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HELMINTH PARASITES OF TRANSLOCATED RACCOONS *(Procyon lotor)* IN THE SOUTHEASTERN UNITED STATES[1]

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Abstract: Raccoons *(Procyon lotor)* typical of animals released by private hunting clubs in the Appalachian Mountains were examined for helminth parasites to evaluate the influence raccoon translocation might have on parasitic diseases. Results were compared with data from resident raccoons from characteristic release areas. Translocated raccoons harbored 19 helminth species that were exotic to resident animals. Most of these exotic parasites were trematodes (74%). An additional 19 species were found in both translocated and resident raccoons, and another 5 species were present only in residents. Three of the 19 exotic helminth parasites and 10 of the 19 enzootic species found in translocated raccoons are known to have some degree of pathogenicity to raccoons, other wildlife, domestic animals or man. At present, disease risks associated with the helminth parasites of these translocated raccoons were not considered alarmingly high; however, potential problems that could not be discounted were artificial intensification of undesirable enzootic parasites on release sites or expression of pathogenicity by exotic parasites presently considered nonsignificant.

INTRODUCTION

The raccoon *(Procyon lotor)* is widely distributed throughout the United States and is highly prized by both raccoon hunters and trappers. In many areas of the mountain and piedmont physiographic provinces in the Southeast, hunters have been importing and releasing large numbers of raccoons from high density populations, primarily from the coastal plain. This practice has been criticized as biologically hazardous, particularly because of possible disease introduction.[23,24,26,28]

Helminth parasites represent one group of infectious agents that may be spread by translocation. Although many surveys have been conducted on helminth parasites of raccoons,[2,6,7,11,12,16,20,29,30] they were not concerned with parasite burdens in translocated raccoons. This study was undertaken to determine the helminth fauna of translocated raccoons in order to evaluate potential influence this practice may have on parasitic diseases in the Southeast. Comparison is made with similar data from resident raccoons from typical release sites.

MATERIALS AND METHODS

One hundred seventy-one raccoons were examined between October, 1976, and May, 1979. Of these, 88 animals were acquired directly or indirectly from commercial sources in Florida, Texas, and Virginia. An additional 30 raccoons were examined from three areas (Glades Co., FL; Liberty Co., GA; and Pender Co., NC)

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that potentially could be exploited for raccoon translocation. For the purpose of this study, the aforementioned animals were designated as translocated raccoons. Fifty-three resident raccoons from typical release areas in Georgia, North Carolina, Tennessee, Virginia and West Virginia were obtained for comparison.

Of the translocated raccoons, 100 were received alive or had died enroute to the laboratory and 18 were received frozen. Sixteen resident raccoons were alive and 37 were frozen when received. Routine parasitologic procedures[9] were employed to recover helminths. Each parasite species was identified and complete parasite counts were made. Larval cestodes from three raccoons from Glades County, Florida were fed to two cestode-free domestic cats to obtain adult tapeworms.

Examinations for *Trichinella spiralis* larvae were performed as described by Crum *et al.*[9] Animals received alive were examined by muscle digestion techniques while frozen animals were examined by muscle compression or standard histologic procedures.

Each helminth species found in translocated raccoons was rated as to its probability of establishment within release areas. Factors thought to favor establishment included: (1) a widespread distribution in North America, particularly in regions with ecologic similarities to typical release destinations; (2) a direct life cycle or widespread distribution of intermediate hosts; (3) a high prevalence and intensity of infection in translocated raccoons; and (4) infectivity for animals other than raccoons present in release areas.[27] Helminths known to be enzootic to mountain or piedmont raccoons were considered as having an excellent probability of survival in release areas. Ratings of possible, improbable or unknown were given to helminths of translocated raccoons that presently are considered exotic to the mountains or piedmont.

RESULTS

Forty-three species of helminths were recovered from 118 translocated and 53 resident raccoons. Nineteen species were exotic to resident animals, and an additional 19 were enzootic to both translocated and resident raccoons. Five other helminths were found only in residents. Translocated raccoons (Table 1) had a more diverse helminth fauna than did resident raccoons (Table 2). This difference was due primarily to the presence of 14 species of exotic trematodes in translocated raccoons. Seventeen of 24 (71%) species in other helminth taxa (cestodes, acanthocephalans and nematodes) occurred in both translocated and resident raccoons. Representative specimens were deposited in the U.S. National Museum Helminthologic Collection.

Eurytrema procyonis was the only trematode present in translocated raccoons that also occurred in resident raccoons. The only gross lesion associated with trematode infections was hypertrophy of the pancreatic ducts and was produced by both *E. procyonis* and *Procyotrema marsupiformis.*

Of the three species of cestodes recovered, *Atriotaenia procyonis* and *Mesocestoides variabilis* were present in both translocated and resident raccoons. Spargana were recovered only from translocated raccoons and developed to adult *Spirometra mansonoides* when fed to cats. Gross lesions were not attributed to cestode infections.

The only acanthocephalan recovered, *Macracanthorhynchus ingens,* was present in both translocated and resident raccoons. Gross lesions were not attributed to this helminth.

Fifteen of the 19 (79%) species of nematodes in translocated raccoons also occurred in resident raccoons; the four species which did not occur in resident raccoons were *Dipetalonema llewellyni,*

TABLE 1. Helminth parasites recovered from 118 translocated raccoons.

County/State (Sample Size)	Glades/Highlands/ Hillsborough/ Orange, FL (51)	Liberty, GA (10)	Pender, NC (10)	Brown, TX (37)	James City, VA (10)	Establishment Probability Rating
TREMATODA						
*Apophallus venustus (76214)[a]	—	—	50%, 32, (0-153)	—	30%, 173, (0-513)	Possible
*Carneophallus turgidus (76216)	—	100%, 1466, (405-3293)	—	3%, 200, (0-200)	—	Improbable
*Euparyphium beaveri (76217)	—	—	20%, 26, (0-55)	—	—	Possible
Eurytrema procyonis (76218)	—	—	—	—	50%, 1220, (0-3974)	Excellent
*Fibricola cratera (76219)	14%, 299,[b] (0-1907)	10%, 32, (0-32)	—	19%, 299, (0-1907)	—	Possible
*Gynaecotyla adunca (76220)	—	100%, 1608, (439-3389)	—	—	—	Improbable
*Heterobilharzia americana (76221)	71%, 8, (0-47)	—	40%, 13, (0-20)	22%, 6, (0-15)	—	Possible
*Parallelorchis diglossus (76223)	6%, 45, (0-87)	—	—	—	—	Improbable
*Parametorchis complexus (76224)	—	—	20%, 57, (0-72)	—	10%, 23, (0-23)	Possible
*Pharyngostomoides adenocephala (76225)	43%, 823, (0-10 414)	—	—	11%, 2214, (0-7964)	— —	Possible
*Pharyngostomoides procyonis (76226)	90%, 1079, (0-7039)	—	70%, 520, (0-1307)	43%, 751, (0-4, 791)	80%, 191, (0-514)	Possible
*Plagiorchus muris (76227)	—	—	—	3%, 2, (0-2)	—	Improbable
*Procyotrema marsupiformis (76228)	—	—	40%, 16, (0-47)	—	—	Unknown
*Ribeiroia ondatrae	2%, 2, (0-2)	—	—	—	—	Improbable

TABLE 1. (continued)

County/State (Sample Size)	Glades/Highlands/ Hillsborough/ Orange, FL (51)	Liberty, GA (10)	Pender, NC (10)	Brown, TX (37)	James City, VA (10)	Establishment Probability Rating
*Stephanoprora spinosa (76229)	—	30%, 3, (0-3)	—	—	—	Improbable
CESTODA						
Atriotaenia procyonis (76230)	16%, 31, (0-127)	10%, 33, (0-33)	70%, 57 (0-179)	92%, 97, (0-818)	60%, 139, (0-226)	Excellent
Mesocestoides variabilis (76231)	8%, 171, (0-313)	—	—	11%, 96, (0-353)	20%, 192, (0-265)	Excellent
*Spirometra mansonoides	18%, 4, (0-11)	—	20%, 1, (0-1)	—	—	Possible
ACANTHOCEPHALA						
Macracanthorhyn.chus ingens (76246)	45%, 4, (0-14)	90%, 15, (0-33)	90%, 7, (0-16)	24%, 5, (0-17)	60%, 3, (0-6)	Excellent
NEMATODA						
Capillaria plica	—	—	10%, 2, (0-2)	—	—	Excellent
Capillaria procyonis (76234)	14%, 2, (0-4)	10%, 2, (0-2)	10%, 1, (0-1)	8%, 1, (0-1)	50%, 4, (0-9)	Excellent
Capillaria putorii (76235)	4%, 5, (0-9)	—	60%, 36, (0-148)	—	60%, 39, (0-86)	Excellent
Capillaria spp.	2%, 1, (0-1)	—	—	—	10%, 8, (0-8)	Excellent
Crenosoma goblei (76236)	59%, 5, (0-26)	—	60%, 5, (0-12)	14%, 2, (0-7)	30%, 2, (0-4)	Excellent
*Dipetalonema llewellyni	2%, 1, (0-1)	—	10%, 1, (0-1)	—	—	Improbable
Dracunculus insignis (76237)	22%, 2, (0-8)	—	20%, 1, (0-1)	—	50%, 3, (0-4)	Excellent

TABLE 1. (continued)

*Filaria taxideae (76232)	—	—	—	78%, 12, (0-38)	—	Possible
*Filaria sp.	—	—	—	3%, 1, (0-1)	—	Unknown
Filaroides sp. (76238)	4%, 22, (0-42)	—	10%, 9, (0-9)	3%, 1, (0-1)	—	Excellent
Gnathostoma procyonis (76239)	55%, 6, (0-30)	10%, 2, (0-2)	10%, 1, (0-1)	—	60%, 2, (0-6)	Excellent
Gongylonema pulchrum (76240)	2%, 1, (0-1)	—	—	—	—	Excellent
Molineus barbatus (76241)	33%, 29, (0-80)	70%, 42, (0-212)	100%, 79, (3-296)	27%, 5, (0-15)	90%, 56, (0-222)	Excellent
Physaloptera rara (76242)	18%, 9, (0-28)	30%, 12 (0-13)	40%, 2, (0-2)	84%, 14, (0-105)	60%, 7, (0-27)	Excellent
Placoconus lotoris (76243)	71%, 51, (0-207)	40%, 1, (0-1)	90%, 90, (0-385)	11%, 7, (0-10)	100%, 69, (3-218)	Excellent
Strongyloides sp. (76244)	49%, 185, (0-1 263)	—	—	3%, 1, (0-1)	—	Excellent
Synhimantus sp.	35%, 15, (0-47)	—	30%, 2, (0-3)	—	—	Excellent
Trichinella spiralis (76245)	4%[c]	—	20%	—	—	Excellent
*Procyonostrongylus muelleri (75225)	10%, 2, (0-16)	—	—	—	—	Unknown

*Helminths considered exotic to release areas.

[a]Numbers in parentheses are U.S.N.M. Helm. Coll. Numbers.

[b]Figures in columns are: percent prevalence, average number of worms per infected raccoon, and (range).

[c]Percent prevalence was the only information available.

Filaria taxideae, Filaria sp. and *Procyonostrongylus muelleri.* Gross lesions were associated with *Dracunculus insignis, Filaroides* sp., *Gnathostoma procyonis* and *Physaloptera rara.* Gravid females of *D. insignis* evoked subcutaneous swelling and inflammation and produced small round ulcers in the skin. Enlarged purulent ulcers as previously described[8] also were observed. Nodules measuring 2.0 to 3.0 cm in diameter in the stomach wall were attributed to penetration and attachment of *G. procyonis.*[1,7,15,16,33] *Filaroides* sp. produced palpable nodules up to 2.5 cm in diameter within one or more lobes of the lungs. Histologic examination of lungs infected with *Filaroides* sp. revealed adult nematodes coiled in pulmonary veins. Endothelial proliferation, thrombus formation and perivascular infiltrations of lymphocytes and eosinophils were associated with the nematodes. Erosions of the stomach mucosa similar to those described by Soulsby[32] were observed in raccoons with heavy burdens of *P. rara.*

DISCUSSION

The long-term impact of helminths imported via raccoon translocation is contingent upon the pathogenicity of the parasites. Understandably, this capability should not be limited to a disease potential for raccoons but should extend to other wildlife, domestic animals and man. At present, only limited data are available in this regard, and the assessments given herein are based on review of the literature[27] and observations made during this study. Evaluations of pathogenicity are arbitrary, and some parasites were categorized as pathogens on the basis of what may be only subclinical tissue damage. Conversely, exotic parasites presently considered harmless may express unforeseen pathogenic capabilities due to biological factors in the release areas.

Pathogenicity was observed during this study or has been described previously from 13 helminth parasites recovered from translocated raccoons, viz., *E. procyonis,*[13,25,31] *Heterobilharzia americana,*[5,19] *P. marsupiformis,*[10,12,18] *S. mansonoides,*[9,21] *Crenosoma goblei,*[15] *D. insignis,*[8] *Filaroides* sp., *G. procyonis,*[1,7,15,16,33] *Molineus barbatus,*[1] *P. rara,*[32] *Placoconus lotoris,*[3,4,33] *Strongyloides* sp.[17] and *T. spiralis.*[32,34]

Of the 19 exotic helminths found in translocated raccoons, three presently are considered to have pathogenic capabilities, viz., *H. americana, P. marsupiformis* and *S. mansonoides.* As rated in Table 1, both *H. americana* and *S. mansonoides* possibly could become established in release areas, and *P. marsupiformis* was rated as unknown. In contrast, 10 of 19 helminth parasites common to translocated and resident raccoons are considered pathogens. In view of these findings, risks associated with artificially intensifying infections of pathogenic enzootic parasites by release of hundreds of translocated raccoons probably are as significant as the danger of exotic helminth introduction.

A major argument against indiscriminant translocation of raccoons has been based on the danger of disease or parasite introduction. Recent reports of rabies,[24] parvovirus enteritis[23] and potentially pathogenic protozoan parasites[28] in translocated raccoons exemplify some disease hazards associated with this practice. The present study did not reveal helminths that warrant extensive alarm; however, caution is indicated because data on adverse effects of these parasites are far from complete. Furthermore, the origin of raccoons routed through commercial dealers is obscure, and future shipments may be heavily infected with other helminths, such as the neurotropic ascarid, *Baylisascaris procyonis,* that have more obvious ecologic ramifications to resident rodents and lagomorphs.[14,22]

TABLE 2. Helminth parasites recovered from 53 resident raccoons.

County/State (Sample Size)	Banks/Dawson/ Habersham/Stephens, GA (10)	Fannin/Rabun/ Union, GA & Cherokee, NC (13)	Hawkins/Union, TN Wise, VA (20)	Ohio, WV (10)
TREMATODA				
Brachylaima virginianum (76215)[a]	—	—	5%, 37, (0-37)	—
Eurytrema procyonis (76218)	—	—	45%, 425, (0-1929)	—
Metagonomoides oregonensis (76222)	20%, 1402,[b] (0-2383)	8%, 569, (0-569)	10%, 36, (0-71)	—
Metorchis conjunctus (75542)	—	—	5%, 9, (0-9)	—
CESTODA				
Atriotaenia procyonis (76230)	—	—	25%, 95, (0-196)	20%, 36, (0-64)
Mesocestoides variabilis (76231)	10%, 2, (0-2)	15%, 7, (0-8)	5%, 2, (0-2)	50%, 33, (0-76)
ACANTHOCEPHALA				
Macracanthorhynchus ingens (76246)	80%, 13, (0-24)	85%, 29, (0-96)	50%, 5, (0-14)	10%, 1 (0-1)
NEMATODA				
Baylisascaris procyonis (76233)	—	—	—	20%, 3, (0-5)
Capillaria plica	10%, 1, (0-1)	—	—	—
Capillaria procyonis (76234)	50%, 1, (0-1)	54%, 3, (0-7)	35%, 2, (0-4)	20%, 2, (0-2)
Capillaria putorii (76235)	50%, 6, (0-11)	69%, 16, (0-61)	75%, 20, (0-71)	60%, 7, (0-15)
Capillaria spp.	—	—	—	30%, 1, (0-1)

TABLE 2. (continued)

County/State (Sample Size)	Banks/Dawson/ Habersham/Stephens, GA (10)	Fannin/Rabun/ Union, GA & Cherokee, NC (13)	Hawkins/Union, TN Wise, VA (20)	Ohio, WV (10)
Crenosoma goblei (76236)	20%, 1, (0-2)	69%, 2, (0-7)	35%, 4, (0-14)	10%, 1, (0-1)
Dracunculus insignis (76237)	20%, 1, (0-1)	—	—	—
Filaroides sp. (76238)	10%, 8, (0-8)	23%, 5, (0-8)	15%, 9, (0-21)	—
Gnathostoma procyonis (76239)	10%, 1, (0-1)	46%, 5, (0-13)	—	—
Gongylonema pulchrum (76240)	10%, 1, (0-1)	8%, 6, (0-6)	5%, 1, (0-1)	—
Heterakis sp.	—	23%, 2, (0-3)	—	—
Molineus barbatus (76241)	70%, 43, (0-86)	78%, 123, (0-951)	95%, 108, (0-889)	80%, 7, (0-14)
Physaloptera rara (76242)	90%, 25, (0-96)	46%, 23, (0-124)	80%, 54, (0-228)	70%, 30, (0-147)
Placoconus lotoris (76243)	80%, 11, (0-57)	92%, 20, (0-67)	95%, 49, (0-148)	80%, 55, (0-151)
Strongyloides sp. (76244)	50%, 35, (0-96)	69%, 11, (0-50)	20%, 6, (0-12)	—
Synhimanthus sp.	20%, 2, (0-2)	—	—	—
Trichinella spiralis (76245)	—	20%[c]	5%	10%

[a]Numbers in parentheses are U.S.N.M. Helm. Coll. Numbers.

[b]Figures in columns are: percent prevalence, average number of worms per infected raccoon, and (range).

[c]Percent prevalence was the only information available.

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LITERATURE CITED

1. ASH, L.R. 1962. Migration and development of *Gnathostoma procyonis* Chandler, 1942, in mammalian hosts. J. Parasit. 48: 298-305.
2. BABERO, B.B. and J.R. SHEPPERSON. 1958. Some helminths of raccoons in Georgia. J. Parasit. 44: 519.
3. BALASINGAM, E. 1964. On the pathology of *Placoconus lotoris* infections in raccoons *(Procyon lotor)*. Can. J. Zool. 42: 903-905.
4. ——. 1964. Studies on the life cycle and developmental morphology of *Placoconus lotoris* (Schwartz, 1925) Webster, 1956 (Ancylostomidae: Nematoda). Can. J. Zool. 42: 869-902.
5. BARTSCH, R.C. and B.C. WARD. 1976. Visceral lesions in raccoons naturally infected with *Heterobilharzia americana*. Vet. Path. 13: 241-249.
6. BODDICKER, M.L. and D.R. PROGULSKE. 1968. Helminth parasites of raccoons in South Dakota. Proc. South Dakota Acad. Sci. 47: 161-166.
7. CHANDLER, A.C. 1942. The helminths of raccoons in east Texas. J. Parasit. 28: 255-268.
8. CRICHTON, V.F.J. and M. BEVERLEY-BURTON. 1977. Observations on the seasonal prevalence, pathology, and transmission of *Dracunculus insignis* (Nematoda: Dracunculoidea) in the raccoon *(Procyon lotor* (L.)) in Ontario. J. Wildl. Dis. 13: 273-280.
9. CRUM, J.M., V.F. NETTLES and W.R. DAVIDSON. 1978. Studies on endoparasites of the black bear *(Ursus americanus)* in the southeastern United States. J. Wildl. Dis. 14: 178-186.
10. HARKEMA, R. and G.C. MILLER. 1959. Studies on the helminths of North Carolina vertebrates. I. *Procyotrema marsupiformis* n.g., n.s. (Strigeida: Diplostomatidae) from the pancreatic duct of the raccoon. J. Parasit. 45: 151-153.
11. —— and ——. 1962. Helminths of *Procyon lotor solutus* from Cape Island, South Carolina. J. Parasit. 48: 333-335.
12. —— and ——. 1964. Helminth parasites of the raccoon, *Procyon lotor*, in the southeastern United States. J. Parasit. 50: 60-66.
13. HERMAN, C.M., P.M. BAUMAN and R.T. HABERMANN. 1957. The prevalence of *Eurytrema procyonis* Denton (Trematoda: Dicrocoeliidae) in some mammals from Maryland. J. Parasit. 43: 113-114.
14. JACOBSON, H.A., P.F. SCANLON, V.F. NETTLES and W.R. DAVIDSON. 1976. Epizootiology of an outbreak of cerebrospinal nematodiasis in cottontail rabbits and woodchucks. J. Wildl. Dis. 12: 357-360.
15. JOHNSON, A.S. 1970. Biology of the raccoon *(Procyon lotor varius)* Nelson and Goldman in Alabama. Auburn Univ. Agric. Exp. Sta. Bull. 402. 148 pp.

16. JORDAN, H.E. and F.A. HAYES. 1959. Gastrointestinal helminths of raccoons *(Procyon lotor)* from Ossabaw Island, Georgia. J. Parasit. 45: 249-252.

17. LITTLE, M.D. 1965. Dermatitis in a human volunteer infected with *Strongyloides* of nutria and raccoon. Am. J. Trop. Med. Hyg. 14: 1007-1009.

18. LOCKE, L.N. and E.E. BROWN. 1965. Occurrence of the fluke, *Procyotrema marsupiformis* Harkema and Miller, 1959, in a Maryland raccoon. J. Parasit. 51: 355.

19. MALEK, E.A., L.R. ASH, H.F. LEE and M.D. LITTLE. 1961. *Heterohilharzia* infections in the dog and other mammals in Louisiana. J. Parasit. 47: 619-623.

20. McNEIL, C.W. and J.T. KROGSDALE. 1953. Parasites of raccoons in southwest Washington. J. Mammal. 34: 123-124.

21. MUELLER, J.F. and F. COULSTON. 1941. Experimental human infection with the sparganum larvae of *Spirometra mansonoides* (Mueller, 1935). Am. J. Trop. Med. Hyg. 21: 399-425.

22. NETTLES, V.F., W.R. DAVIDSON, S.K. FISK and H.A. JACOBSON. 1975. An epizootic of cerebrospinal nematodiasis in cottontail rabbits. J. Am. vet. med. Ass. 167: 600-602.

23. ——, J.E. PEARSON, G.A. GUSTAFSON and J.L. BLUE. 1980. Parvovirus infection in translocated raccoons. J. Am. vet. med. Ass. 177: 787-789.

24. ——, J.H. SHADDOCK, R.K. SIKES and C.R. REYES. 1979. Rabies in translocated raccoons. Am. J. Publ. Health 69: 601-602.

25. PENNER, L.R., C.F. HELMBOLDT and A.L. GRISWOLD. 1954. *Eurytrema procyonis* in a raccoon from Connecticut. Proc. Helm. Soc. Wash. 21: 34-35.

26. PRATHER, E.C., W.J. BIGLER, G.L. HOFF and J.A. TOMAS. 1975. Rabies in Florida: history, status, trends. Florida Dept. Health Rehabil. Serv. Monograph 14. 122 pp.

27. SCHAFFER, G.D. 1979. Helminth parasites of translocated raccoons *(Procyon lotor)* in the southeastern United States. M.S. Thesis, Univ. of Georgia, Athens, Georgia. 93 pp.

28. ——, W.L. HANSON, W.R. DAVIDSON and V.F. NETTLES. 1978. Hematotropic parasites of translocated raccoons in the Southeast. J. Am. vet. med. Ass. 173: 1148-1151.

29. SCHULTZ, A.L. 1962. A survey of parasites of the raccoon, *Procyon lotor,* in southeastern Michigan. M.S. Thesis, Univ. of Michigan, Ann Arbor, Michigan. 42 pp.

30. SENGER, C.M. and K.A. NEILAND. 1955. Helminth parasites of some fur-bearers of Oregon. J. Parasit. 41: 637-638.

31. SHELDON, W.G. 1966. Pancreatic flukes *(Eurytrema procyonis)* in domestic cats. J. Am. vet. med. Ass. 148: 251-253.

32. SOULSBY, E.J.L. 1975. *Helminths, Arthropods and Protozoa of Domesticated Animals.* 6th Ed. Williams and Wilkins Co., Baltimore, Md. 824 pp.

33. STANSELL, K.B. 1974. Internal parasites of coastal raccoons with notes on changes in parasite burdens after transportation and release in the upper piedmont section of South Carolina. Statewide Wildl. Res. Proj. W-38-10. Final Job Rept., South Carolina Wildl. and Marine Resour. Dept., Div. of Game and Freshwater Fish. 112 pp.

34. WINSLOW, D.J., D.L. PRICE, R.C. NEAFIE and C.M. HERMAN. 1966. Trichinosis in Maryland raccoons. Bull. Wildl. Dis. Ass. 2: 81-82.

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