Dispharynx nasuta (Nematoda) in California Quail (Callipepla californica) in Western Oregon

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Dispharynx nasuta (Nematoda) in California Quail (*Callipepla californica*) in Western Oregon

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ABSTRACT: Seventy-six California quail (*Callipepla californica*) were collected during a 22-mo period from the E. E. Wilson Wildlife Area near Monmouth, Oregon. *Dispharynx nasuta* occurred in 38% of the birds with a mean intensity of 4.9 ± 5.1. In one of 2 yr, host age was significantly associated with prevalence, with immature males showing the highest prevalence (73%). Although *C. californica* has been the subject of several parasitological surveys, this is the first record of *D. nasuta* in this host.

Key words: *Callipepla californica*, *Dispharynx nasuta*, California quail, western Oregon, new host record, host–parasite relationships.

Dispharynx nasuta has been reported from several orders of birds. Within the order Galliformes, it has been reported from a limited number of free-ranging host species in North America. These include northern bobwhite (*Colinus virginianus*; Venard, 1933; Kellogg and Prestwood, 1968; Palermo and Doster, 1970; Davidson et al., 1980; McRae and Dimmick, 1981; Forrester et al., 1984; Moore et al., 1986), wild turkey (*Meleagris gallopavo*; Hon et al., 1975; Prestwood et al., 1975), blue grouse (*Dendragapus obscurus*; Bendell, 1955), and ruffed grouse (*Bonasa umbellus*; Goble and Kutz, 1945; Bump et al., 1947; Davidson et al., 1977). It can be pathogenic for a variety of hosts (Cram, 1931; Goble and Kutz, 1945; Bendell, 1955; Hon et al., 1975; Ramaswamy and Sundaram, 1984; Rickard, 1985). However, the northern bobwhite was the only quail in which it had been observed. Helminth parasites of California quail (*Callipepla californica*) have been the subject of several surveys (O'Roke, 1928; Krogsdale, 1950; Chandler, 1970), but most were conducted in the arid or semiarid portions of this bird's range and none reported *D. nasuta*, which is transmitted by terrestrial isopod intermediate hosts (Cram, 1931). Because ambient humidity can strongly influence both parasite survivorship outside the host and host diet (predation on intermediate hosts), we surveyed the parasites of California quail from a mesic area.

Seventy-six California quail were collected by shooting on the E. E. Wilson Wildlife Area (WWA), a 650-ha site located 15 km south of Monmouth, Benton County, Oregon (44°50′N, 123°15′W), from February 1986 to November 1987. Their ages were determined by the appearance of the primary coverts (Leopold, 1939), and they were examined for *D. nasuta*. This study site, located within the mesic portion of the range of California quail, supports densities of approximately one quail/3 ha in winter (Crawford and Oates, 1986). California quail were introduced into western Oregon in 1912 from native populations in southwestern Oregon (Finley, 1915).

Intestinal tracts were fixed in 70% ethanol and the proventriculus and its contents were examined under a dissecting microscope for *D. nasuta*. Infections often were associated with a thickening of the proventricular wall. We did not further investigate the pathological consequences of infection. A multiway contingency analysis (Fienberg, 1983) was used to test for differences in nematode prevalence among year, sex and age classes of quail, with a value of 0.5 added to cells containing zero. Although a statistical comparison of seasons was desirable, sample sizes were insufficient. Immature birds ranged from 2.5 to 12.0 mo of age; adults were >12 mo old. Representative specimens of nematodes from this study have been deposited

TABLE 1. Prevalence of *Dispharynx nasuta* in California quail collected in western Oregon, followed by multiway contingency analysis.

1986–1987

Age	Sex	Prevalence	(*n*)
Juvenile	male	67.9	(28)
	female	25.0	(16)
Adult	male	5.0	(20)
	female	41.7	(12)

Factor	df	χ^2	*P*
Parasitism × sex × age × year	1	4.42	<0.05
Parasitism × sex × age	1	15.42	<0.001
Parasitism × sex × year	1	1.45	>0.20
Parasitism × age × year	1	0.001	>0.95
Sex × age × year	1	1.12	>0.25
Parasitism × sex	1	8.77	<0.05
Sex × age	1	0.01	>0.90
Parasitism × year	1	0.18	>0.65
Sex × year	1	0.34	>0.55
Age × year	1	1.14	>0.25

1986

Age	Sex	Prevalence	(*n*)
Juvenile	male	73.3	(15)
	female	0	(6)
Adult	male	0	(12)
	female	37.5	(8)

Factor	df	χ^2	*P*
Parasitism × age × sex	1	15.61	<0.001
Parasitism × sex	1	1.10	>0.25
Parasitism × age	1	6.17	<0.05
Sex × age	1	0.10	>0.75

1987

Age	Sex	Prevalence	(*n*)
Juvenile	male	61.5	(13)
	female	40.0	(10)
Adult	male	12.5	(8)
	female	50.0	(4)

Factor	df	χ^2	*P*
Parasitism × sex × age	1	2.96	<0.10
Parasitism × sex	1	0.02	>0.85
Parasitism × age	1	2.49	>0.10
Sex × age	1	0.37	>0.50

in the U.S. National Parasite Collection (Animal Parasitology Institute, USDA, 1180 BARC-East, Beltsville, Maryland 20705, USA; accession number 79521).

Prevalence of *D. nasuta* was 38% (29 of 76 birds), and mean intensity was 4.9 ± 5.1 helminths per infected bird (range = 1–19; Table 1). There was a significant interaction among year, age, sex and prevalence. Therefore we analyzed the data from each year separately. For the 1987 data, prevalence did not differ significantly by age or sex, and the three-way interaction term (parasitism × sex × age) was marginally insignificant ($P = 0.08$) because of low prevalence in adult males (12%). This three-way term was highly significant for the 1986 data ($P < 0.001$), which show only juvenile males and adult females to be infected.

TABLE 2. Seasonal prevalence of *Dispharynx nasuta* in California quail collected in western Oregon.

Season[a]	Prevalence (*n*) 1986	1987
Winter	100 (4)	30 (10)
Spring	25 (12)	67 (9)
Summer	50 (12)	43 (7)
Fall	8 (13)	33 (9)

[a] Winter, December to February; Spring, March to May; Summer, June to August; Fall, September to November.

Although intensity data were similar to those of other studies of *D. nasuta* in the Galliformes, prevalence was exceeded only by that in blue grouse chicks (Bendell, 1955). In other studies of *D. nasuta* where prevalence in immature and adult birds was reported separately, immature birds typically exhibited higher prevalences (Goble and Kutz, 1945; Bump et al., 1947; Bendell, 1955; Prestwood et al., 1975; Davidson et al., 1980; Moore et al., 1986).

High prevalance of *D. nasuta* in this population of California quail was considered unusual because of its absence from surveys of populations elsewhere. Presence or absence of a parasite may be related to differences in foods, particularly isopods, consumed by these birds across their range. Isopods were not reported in diet studies of California quail in California (Grinnell et al., 1918; Dawson, 1923; Bowles, 1925; Sumner, 1935; Glading et al., 1940; Shields and Duncan, 1966; Duncan, 1968; but see Browning, *in* Leopold, 1977), Washington

(Dawson and Bowles, 1909; Beer and Tidyman, 1942; Crispens et al., 1960, 1962; Anthony, 1970), and central Oregon (Yadon, 1954). In a 2-yr survey of 101 California quail crops from WWA, Oates (1979) found that isopods were most abundant in summer diets (June to August; 16%). They were scarce in winter (December to February; 3%), and were not found during the remainder of the year. Seasonal trends in *D. nasuta* prevalence roughly parallel these dietary trends (Table 2).

Isopods may not have to be a major diet item for the parasites they transmit to reach high levels of prevalence, especially if behavior of the parasitized isopod is modified in a manner that enhances risk of predation. For instance, isopods accounted for 3 to 11% of the diet of nestling starlings (*Sturnus vulgaris*) in New Mexico but prevalence of an acanthocephalan parasite transmitted by the isopod was 8 to 32% (Moore, 1986). Moore (1983) demonstrated that isopods with this parasite behaved differently from uninfected isopods and were more likely to be preyed upon. *Dispharynx nasuta* also alters isopod behavior; infected isopods are more photophilic than uninfected conspecifics (Moore and Lasswell, 1986), which may result in increased vulnerability of infected isopods to predation by quail.

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LITERATURE CITED

ANTHONY, R. G. 1970. Food habits of California quail in southeastern Washington during the breeding season. The Journal of Wildlife Management 34: 950–953.

BEER, J., AND W. TIDYMAN. 1942. The substitution of hard seeds for grit. The Journal of Wildlife Management 6: 70–82.

BENDELL, J. F. 1955. Disease as a control of a population of blue grouse, *Dendragapus obscurus fuliginosus* (Ridgway). Canadian Journal of Zoology 33: 195–223.

BOWLES, J. H. 1925. Additional notes on stomach contents of birds. Murrelet 6: 60.

BUMP, G., R. W. DARROW, F. D. EDMINSTER, AND W. F. CRISSEY (editors). 1947. The ruffed grouse: Life history, propagation, management. New York State Conservation Department, Buffalo, New York, 915 pp.

CHANDLER, R. E. 1970. Helminth parasites of California quail (*Lophortyx californicus*) from the Okanagan Valley, British Columbia. Canadian Journal of Zoology 48: 741–744.

CRAM, E. G. 1931. Developmental stages of some nematodes of the Spiruroidea parasitic in poultry and game birds. USDA Technical Bulletin #227, Washington, D.C., 27 pp.

CRAWFORD, J. A., AND R. M. OATES. 1986. Sex and age ratios of shot and trapped California quail. Wildlife Society Bulletin 14: 380–382.

CRISPENS, C. G., JR., I. O. BUSS, AND C. F. YOCUM. 1960. Food habits of the California quail in eastern Washington. Condor 62: 473–477.

———, ———, AND ———. 1962. Additional data on the food of California quail in eastern Washington. Condor 64: 166–167.

DAVIDSON, W. R., G. L. DOSTER, S. R. PURSGLOVE, JR., AND A. K. PRESTWOOD. 1977. Helminth parasites of ruffed grouse (*Bonasa umbellus*) from the eastern United States. Proceedings of the Helminthological Society of Washington 44: 156–161.

———, F. E. KELLOGG, AND G. L. DOSTER. 1980. Seasonal trends of helminth parasites of bobwhite quail. Journal of Wildlife Diseases 16: 367–375.

DAWSON, W. L. 1923. The birds of California. South Mouton Company, San Francisco, California, 2121 pp.

———, AND J. H. BOWLES. 1909. The birds of Washington. Occidental Publishing Company, Seattle, Washington, 977 pp.

DUNCAN, D. A. 1968. Food of California quail on burned and unburned central California foothill rangeland. California Fish and Game 54: 123–127.

FIENBERG, S. E. 1983. The analysis of cross-classified categorical data, 2nd ed. MIT Press, Cambridge, Massachusetts, 198 pp.

FINLEY, W. L. 1915. California quail liberated. Oregon Sportsman 3: 16–17.

FORRESTER, D. J., J. A. CONTI, A. O. BUSH, L. D. CAMPBELL, AND R. K. FROHLICH. 1984. Ecology of helminth parasitism of bobwhites in Florida. Proceedings of the Helminthological Society of Washington 51: 255–260.

GLADING, B., H. H. BISWELL, AND C. F. SMITH. 1940. Studies on the food of the California quail in 1937. The Journal of Wildlife Management 4: 128–144.

GOBLE, F. C., AND H. L. KUTZ. 1945. The genus

Dispharynx (Nematoda: Acuariidae) in galliform and passeriform birds. The Journal of Parasitology 31: 323–331.

GRINNELL, J., H. C. BRYANT, AND T. I. STOVER. 1918. The game birds of California. University of California Press, Berkeley, California, 642 pp.

HON, L. T., D. J. FORRESTER, AND L. E. WILLIAMS, JR. 1975. Helminths of wild turkeys in Florida. Proceedings of the Helminthological Society of Washington 42: 119–127.

KELLOGG, F. E., AND A. K. PRESTWOOD. 1968. Gastrointestinal helminths from wild and pen-raised bobwhites. The Journal of Wildlife Management 32: 468–475.

KROGSDALE, J. T. 1950. Survey of endoparasites in California valley quail of the Palouse area. Transactions of the American Microscopical Society 69: 398–402.

LEOPOLD, A. S. 1939. Age determination in quail. The Journal of Wildlife Management 3: 261–265.

———. 1977. The California quail. University of California Press, Berkeley, California, 281 pp.

MCRAE, W. A., AND R. W. DIMMICK. 1981. First occurrences of *Cyrnea colini* and *Dispharynx* sp. in bobwhites in Tennessee. Journal of the Tennessee Academy of Science 56: 55–56.

MOORE, J. 1983. Responses of an avian predator and its isopod prey to an acanthocephalan parasite. Ecology 64: 1000–1015.

———. 1986. Dietary variation among nestling starlings. Condor 88: 181–189.

———, M. FREEHLING, AND D. SIMBERLOFF. 1986. Gastrointestinal helminths of the northern bobwhite in Florida: 1968 and 1983. Journal of Wildlife Diseases 22: 497–501.

———, AND J. LASSWELL. 1986. Altered behavior in isopods (*Armadillidium vulgare*) infected with the nematode *Dispharynx nasuta*. The Journal of Parasitology 72: 186–189.

OATES, R. M. 1979. Effects of habitat manipulations on California quail in western Oregon. M.S. Thesis. Oregon State University, Corvallis, Oregon, 53 pp.

O'ROKE, E. C. 1928. Parasites and parasitic diseases in the California valley quail. California Fish and Game 14: 193–198.

PALERMO, R. J., AND G. L. DOSTER. 1970. A comparison of the late winter foods and parasites of bobwhite quail and black francolins in southwestern Louisiana. Proceedings of the Annual Conference of the Southeastern Association of Game and Fish Commissioners 24: 206–212.

PRESTWOOD, A. K., F. E. KELLOGG, AND G. L. DOSTER. 1975. Parasitism among wild turkeys in the southeast. *In* Proceedings of the Third National Wild Turkey Symposium, L. K. Halls (ed.). Texas Chapter of the Wildlife Society, Austin, Texas, pp. 27–32.

RAMASWAMY, K., AND R. K. SUNDARAM. 1984. Histopathological changes in the proventriculus of fowl given experimental monospecific infection with *Acuaria spiralis*. Veterinary Parasitology 17: 309–317.

RICKARD, L. G. 1985. Proventricular lesions associated with natural and experimental infections of *Dispharynx nasuta* (Nematoda: Acuariidae). Canadian Journal of Zoology 63: 2663–2668.

SHIELDS, P. W., AND D. A. DUNCAN. 1966. Fall and winter food of California quail in dry years. California Fish and Game 52: 275–282.

SUMNER, E. L., JR. 1935. A life history study of the California quail, with recommendations for its conservation and management. California Fish and Game 21: 167–253, 275–342.

VENARD, C. 1933. Helminths and coccidia from the Ohio bobwhite. The Journal of Parasitology 19: 205–208.

YADON, V. L. 1954. Ecological aspects of the valley quail in the Madras area of central Oregon. M.S. Thesis. Oregon State University, Corvallis, Oregon, 140 pp.

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