

Parasites of the greater shearwater (*Puffinus gravis*) from Newfoundland, Canada

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Received May 29, 1979

BOURGEOIS, C. E., and W. THRELFALL. 1979. Parasites of the greater shearwater (*Puffinus gravis*) from Newfoundland, Canada. *Can. J. Zool.* 57: 1355-1357.

Two groups of ectoparasites (Mallophaga and Acarina) and two groups of helminths (Cestoda and Nematoda) were recovered from 49 *Puffinus gravis* collected off the coast of insular Newfoundland, in 1974 and 1975. Mallophagans of the genera *Ancistrana*, *Austromenopon*, *Docophoroides*, *Halipeurus*, *Naubates*, *Saemundssonina*, and *Trabeculus*, and acarines belonging to the genera *Brephosceles*, *Microspalax*, and *Zachvatkinia* were recovered. Of the 10 genera and 12 species collected, 3 genera (*Docophoroides*, *Microspalax*, *Zachvatkinia*) and 2 species (*Saemundssonina peusi*, *Halipeurus diversus*) had not previously been recorded on this host.

Cestodes of the genus *Tetrabothrius* and nematodes of the genera *Contracaecum*, *Seuratia*, *Stegophorus*, *Tetrameres*, and the subfamily Dicheilonematinae were also obtained. Before this study no nematodes had been recovered from this host.

Details of the degree of infestation of the birds are given, as well as the distribution of each ectoparasite species on the host.

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Des parasites appartenant à deux groupes d'ectoparasites (mallophages et acariens) et à deux groupes d'helminthes (cestodes et nématodes) ont été trouvés chez 49 *Puffinus gravis* capturés sur les côtes de l'Île de Terre-Neuve, en 1974 et 1975. Les mallophages recueillis appartiennent aux genres *Ancistrana*, *Austromenopon*, *Docophoroides*, *Halipeurus*, *Naubates*, *Saemundssonina* et *Trabeculus*, et les acariens appartiennent aux genres *Brephosceles*, *Microspalax* et *Zachvatkinia*. Des 10 genres et 12 espèces rencontrés, 3 genres (*Docophoroides*, *Microspalax* et *Zachvatkinia*) et 2 espèces (*Saemundssonina peusi* et *Halipeurus diversus*) sont nouveaux chez cet hôte.

Des cestodes du genre *Tetrabothrius* et des nématodes des genres *Contracaecum*, *Seuratia*, *Stegophorus*, *Tetrameres*, et de la sous-famille des Dicheilonematinae ont également été trouvés. Avant cette étude, jamais on n'avait rencontré de nématodes chez cet oiseau.

On trouvera également dans ce travail des précisions sur la gravité du parasitisme ainsi que sur la répartition chez l'hôte des diverses espèces d'ectoparasites.

[Traduit par le journal]

Introduction

The shearwaters (Procellariiformes: Procellariidae) are cosmopolitan in their distribution, occurring in all the major oceans of the world, with most species breeding south of the equator. Godfrey (1966) lists 10 species that have been reported in Canada. These birds are basically pelagic and spend their winter (nonbreeding season) wandering the oceans, with several species appearing off the coast of Newfoundland.

No quantitative work has been done on the metazoan parasites of any bird of this subfamily, although the ectoparasites are reasonably well known. In view of this apparent lack of published material, a study was initiated in 1975 to determine the parasite burden of the greater shearwater (*Puffinus gravis* (O'Reilly)). It was hoped that the work would provide much needed baseline data on this aspect of the biology of this bird.

Materials and Methods

Forty-seven *P. gravis* were collected (shot, 12-gauge shotgun) in Notre Dame Bay, Newfoundland (41 during August 20-30 and 6 in the period December 1-6, 1975). One other bird was taken from a fishing net at Witless Bay in June, 1975, while another was found dead on the beach at Portugal Cove South in the summer of 1974.

Each bird was placed in a plastic bag, packed in ice, and later frozen for future examination. Forty-nine birds were examined for helminths and feathermites, while 48 were examined for Mallophaga. All parasites were removed, preserved, and stained according to the methods described by Eveleigh and Threlfall (1976) and Andrews and Threlfall (1975).

Taxonomic designations follow the works of Baer (1954), Dubinin (1949), Johnston and Mawson (1945), Mendonça and Rodrigues (1968), Peterson (1971), Price and Clay (1971), and Timmerman (1965). Data were analysed using $2 \times K$ contingency tests.

Results and Discussion

Two groups of ectoparasites, namely Mallophaga (adults and nymphs of six genera, adults

TABLE 1. Metazoan parasites recovered from greater shearwaters from Newfoundland

Parasite	No. birds infested or infected, %	No. parasites per infested or infected bird		Total parasites collected	Most common location on or in bird
		Range	Mean		
Mallophaga					
Ichnocera					
<i>Trabeculus hexakon</i> (Waterson, 1914)	46(96)	1-69	25	1158(328 M, 319 F, 511 N)	Head, neck (yielded 93% of specimens)**
<i>Saemundssonina peusi</i> (Eichler, 1949)	11(23) ^a	1-45	11	131(30 M, 34 F, 67 N)	Head, neck (74%)*
<i>Halipeurus gravis</i> Timmerman, 1961	41(85)	1-18	7	274(64 M, 210 F)	Back, breast, wing (89%)**
<i>Halipeurus diversus</i> (Kellogg, 1896)	15(31) ^a	1-8	2	29(15 M, 14 F)	Breast*
<i>Halipeurus</i> spp. Nymphs	46(96)	1-30	11	490	Back, breast, wing (90%)**
<i>Naubates harrisoni</i> (Bedford, 1930)	36(74)	1-14	4	134(21 M, 21 F, 92 N)	Breast, wing (55%)**
<i>Docophoroides</i> sp.	1(2) ^a	1	1	1(1 F?)	Breast
Amblycera					
<i>Austromenopon paululum</i> (Kellogg & Chapman, 1899)	33(69)	1-12	2	144(39 M, 51 F, 34 N)	Breast, wing (59%)**
<i>Ancistronea vagelli</i> (J. Chr. Fabricius, 1787)	1(2)	6	6	6(5 F, 1 N)	Breast
Acarina					
<i>Brephosceles puffini</i> Peterson, 1971	31(63)	— ^b	—	—	Breast**
<i>Brephosceles parvatus</i> Peterson, 1971	16(33)	—	—	—	Breast**
<i>Microspalax manicata</i> Megnin & Trouessart, 1884	30(61) ^a	—	—	—	Wing**
<i>Zachuatinia</i> sp.	23(47) ^a	—	—	—	Wing**
Cestoda					
<i>Tetrabothrius</i> sp.	48(97)	1-several hundred			Duodenum and small intestine
Nematoda					
<i>Seurati shipleyi</i> (Stossich, 1900)	17(35) ^a	1-7	2	34(14 M, 20 F)	Proventriculus
<i>Tetrameres</i> sp.	1(2) ^a	1	1	1 F	Proventriculus
<i>Stegophorus</i> sp.	38(77) ^a	1-38	8	310(97 M, 202 F, 11 larvae)	Gizzard
<i>Contracaecum</i> spp.	7(14) ^a	1-3	2	14(7 M, 3 F, 4 larvae)	Proventriculus
subfamily Dicheilonematinae	1(2) ^a	4	4	4(3 M, 1 F) (immature)	Air sacs

NOTE: *, $P > 0.5$, when stated region(s) was(were) compared with other body regions.**, $P < 0.005$ when stated region(s) was(were) compared with other body regions. M, male; F, female; N, nymph.^aNew host record.^b—, no attempt was made to estimate numbers of mites because of enormous numbers (1000's) per infested bird.

only of one genus) and Acarina (adults and nymphs of three genera), were recovered (Table 1). Multiple infestations with Mallophaga were noted in all cases except two, when the birds bore only one species of louse each. The number of louse species per infested bird ranged from 1 to 6 (mean 4). In the case of mites, four birds were parasite free, while infested birds bore from 1 to 4 species (mean 2). No evidence of competition between the two groups and individual species was detected, although differences in the frequency of occurrence and intensity of infestation in various body regions were noted (Table 1).

On examination, many of the bags in which the birds had been stored were found to contain Mallophaga (approximately 28% of the total collected). The lice represented all the species found on the shearwaters, with the exception of *Docophoroides* sp. and *A. vagelli*, and occurred in the same proportions as on the birds (male to female and adult to nymph ratios were the same). Slightly more *Halipeurus* spp. than members of any other genus fell off the birds, perhaps because of the nature of the physical environment in which they are found, namely the back and wings, where the feathers are fewer in number and less dense than in other parts of the bird's body. The loss of lice did not affect the distribution outlined above, as validated when five freshly killed *P. gravis* were examined for ectoparasites in June, 1978, and the distributions were found to correspond exactly with the foregoing.

The ectoparasites found were located in the regions suggested for the appropriate group by various workers (e.g. Clay 1957). An exception to the above was seen in the case of the mite genus *Brephosceles*. Dubinin (1949) reported that the secondary feathers were primary loci for *Brephosceles* species during moderate and light infestations and that in heavy infestations the mites were distributed throughout the wings and tail. These findings do not coincide with those of the present study, the mites recovered showing a definite preference for the breast region, whatever the degree of infestation. The findings of this study agree with those of Fitzpatrick (1975), which leads one to question Dubinin's (1949) and Peterson's (1971) assertions.

Five genera of endoparasites (one of Cestoda, four of Nematoda) and specimens of one subfamily of Nematoda were identified in the birds examined (Table 1).

Most of the cestodes that were found were immature and identified as *Tetrabothrius* sp. The small number of adults recovered all proved to be *Tetrabothrius procerus* Spätlich 1909.

The foregoing adds to our basic knowledge of the parasitofauna of shearwaters. However, it became increasingly evident, as the study progressed, that far more work remains to be done, with regard to both the hosts and the parasites they carry, before we have a proper idea of the relationships that exist between them.

Acknowledgements

We thank Dr. W. T. Atyeo for his help with the feathermites and Dr. K. C. Emerson for his aid with the Mallophaga. We also thank the National Research Council of Canada for the award (NRCC-A3500) to the junior author.

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