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Incidence and Effects of Botfly Parasitism in the Eastern Chipmunk [1]

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Abstract

Comparison of bot-infested and bot-free chipmunks collected during 1966-1969 revealed no significant differences in rate of infestation among sex-age classes. Splenomegaly and thymic involution were associated with bot infestation, and adrenal weights were greater in bot-infested adult females. Parasitized animals of all sex-age classes tended to be larger than non-parasitized individuals, and reproductive organs were heavier in infested adults of both sexes. Evidence of bot-induced mortality was not found, but results indicate the possibility of differential loss of bot-infested animals from the population.

Parasitism by botfly *(Cuterebridae)* larvae is a common phenomenon in natural populations of the eastern chipmunk *(Tamias striatus)*, and the incidence of bot infestation may vary widely in different years and locations.[1,2,6,10,11] Bennett[1] concluded that cuterebrid larvae have little effect on the host except possibly through secondary infection following larva emergence. Accumulating evidence in other species, however, indicates that effects of bot infestation on host populations may be more severe than previously was believed.[7] During a long-term population study of the eastern chipmunk, data were obtained in order to further examine host - parasite interrelationships in this species.

Materials and Methods

During March-November, 1966-1969, a total of 162 chipmunks was shot on a 114 acre area in Wayne county, northeastern Pennsylvania. Animals were autopsied and skins were removed and inverted to examine for scars due to bot emergence. Relative age was assigned on the basis of reproductive development. Males having flaccid, brownish testes with thickened, wrinkled tunicae albuginea were classed as mature but with regressed testes. Those having small, light-colored testes with thin, unwrinkled tunicae albuginea were considered immature. Females with clear evidence of uterine growth, uterine scars, or which were pregnant were classed as mature. Uteri of immature females were thin and undeveloped. Organs were weighed following fixation in 10 per cent neutral buffered formalin.

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Results

The earliest and latest observations of infestation by botfly larvae were made on August 7, 1966 and October 12, 1967, respectively. Seasonal incidence of parasitism was comparable for each year, as were mean organ and body weights, and data for 1966-1969 therefore were combined for analysis. The overall incidence of cuterebrid infestation was 51 per cent (Table 1), and there were no significant differences in rate of infestation among sex and age classes. Bi-weekly incidence of infestation was: August 1-15 — 4/11, August 16-31 — 6/8, September 1-15 — 23/30, September 16-30—9/19, October 1-15 — 5/26. Infestation by a single larva occurred more often than multiple infestations (35/47 = 1 larva; 8/47 = 2 larvae; 1/47 = 3 larvae; 3/47 = 4 larvae). Scars indicating recent emergence of larvae were observed in eight animals (2 immature males, 4 immature females, 2 adult females); one wound was purulent.

TABLE 1. *Incidence of bot infestation by sex-age classes in eastern chipmunks during August 7 October 12, 1966-1969.*

	Adult		Immature	
	Male	Female	Male	Female
Bot-free	7	7	17	14
Bot-infested	6	4	16	21
Total	13	11	33	35

Organ and body weights and body lengths of bot-infested and bot-free chipmunks are shown in Table 2. Only animals killed each year during the period of observed cuterebrid parasitism in the population were used in statistical analyses. Two-way analyses of variance revealed that body weight and length of head and body were significantly greater in parasitized individuals ($P < 0.001$ in both cases). Since all chipmunks were weighed after removal of larvae, the difference in body weight is independent of larval weights. Thymus weights also were less ($P < 0.025$) and spleen weights greater ($P < 0.001$) in animals parasitized by botfly larvae. Splenomegaly observed in bot-infested *Peromyscus leucopus* has been attributed to increased hemopoietic activity in splenic red pulp.[4,9] Consistent with previous observations (Cosgrove, personal communication) in the grey squirrel *(Sciurus carolinensis)*, splenomegaly in the present study was not associated with extramedullary hemopoietic activity.

Weights of testes and uteri were not significantly different in bot-free and bot-infested immature animals, but these organs were heavier in bot-infested adults ($P < 0.05$ in both cases). Consistent histological differences between testes of bot-free and bot-infested males were not apparent for either age class. Adrenal glands also were heavier in parasitized adult females ($P < 0.01$). Relative adrenal enlargement was not attributable to differences in reproductive condition, since all but one adult female (bot-infested as well as bot-free) showed evidence of recently having weaned a litter (teats were enlarged but not recently suckled). Two pregnant, bot-free females were collected during the period of observed bot infestation in the population, but no pregnant, bot-infested females were found.

Discussion

Differences observed in incidence of infestation by cuterebrid larvae among sex and age classes in chipmunk populations are inconsistent. Bennett[1] recorded a higher rate of infestation in adult males (as compared to other sex-age classes), while Dorney[6] reported that immature animals were parasitized more frequently than adults. In the present study, bot infestation was independent of sex and relative age. However, evidence indicates that larger animals of all sex and age classes were more susceptible to bot infestation. If it is assumed that larger

TABLE 2. *Body size and organ weights (mean ± SE) in bot-infested and bot-free Eastern Chipmunks. Sample size is given in parenthesis.*

	Body Weight (g)	Head & Body Length (mm)	Adrenals (mg/100 g)	Spleen (mg)	Testes (mg)	Thymus (mg)	Uterus (mg)
Bot-free							
Adult							
Male	81.0±4.1 (7)	141.0±5.4 (7)	64.7±4.7 (7)	231.2±25.9 (6)	97.9±8.9 (6)	81.0± (1)	———
Female	87.8±4.6 (7)	148.4±4.4 (7)	59.9±6.6 (5)	238.3±29.6 (6)	———	59.1±14.1 (5)	57.3±10.6 (4)
Immature							
Male	76.0±3.5 (17)	143.8±3.7 (17)	59.5±5.3 (15)	293.6±31.5 (14)	48.6±6.9 (14)	85.6±24.4 (9)	———
Female	76.2±4.4 (14)	146.4±4.6 (14)	56.2±3.2 (14)	269.1±33.2 (11)	———	126.4±20.6 (11)	14.7±1.5 (12)
Bot-infested							
Adult							
Male	92.8±1.2 (6)	156.0±6.0 (6)	58.4±3.8 (6)	386.4±103.2 (4)	130.7±22.1 (5)	58.5±2.5 (2)	———
Female	87.5±8.9 (4)	151.7±9.5 (4)	118.8±14.2 (4)	211.3±33.0 (3)	———	37.0±27.0 (2)	96.7±12.3 (4)
Immature							
Male	81.3±2.8 (16)	149.3±3.0 (15)	61.1±3.3 (14)	437.6±33.0 (15)	41.6±4.2 (13)	61.0±14.3 (6)	———
Female	84.9±2.8 (21)	148.4±3.0 (21)	58.8±3.1 (20)	453.2±43.8 (19)	———	70.9±9.6 (11)	13.8±1.4 (14)

individuals tend to be more active, these results may be consistent with the interpretation[1,3,6] that behavioral differences influence exposure to botfly parasitism.

Physiologic effects of cuterebrid parasitism upon individual animals and host populations are poorly understood, and species differences probably exist.[7,9] Consistent with previous findings in *Microtus pennsylvanicus*[5] and *P. leucopus*,[4,9] bot infestation in chipmunks was associated with splenomegaly and thymic involution. As indicated by body size and organ weights and histology, parasitism did not inhibit growth and reproductive development. Although mean adrenal gland weights were significantly heavier only in bot-infested adult females, thymic involution observed in all sex-age classes probably reflects an increase in adrenocortical activity related to bot infestation. Significant adrenal enlargement in post-lactating females further may indicate that bot infestation produces a more severe pathologic response in these individuals.

Relatively few chipmunks (as compared to the total number of bot-infested animals) bore either recent or old scars indicating larva emergence, suggesting that there may have been selective loss of bot-infested animals from the population. In contrast to previous reports, Miller and Getz[8] also found that bot-infested *P. leucopus* disappeared from a population at a higher rate than did non-infested animals. Whether differential loss of bot-infested chipmunks might be due to mortality or movement is not known.

Literature Cited

1. BENNETT, G. F. 1955. Studies on *Cuterebra emasulator* Fitch 1856 (Diptera: Cuterebridae) and a discussion of the status of the genus Cephenemyia Ltr. 1818. Can. J. Zool. 33: 75-98.
2. BLAIR, W. F. 1942. Size of home range and notes on the life history of the woodland deer-mouse and eastern chipmunk in northern Michigan. J. Mammal. 23: 27-36.
3. CATTS, E. P. 1965. Host-parasite interrelationships in rodent bot fly infections. Trans. N. Am. Wildl. Nat. Res. Conf. 30: 184-195.
4. CHILDS, H. E., and G. E. COSGROVE. 1966. A study of pathological conditions in wild rodents in radioactive areas. Am. Midland Natur. 76: 309-324.
5. CLOUGH, G. C. 1965. Physiological effect of botfly parasitism on meadow voles. Ecology 46: 344-346.
6. DORNEY, R. S. 1965. Incidence of botfly larvae *(Cuterebra emasculator)* in the chipmunk *(Tamias striatus)* and red squirrel *(Tamiasciurus hudsonicus)* in northern Wisconsin. J. Parasitol. 51: 893-894.
7. DUNAWAY, P. B., J. A. PAYNE, L. L. LEWIS, and J. D. STORY. 1967. Incidence and effects of *Cuterebra* in *Peromyscus*. J. Mammal. 48: 38-51.
8. MILLER, D. H., and L. L. GETZ. 1969. Botfly infections in a population of *Peromyscus leucopus*. J. Mammal. 50: 277-283.
9. PAYNE, J. A., and G. E. COSGROVE. 1966. Tissue changes following Cuterebra infestation in rodents. Am. Midland Natur. 75: 205-213.
10. SETON, E. T. 1929. *Lives of Game Animals*. Vol. 4. Doubleday, Doran and Co., New York. pp. 184-215.
11. WECKER, S. C. 1962. The effects of botfly parasitism on a local population of the white-footed mouse. Ecology 43: 561-565.