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Source: Journal of Wildlife Diseases, 20(4) : 347-348

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-20.4.347

Journal of Wildlife Diseases, 20(4), 1984, pp. 347–348

Attempt to Determine Species of *Protostrongylus*-type (Nematoda: Protostrongylidae) Infective Larvae Based on Total Body Length

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In western North America, it is common to find sympatric populations of mule deer (*Odocoileus hemionus* (Rafinesque)), Rocky Mountain bighorn sheep (*Ovis canadensis canadensis* Shaw), and snowshoe hares (*Lepus americanus* Erxleben). These hosts are frequently infected with the lungworms *Orthostrongylus macrotis* (Dikmans, 1931), *Protostrongylus stilesi* Dikmans, 1931 and/or *Protostrongylus rushi* Dikmans, 1937, and *Protostrongylus boughtoni* Goble and Dougherty, 1943, respectively (Worley and Eustace, 1972, Proc. Helminthol. Soc. Wash. 39: 135–138; Hibler et al., 1982, *In* Diseases of Wildlife in Wyoming, 2nd Ed., Thorne et al. (eds.), Wyoming Game and Fish Department, Cheyenne, Wyoming, pp. 208–213; Olsen, 1954, Proc. Helminthol. Soc. Wash. 21: 52). These parasites can use the same genera or species of terrestrial gastropods as intermediate hosts. The morphologic characteristics of third-stage (infective) larvae of these species are difficult to study in detail and are superficially similar due to the presence of an enveloping, dark brown, rugose "sheath," which is the modified first-stage cuticle. If the species of infective larvae could be determined by measurement of total body length of specimens recovered from naturally infected snails, studies on the transmission of these lungworms would be facilitated.

To determine the feasibility of this procedure, laboratory-reared *Vallonia pulchella* (Müller) were exposed to first-stage larvae from the feces of naturally infected bighorn sheep (*P. stilesi* and/or *P. rushi*), or mule deer (*O. macrotis*), or larvae recovered from the lungs of naturally infected snowshoe hares (*P. boughtoni*) (see Kralka and Samuel, 1984, Can. J. Zool. 62: 473–479, for snail exposure and culture techniques). Later, infective larvae were teased from the snail feet into 0.85% saline, then fixed in steaming glycerin-alcohol (5% glycerin in 70% EtOH). The fixative was evaporated to pure glycerin and larvae were examined as whole mounts, without removing the dark outer cuticle. Total lengths of 20 larvae from each group were measured using a drawing tube and measuring wheel.

The infective larvae differed significantly in length (Kruskal-Wallis $H = 58.28$; $P < 0.001$). However, measure-

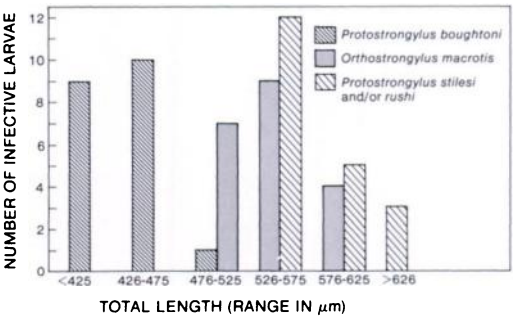

FIGURE 1. Ranges of total body length of three species of infective *Protostrongylus*-type larvae. (*Protostrongylus boughtoni* measurements from Kralka and Samuel, 1984, Can. J. Zool. 62: 473–479.)

Received for publication 14 March 1984.

ments overlapped (Fig. 1). The maximum length of *P. boughtoni* (range = 380–500 μm) fell below the range of larvae of *Protostrongylus* spp. from bighorn sheep (527–673 μm), but overlapped with that of *O. macrotis* (488–611 μm). Also, maximum length of *O. macrotis* overlapped with the range of *Protostrongylus* spp. from bighorns. Therefore, where the three definitive hosts are sympatric, only infective larvae in the extremes of the total length range for all species can be identified with confidence. Larvae of *P. boughtoni* can be distinguished from those of *Protostrongylus* spp. from bighorns if there is no possibility of *Orthostrongylus* larvae occurring in a sample.

Although total length is not the most consistent morphologic basis on which to separate species of helminths, such a method is attractive in its simplicity and adaptability to field studies. Third-stage larvae of some species in the confamiliar genus *Parelaphostrongylus* differ in tail structure (Ballantyne and Samuel, 1984, J. Parasitol. In press). Specific structural differences may be found among *Protostrongylus* and *Orthostrongylus* infective larvae, but rapid examination of fine morphological details is prevented by the nearly opaque first-stage cuticle. Removal of this cuticle without damaging the larva inside, though not impossible, is extremely difficult and time-consuming.

We wish to thank Brent Gray and Judith Samson for assistance in exposing and maintaining snails. This study was supported by the Alberta Fish and Wildlife Division, and the Natural Sciences and Engineering Research Council of Canada.

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Skrjabingylus chitwoodorum Hill, 1939 (Nematoda: Metastrongyloidea) in Striped Skunks from Northcentral Minnesota

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The nematode *Skrjabingylus chitwoodorum* occurs in the frontal sinuses of striped skunks (*Mephitis mephitis* Schreber) and causes progressive deformation of the frontal region of the cranium. The frequency of lesions and degree of deformation were related to relative age and geographic distribution of skunks (Kirkland and Kirkland, 1983, Can. J. Zool. 61: 2913–2920). There are, however, no published accounts relating skull lesions to actual ages of striped skunks, nor is there documentation of how numbers of worms relate to age and degree of deformation. This note presents age-specific documentation of prevalence of lesions and numbers of adult *S. chitwoodorum* in the frontal sinuses of striped skunks from a forested region in northcentral Minnesota.

Skunks were collected in the northeastern portion of Itasca County, Minnesota (47°52′N, 93°22′W). In Grand Rapids, 50 km southwest of the study area, mean January temperature is −14 C, and in July the mean is 19 C (U.S. Dept. Commerce, unpubl. data). Snow cover is usually present from December through early April, and during the winters of 1970–1971 through 1982, mean January–March snow depth was 46 cm. Total annual precipitation averages 29.9 cm.

Received for publication 25 April 1984.