 0.6 (SE) (n = 19, range 18–29), which is about 10 days longer than that reported by Faust et al. (1975); the reason for this difference is unknown. In three cases, larvae which pupated in August and September 1975 did not emerge until the first 2 weeks of May. If this is also the time adults emerge in the field and if the maximum life-span of the adult flies is 53 days (Ford 1956), a recrudescence of parasitism on June 12 is reasonable.

More instances of parasitism in May and June could have been expected, but for the reason stated below did not occur.

Of the 1933 animals known to be alive during the period of maximum infestation (Table 1), 104 (5.4%) were parasitized by *W. sigil*. This figure is probably an underestimate because the development time for the larvae is 7–9 days (whereas our trapping interval was generally 14 days so that an infested vole could have been missed), because the probability of capture of animals in any trapping session was low (50–70%), and because of errors in identification.

Previous studies suggested that primarily younger animals were affected by this fly (Kingscote 1955; Strickland 1949; Lopushinsky 1970). However, I found that the frequency of parasitism was distributed according to the frequency of the various size classes in the trappable population ($x^2 = 3.70, df 5, not significant$) (Table 2). During the summer of 1975, few animals were breeding (Boonstra 1976), and few postweaning voles were exposed to these flies. This segment of the population may be more susceptible to parasitism by *W. sigil*, but adults and subadults are certainly not immune.

*Wooliella sigil* may be able to parasitize the older voles because of the presence of bottlenecks. Bottly larvae create holes in the skin through which *W. sigil* larvae are able to pass; perhaps bottles also make the skin so tender that entry into older voles is easier. Figure 1 shows that the incidence and timing of bottly parasitism and *W. sigil* parasitism are closely associated. The correlation between the frequency of bottly parasitism and the frequency of *W. sigil* parasitism for all four grids is moderately good ($r = 0.54, n = 40, P < 0.001$). A number of *W. sigil* larvae were often found in the same lesion with a bottly larva. Throughout the summer, 32–20%
(n = 121) of the voles infested with W. sigil were simultaneously infested with bothy larvae. The frequency of this association was significantly higher (P = 0.003) than that of voles infested with bothy larvae in the general population during the period from August to mid-September (21.7%; infested, n = 2466). Nevertheless, few voles were infested with bothy larvae at the same time. Susceptibility to parasitism by W. sigil may depend on prior infestation with a bothy. The evidence suggests that the presence of bothy larvae facilitates parasitism by W. sigil. However, it is not obligatory, because the case of parasitism by W. sigil in June occurred about 1 month before the first bothy infestation.

Of the 121 animals caught in 1975 that were infested with W. sigil, only 6 were known to be alive 2 weeks later (a minimum 2-week survival rate of 0.65). This compares with a survival rate of 0.66 per 2 weeks for the control population during the period from August to mid-September. Therefore, an animal parasitized by W. sigil is almost certain to die. Voles parasitized by this fly were sometimes found dead or dying in the traps. Larvae were found feeding on body tissues in the inguinal region, along the hind legs, and along the lower portion of the back. Death of the vole often appeared to result from extensive hemorrhaging. Penetration of the abdominal cavity was also found in animals that had just died. The minimum number of larvae necessary to kill a vole was one (in this case the larva had cut the femoral artery of the vole, with the average number of larvae per infested vole being 14.5 ± 2.9 (SE) (n = 22, range 1-58). Kingscote (1935) reported that 5-20 W. sigil larvae were sufficient to kill the young of a number of species. The larvae do not appear to require a living host to complete their development. Several of the dead voles that had large numbers of larvae were reduced to hair and bones within a few days of being put into plastic containers.

There may be interspecific competition between bothy and W. sigil. I have no evidence that W. sigil kill bothy larvae directly. However, by killing voles that are simultaneously parasitized by bothy fly larvae, W. sigil may remove the food supply from the bothy larvae. Bothy larvae cannot develop in dead voles, as W. sigil larvae can, and so, if the bothy larvae are too young when the vole dies, they also die.

The effect of W. sigil on the population was probably relatively minor because of its low incidence. Over half the population disappeared per month during the summer even when the proportion of the total less estimated to be caused by W. sigil was eliminated. The cause of the poor summer survival was part related to the presence of bothy parasitism. For example, during the summer bothy season, males on the control grid which were not infested with bothy fly larvae had a minimum 2-week survival rate of 0.69 compared with 0.50 for males infested with bothy fly larvae (χ² = 11.37, P < 0.001) (Koonstra, unpublished data). Females showed the same differences. However, Iverson and Turner (1968)
found that botflies had no effect on survival. The vole may serve as a major host species for W. nigripalpis in this area, sustaining populations of this fly which may then secondarily infest man and his domestic animals.

Acknowledgments

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