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Safety and competitiveness partnering the food chain

Trichinella in rodents

Antti Oksanen

MICE PHOTO: THE SIDNEY MORNING HERALD

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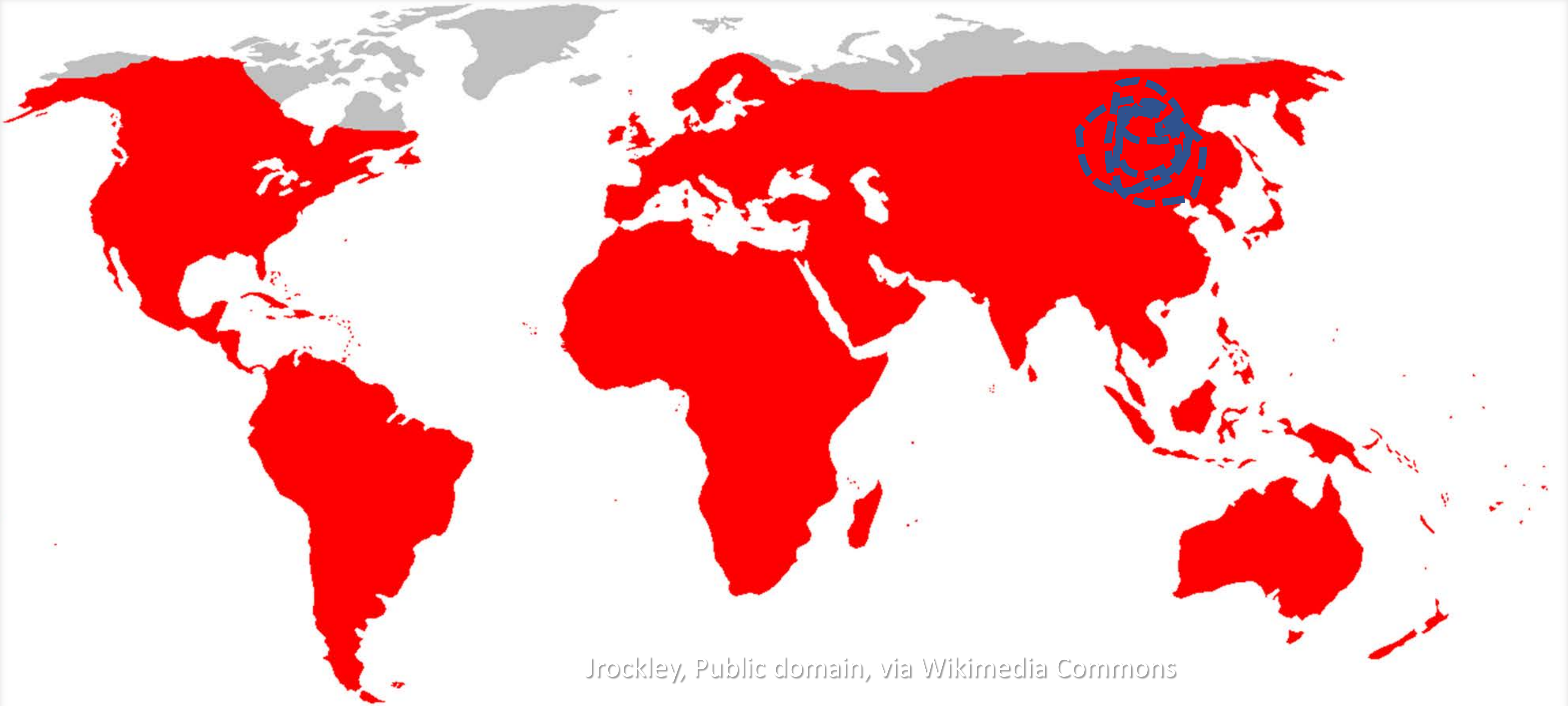
FACULTY OF VETERINARY MEDICINE

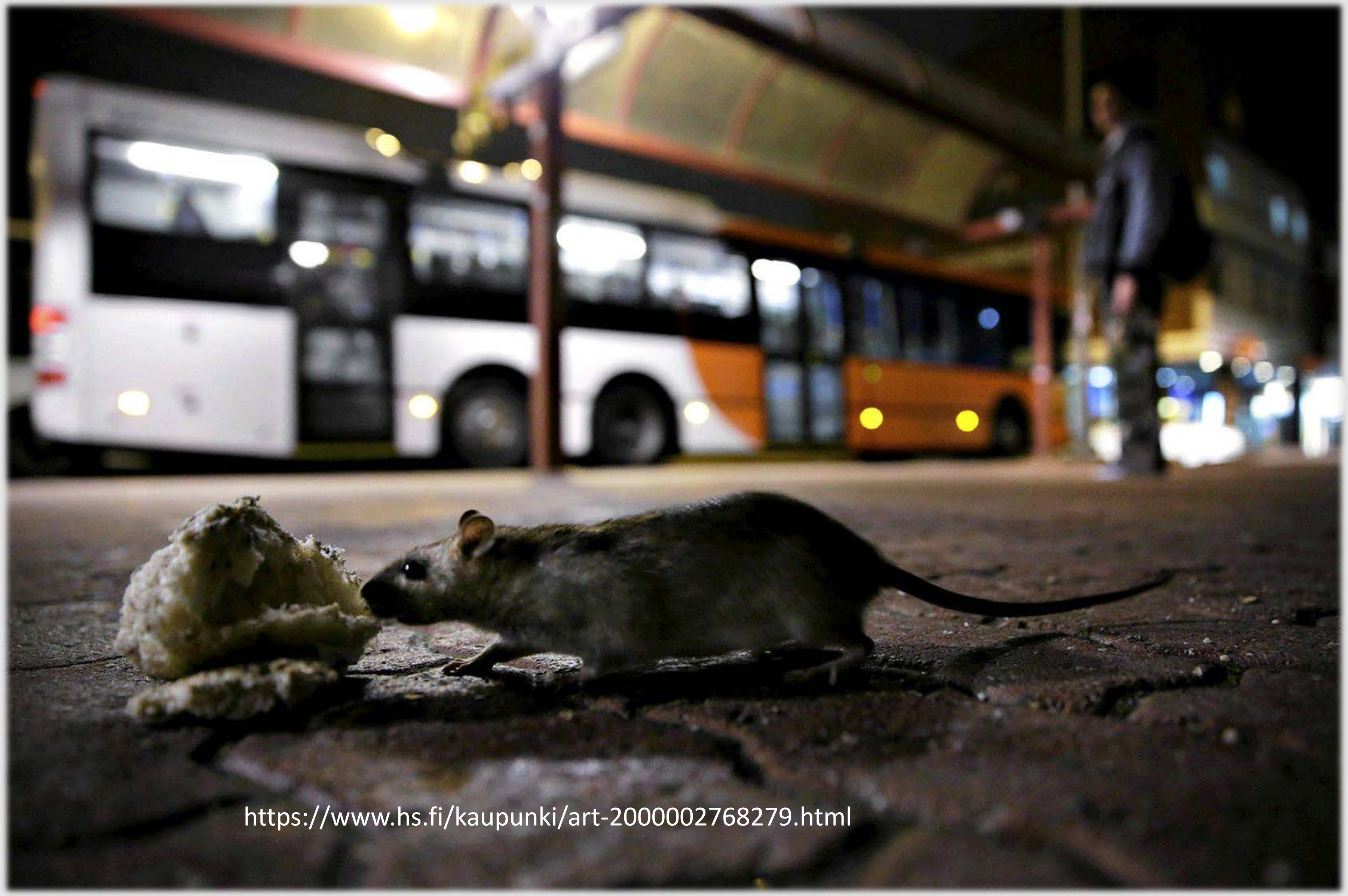
Trichinella

Trichinella AND mice	2061
Trichinella AND "wild mice“	2
Trichinella AND rats	910
Trichinella AND "wild rats“	6
Trichinella AND experimental	814
Trichinella AND experimental AND mice	420
Trichinella AND experimental AND rats	179

Brown rat, *Rattus norvegicus*

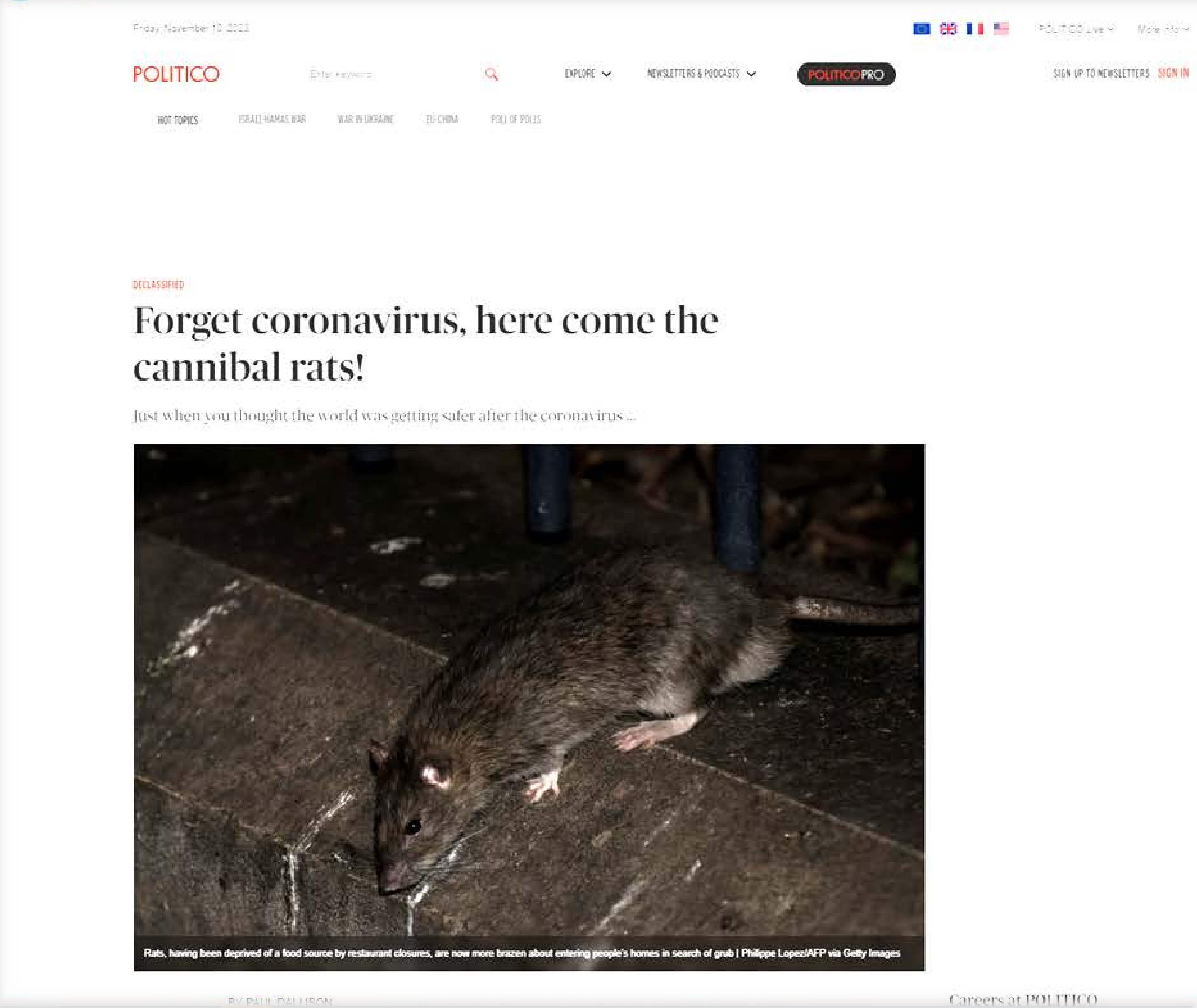


Jrockley, Public domain, via Wikimedia Commons



https://www.hs.fi/kaupunki/art-2000002768279.html

“The often estimated number of rats in Helsinki is 100,000, but there could be even half a million of them.”
Tuomas Aivelo, Helsinki Urban Rat Project



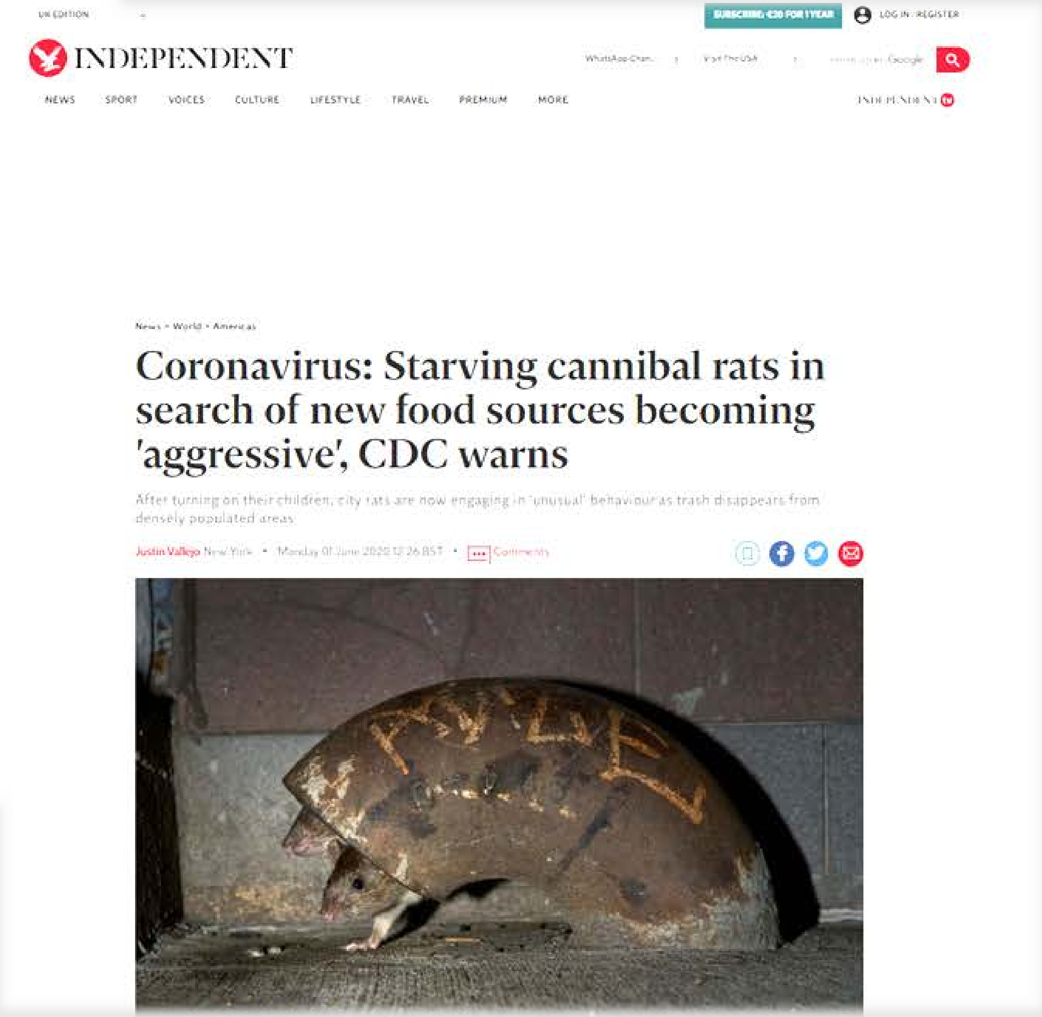
DECLASSIFIED

Forget coronavirus, here come the cannibal rats!

Just when you thought the world was getting safer after the coronavirus ...

Rats, having been deprived of a food source by restaurant closures, are now more brazen about entering people's homes in search of grub | Philippe Lopez/AFP via Getty Images

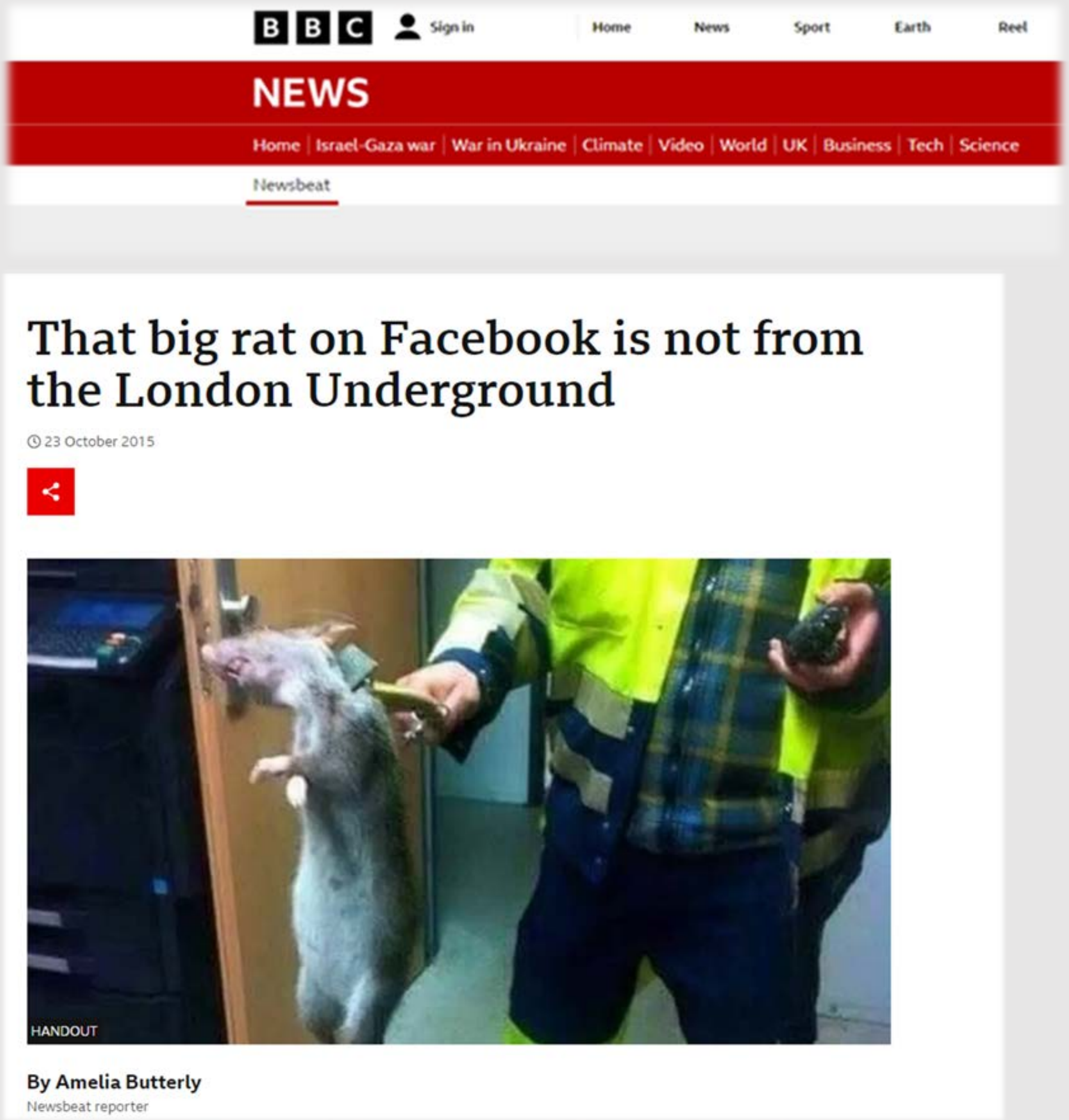
BY PAUL DALLISON



Coronavirus: Starving cannibal rats in search of new food sources becoming 'aggressive', CDC warns

After turning on their children, city rats are now engaging in 'unusual' behaviour as trash disappears from densely populated areas

Justin Vallejo New York • Monday 01 June 2020 12:26 BST

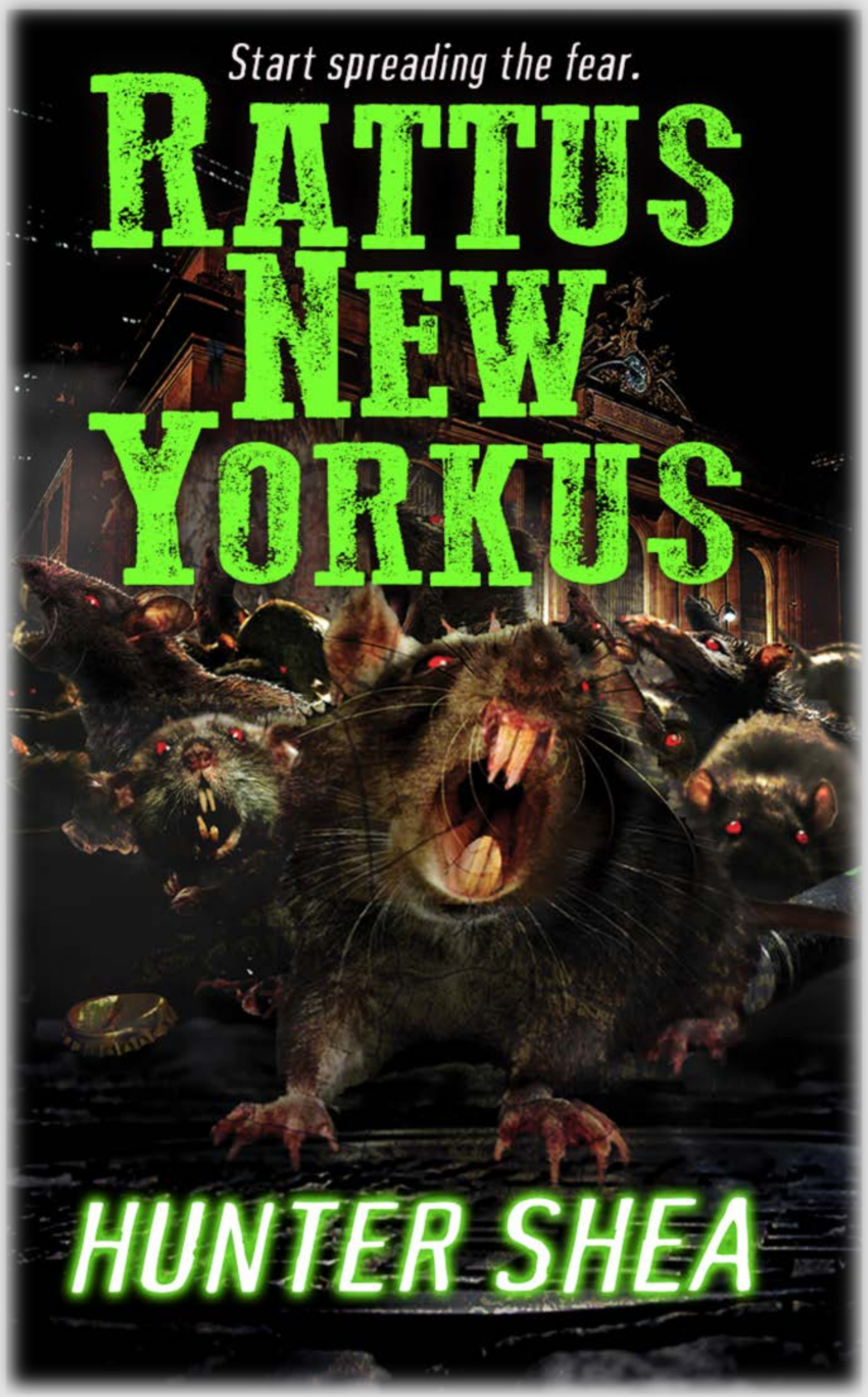


That big rat on Facebook is not from the London Underground

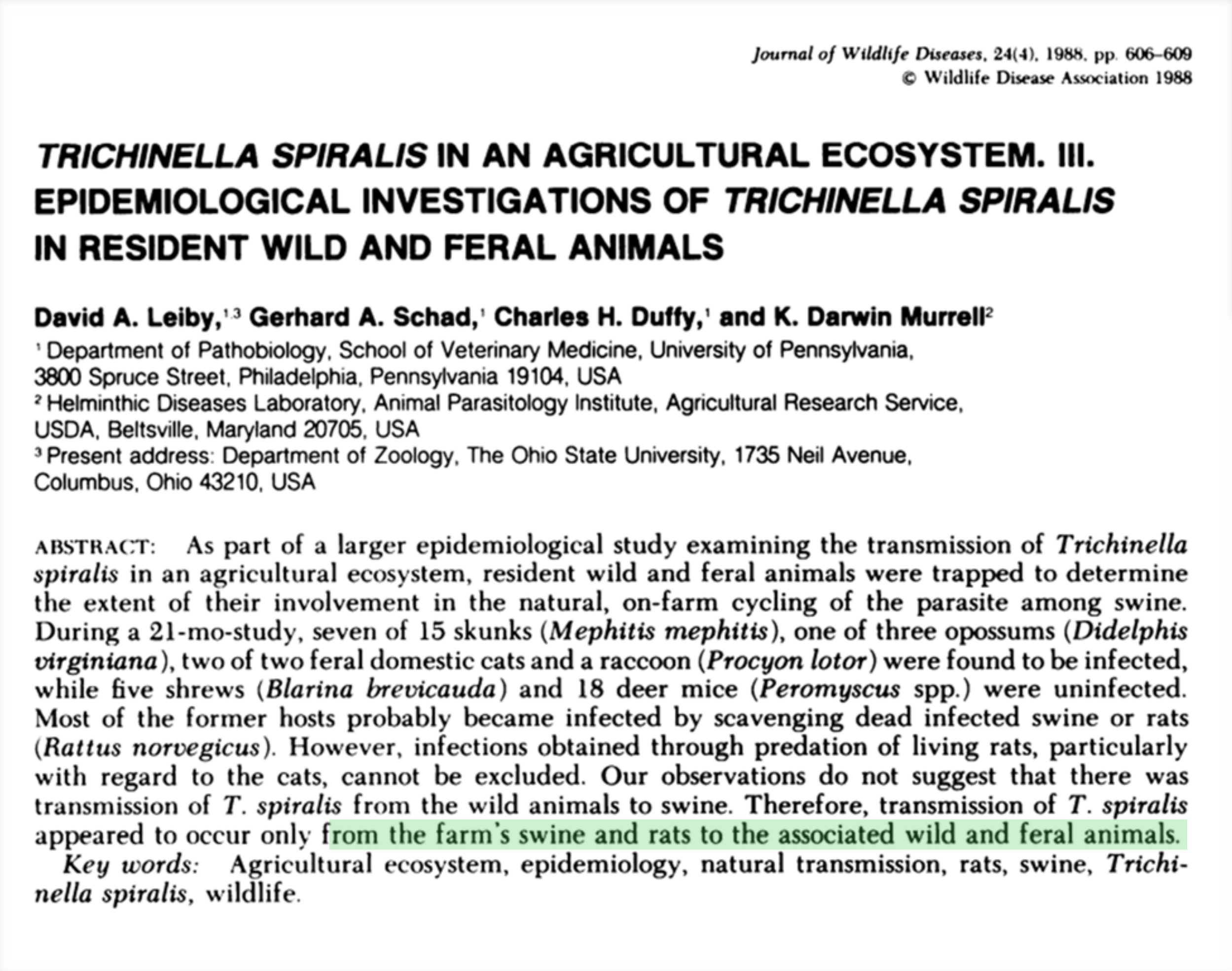
23 October 2015

By Amelia Butterly

Newsbeat reporter


Start spreading the fear.
RATTUS NEW YORKUS
HUNTER SHEA


NIGHT OF TERROR



Journal of Wildlife Diseases, 24(4), 1988, pp. 606–609

TRICHINELLA SPIRALIS IN AN AGRICULTURAL ECOSYSTEM. III. EPIDEMIOLOGICAL INVESTIGATIONS OF *TRICHINELLA SPIRALIS* IN RESIDENT WILD AND FERAL ANIMALS

David A. Leiby,[1,3] **Gerhard A. Schad,**[1] **Charles H. Duffy,**[1] **and K. Darwin Murrell**[2]
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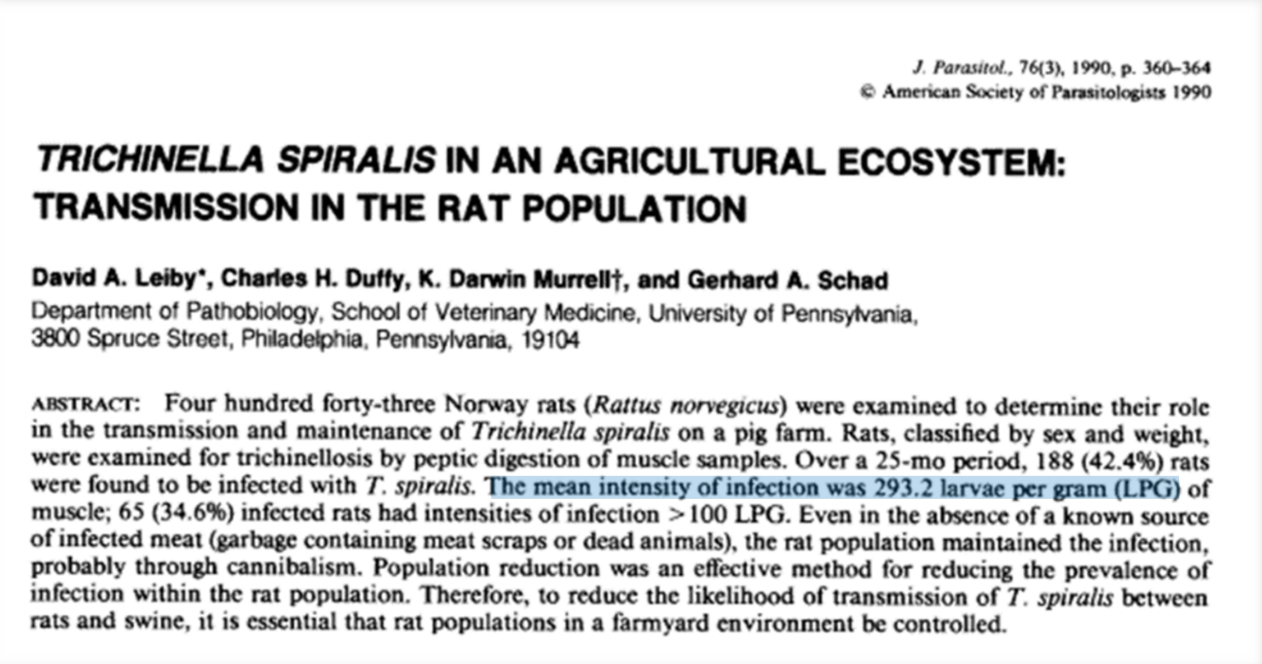
[2] Helminthic Diseases Laboratory, Animal Parasitology Institute, Agricultural Research Service,
USDA, Beltsville, Maryland 20705, USA
[3] Present address: Department of Zoology, The Ohio State University, 1735 Neil Avenue,
Columbus, Ohio 43210, USA

ABSTRACT: As part of a larger epidemiological study examining the transmission of *Trichinella spiralis* in an agricultural ecosystem, resident wild and feral animals were trapped to determine the extent of their involvement in the natural, on-farm cycling of the parasite among swine. During a 21-mo-study, seven of 15 skunks (*Mephitis mephitis*), one of three opossums (*Didelphis virginiana*), two of two feral domestic cats and a raccoon (*Procyon lotor*) were found to be infected, while five shrews (*Blarina brevicauda*) and 18 deer mice (*Peromyscus* spp.) were uninfected. Most of the former hosts probably became infected by scavenging dead infected swine or rats (*Rattus norvegicus*). However, infections obtained through predation of living rats, particularly with regard to the cats, cannot be excluded. Our observations do not suggest that there was transmission of *T. spiralis* from the wild animals to swine. Therefore, transmission of *T. spiralis* appeared to occur only from the farm's swine and rats to the associated wild and feral animals.

Key words: Agricultural ecosystem, epidemiology, natural transmission, rats, swine, *Trichinella spiralis*, wildlife.

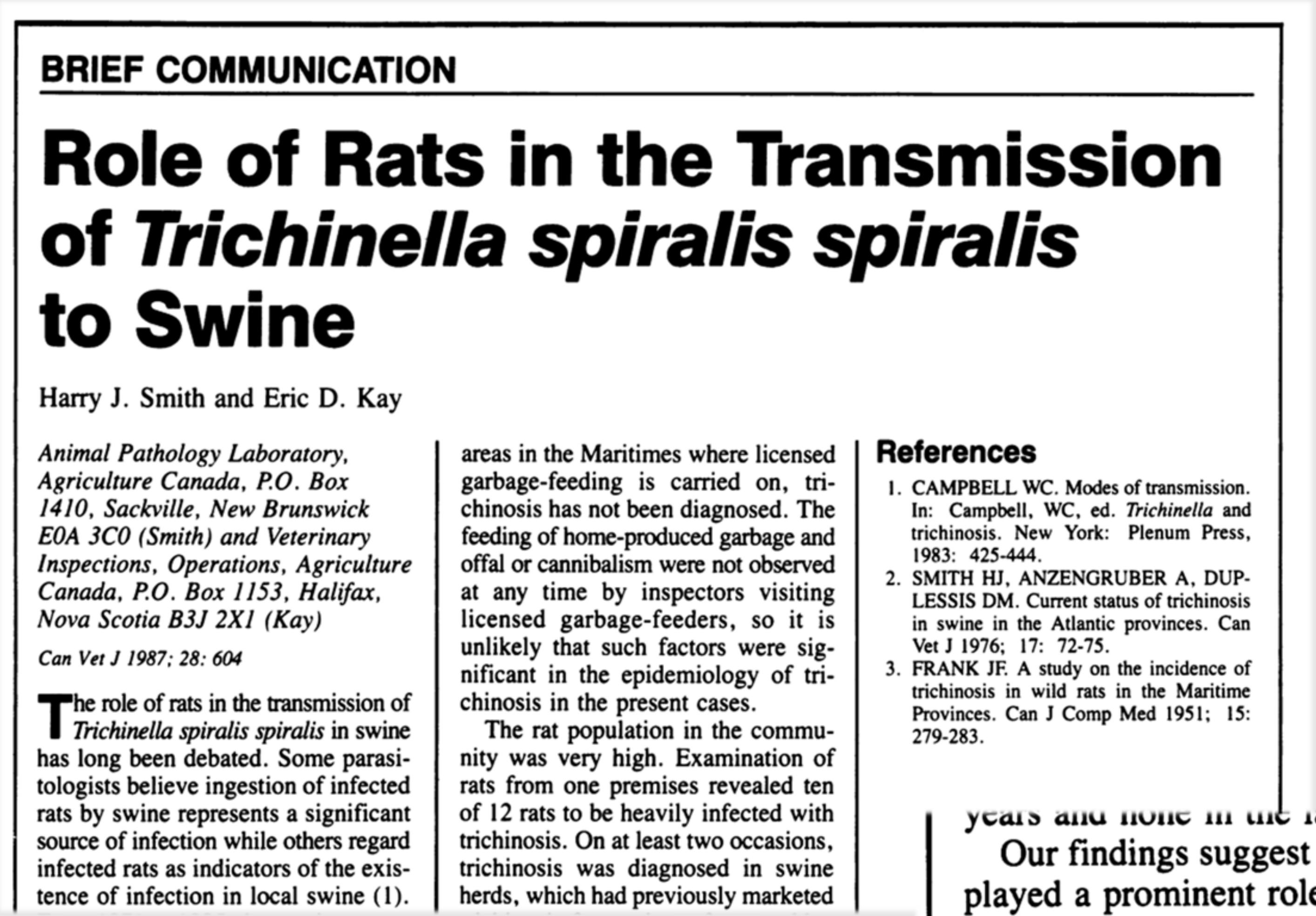


J. Parasitol., 76(3), 1990, p. 360–364

TRICHINELLA SPIRALIS IN AN AGRICULTURAL ECOSYSTEM: TRANSMISSION IN THE RAT POPULATION

David A. Leiby*, Charles H. Duffy, K. Darwin Murrell†, and Gerhard A. Schad
Department of Pathobiology, School of Veterinary Medicine, University of Pennsylvania,
3800 Spruce Street, Philadelphia, Pennsylvania, 19104

ABSTRACT: Four hundred forty-three Norway rats (*Rattus norvegicus*) were examined to determine their role in the transmission and maintenance of *Trichinella spiralis* on a pig farm. Rats, classified by sex and weight, were examined for trichinellosis by peptic digestion of muscle samples. Over a 25-mo period, 188 (42.4%) rats were found to be infected with *T. spiralis*. The mean intensity of infection was 293.2 larvae per gram (LPG) of muscle; 65 (34.6%) infected rats had intensities of infection >100 LPG. Even in the absence of a known source of infected meat (garbage containing meat scraps or dead animals), the rat population maintained the infection, probably through cannibalism. Population reduction was an effective method for reducing the prevalence of infection within the rat population. Therefore, to reduce the likelihood of transmission of *T. spiralis* between rats and swine, it is essential that rat populations in a farmyard environment be controlled.



BRIEF COMMUNICATION

Role of Rats in the Transmission of *Trichinella spiralis spiralis* to Swine

Harry J. Smith and Eric D. Kay

Animal Pathology Laboratory, Agriculture Canada, P.O. Box 1410, Sackville, New Brunswick E0A 3C0 (Smith) and Veterinary Inspections, Operations, Agriculture Canada, P.O. Box 1153, Halifax, Nova Scotia B3J 2X1 (Kay)

Can Vet J 1987; 28: 604

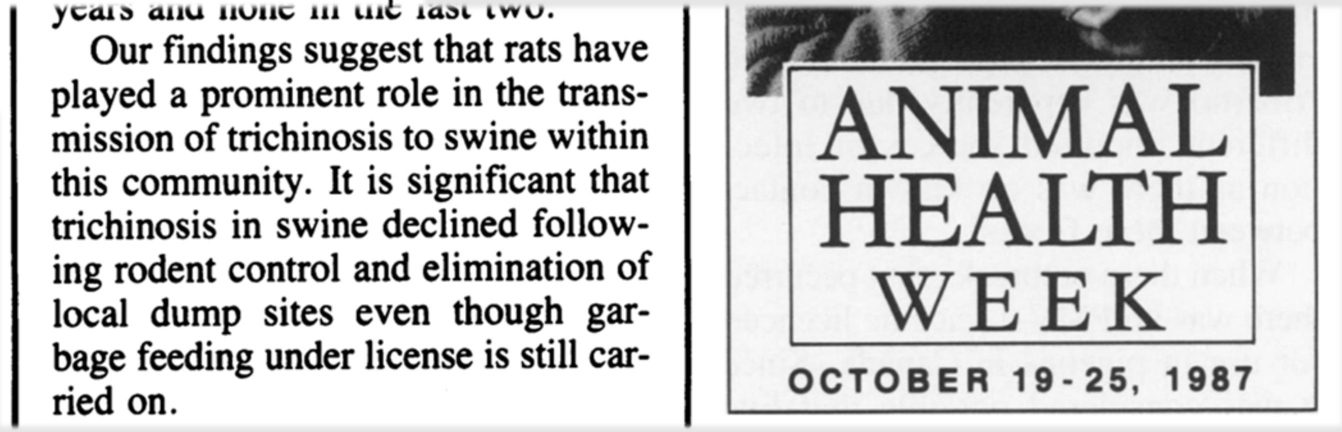
The role of rats in the transmission of *Trichinella spiralis spiralis* in swine has long been debated. Some parasitologists believe ingestion of infected rats by swine represents a significant source of infection while others regard infected rats as indicators of the existence of infection in local swine (1).

areas in the Maritimes where licensed garbage-feeding is carried on, trichinosis has not been diagnosed. The feeding of home-produced garbage and offal or cannibalism were not observed at any time by inspectors visiting licensed garbage-feeders, so it is unlikely that such factors were significant in the epidemiology of trichinosis in the present cases.

The rat population in the community was very high. Examination of rats from one premises revealed ten of 12 rats to be heavily infected with trichinosis. On at least two occasions, trichinosis was diagnosed in swine herds, which had previously marketed

References

1. CAMPBELL WC. Modes of transmission. In: Campbell, WC, ed. *Trichinella* and trichinosis. New York: Plenum Press, 1983: 425-444.
2. SMITH HJ, ANZENGRUBER A, DUPLESSIS DM. Current status of trichinosis in swine in the Atlantic provinces. Can Vet J 1976; 17: 72-75.
3. FRANK JF. A study on the incidence of trichinosis in wild rats in the Maritime Provinces. Can J Comp Med 1951; 15: 279-283.



years and none in the last two.

Our findings suggest that rats have played a prominent role in the transmission of trichinosis to swine within this community. It is significant that trichinosis in swine declined following rodent control and elimination of local dump sites even though garbage feeding under license is still carried on.

Veterinary Parasitology 279 (2020) 109052

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Research paper

Diversity of *Trichinella* species in relation to the host species and geographical location

Ewa Bilska-Zając*, Mirosław Różycki, Katarzyna Grądziel-Krukowska, Aneta Bełcik, Iwona Mizak, Jacek Karamon, Jacek Sroka, Jolanta Zdybel, Tomasz Cencek

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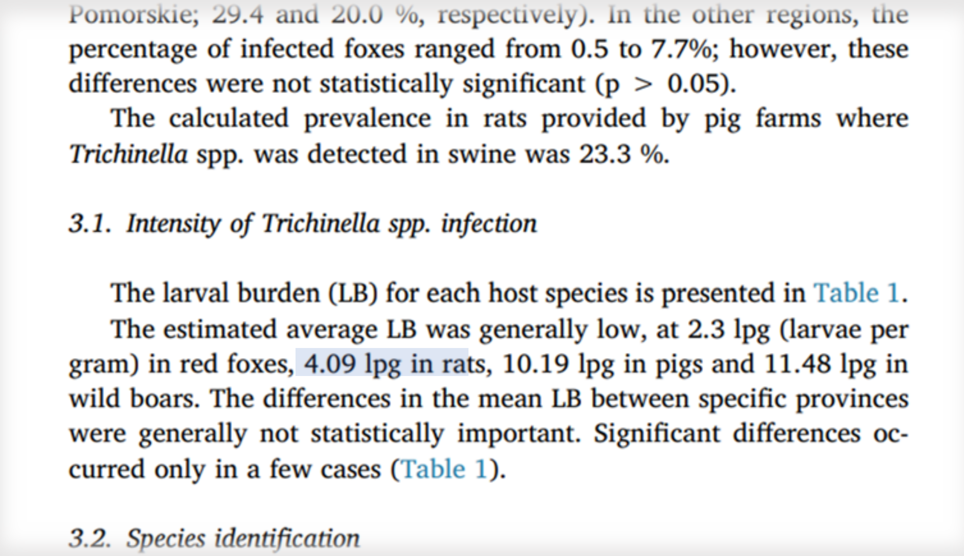


Pomorskie; 29.4 and 20.0 %, respectively). In the other regions, the percentage of infected foxes ranged from 0.5 to 7.7%; however, these differences were not statistically significant (p > 0.05).

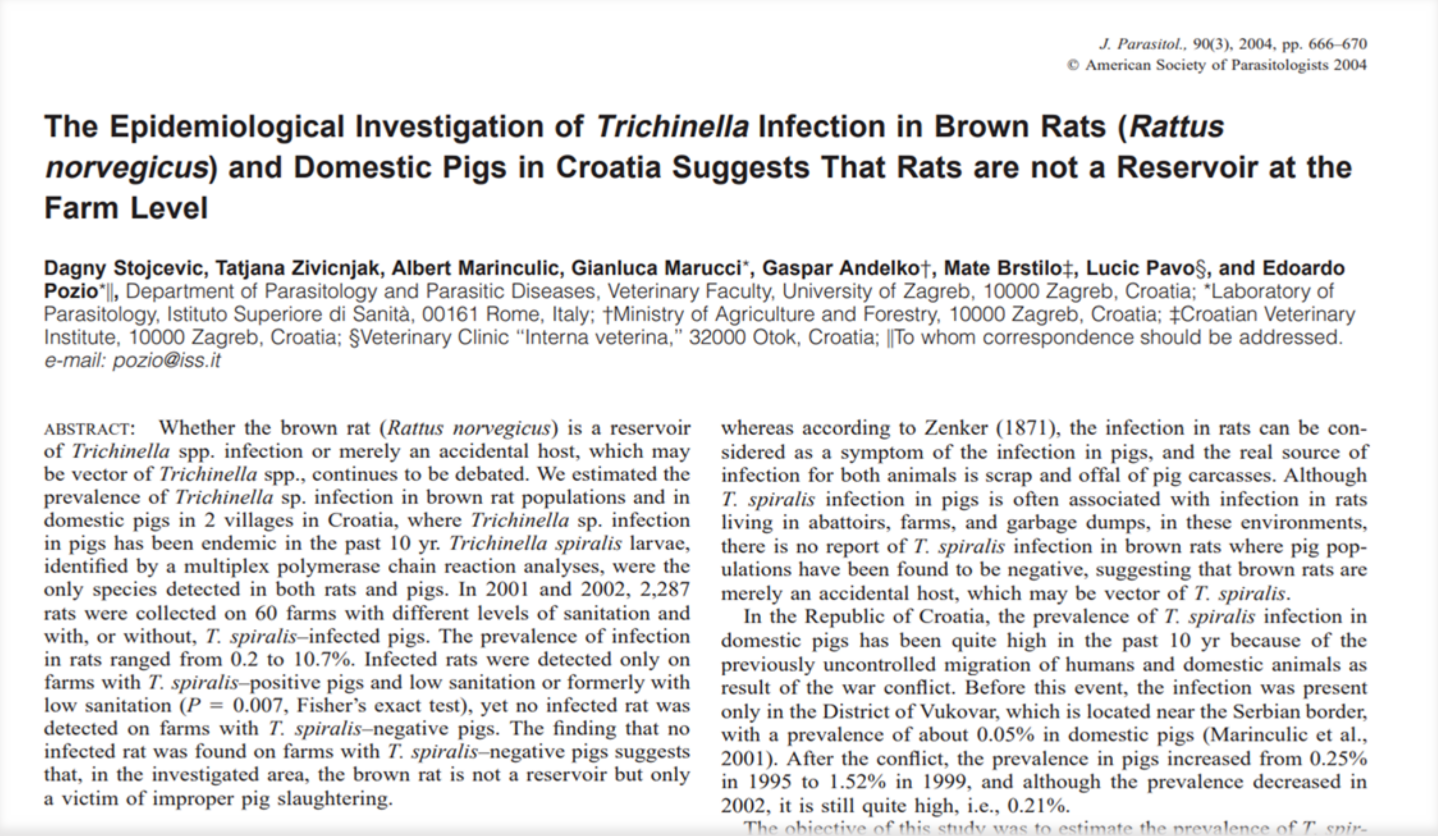
The calculated prevalence in rats provided by pig farms where *Trichinella* spp. was detected in swine was 23.3 %.

3.1. *Intensity of Trichinella spp. infection*

The larval burden (LB) for each host species is presented in Table 1.

The estimated average LB was generally low, at 2.3 lpg (larvae per gram) in red foxes, 4.09 lpg in rats, 10.19 lpg in pigs and 11.48 lpg in wild boars. The differences in the mean LB between specific provinces were generally not statistically important. Significant differences occurred only in a few cases (Table 1).

3.2. *Species identification*



J. Parasitol., 90(3), 2004, pp. 666–670

The Epidemiological Investigation of *Trichinella* Infection in Brown Rats (*Rattus norvegicus*) and Domestic Pigs in Croatia Suggests That Rats are not a Reservoir at the Farm Level

Dagny Stojcevic, Tatjana Zivicnjak, Albert Marinculic, Gianluca Marucci*, Gaspar Andelko†, Mate Brstilo‡, Lucic Pavo§, and Edoardo Pozio*‖, Department of Parasitology and Parasitic Diseases, Veterinary Faculty, University of Zagreb, 10000 Zagreb, Croatia; *Laboratory of Parasitology, Istituto Superiore di Sanità, 00161 Rome, Italy; †Ministry of Agriculture and Forestry, 10000 Zagreb, Croatia; ‡Croatian Veterinary Institute, 10000 Zagreb, Croatia; §Veterinary Clinic "Interna veterina," 32000 Otok, Croatia; ‖To whom correspondence should be addressed. *e-mail: pozio@iss.it*

ABSTRACT: Whether the brown rat (*Rattus norvegicus*) is a reservoir of *Trichinella* spp. infection or merely an accidental host, which may be vector of *Trichinella* spp., continues to be debated. We estimated the prevalence of *Trichinella* sp. infection in brown rat populations and in domestic pigs in 2 villages in Croatia, where *Trichinella* sp. infection in pigs has been endemic in the past 10 yr. *Trichinella spiralis* larvae, identified by a multiplex polymerase chain reaction analyses, were the only species detected in both rats and pigs. In 2001 and 2002, 2,287 rats were collected on 60 farms with different levels of sanitation and with, or without, *T. spiralis*–infected pigs. The prevalence of infection in rats ranged from 0.2 to 10.7%. Infected rats were detected only on farms with *T. spiralis*–positive pigs and low sanitation or formerly with low sanitation ($P = 0.007$, Fisher's exact test), yet no infected rat was detected on farms with *T. spiralis*–negative pigs. The finding that no infected rat was found on farms with *T. spiralis*–negative pigs suggests that, in the investigated area, the brown rat is not a reservoir but only a victim of improper pig slaughtering.

whereas according to Zenker (1871), the infection in rats can be considered as a symptom of the infection in pigs, and the real source of infection for both animals is scrap and offal of pig carcasses. Although *T. spiralis* infection in pigs is often associated with infection in rats living in abattoirs, farms, and garbage dumps, in these environments, there is no report of *T. spiralis* infection in brown rats where pig populations have been found to be negative, suggesting that brown rats are merely an accidental host, which may be vector of *T. spiralis*.

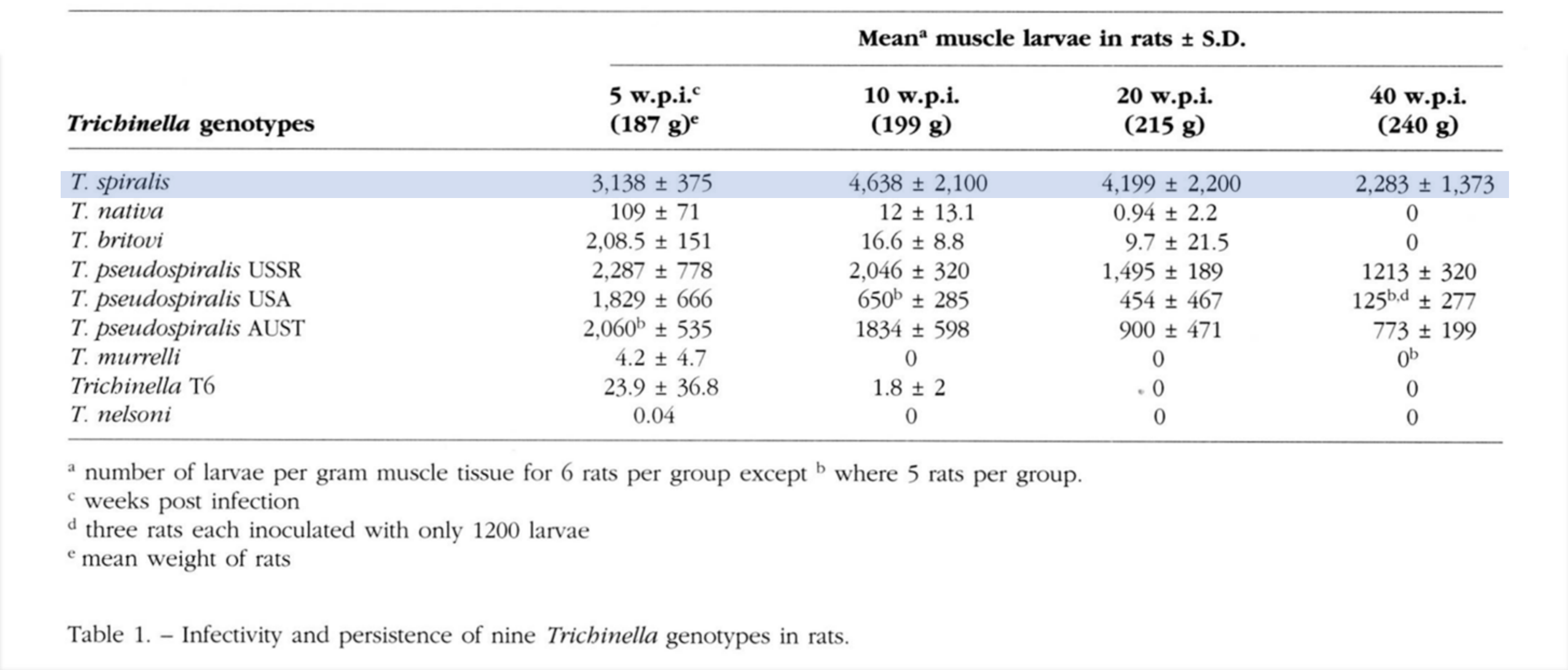
In the Republic of Croatia, the prevalence of *T. spiralis* infection in domestic pigs has been quite high in the past 10 yr because of the previously uncontrolled migration of humans and domestic animals as result of the war conflict. Before this event, the infection was present only in the District of Vukovar, which is located near the Serbian border, with a prevalence of about 0.05% in domestic pigs (Marinculic et al., 2001). After the conflict, the prevalence in pigs increased from 0.25% in 1995 to 1.52% in 1999, and although the prevalence decreased in 2002, it is still quite high, i.e., 0.21%.

The objective of this study was to estimate the prevalence of *T. spir-*

Article available at http://www.parasite-journal.org or http://dx.doi.org/10.1051/parasite/200108s2216

INFECTIVITY, PERSISTENCE AND SEROLOGICAL RESPONSE OF NINE *TRICHINELLA* GENOTYPES IN RATS

MALAKAUSKAS A.*,**, KAPEL C.M.O.* & WEBSTER P.*



	Mean[a] muscle larvae in rats ± S.D.			
***Trichinella* genotypes**	**5 w.p.i.[c] (187 g)[e]**	**10 w.p.i. (199 g)**	**20 w.p.i. (215 g)**	**40 w.p.i. (240 g)**
T. spiralis	3,138 ± 375	4,638 ± 2,100	4,199 ± 2,200	2,283 ± 1,373
T. nativa	109 ± 71	12 ± 13.1	0.94 ± 2.2	0
T. britovi	2,08.5 ± 151	16.6 ± 8.8	9.7 ± 21.5	0
T. pseudospiralis USSR	2,287 ± 778	2,046 ± 320	1,495 ± 189	1213 ± 320
T. pseudospiralis USA	1,829 ± 666	650[b] ± 285	454 ± 467	125[b,d] ± 277
T. pseudospiralis AUST	2,060[b] ± 535	1834 ± 598	900 ± 471	773 ± 199
T. murrelli	4.2 ± 4.7	0	0	0[b]
Trichinella T6	23.9 ± 36.8	1.8 ± 2	0	0
T. nelsoni	0.04	0	0	0

[a] number of larvae per gram muscle tissue for 6 rats per group except [b] where 5 rats per group.

[c] weeks post infection

[d] three rats each inoculated with only 1200 larvae

[e] mean weight of rats

Table 1. – Infectivity and persistence of nine *Trichinella* genotypes in rats.

Inbred Fisher 344 rats

210 THE JOURNAL OF PARASITOLOGY, VOL. 91, NO. 1, FEBRUARY 2005

J. Parasitol., 91(1), 2005, pp. 210–213
© American Society of Parasitologists 2005

Spatial Variation of *Trichinella* Prevalence in Rats in Finnish Waste Disposal Sites

T. Mikkonen, J. Valkama*, H. Wihlman†, and A. Sukura, Department of Basic Veterinary Sciences, Faculty of Veterinary Medicine, P.O. Box 66, University of Helsinki, FIN-00014 Helsinki, Finland; *Ringing Centre, Finnish Museum of Natural History, University of Helsinki, FIN-00014 Helsinki, Finland; †The National Food Agency, Vanha talvitie 5, P.O. Box 28, 00581 Helsinki, Finland. *e-mail: taina.mikkonen@helsinki.fi*

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1994: 142/569 = 25%
2000: 0/198 = 0%

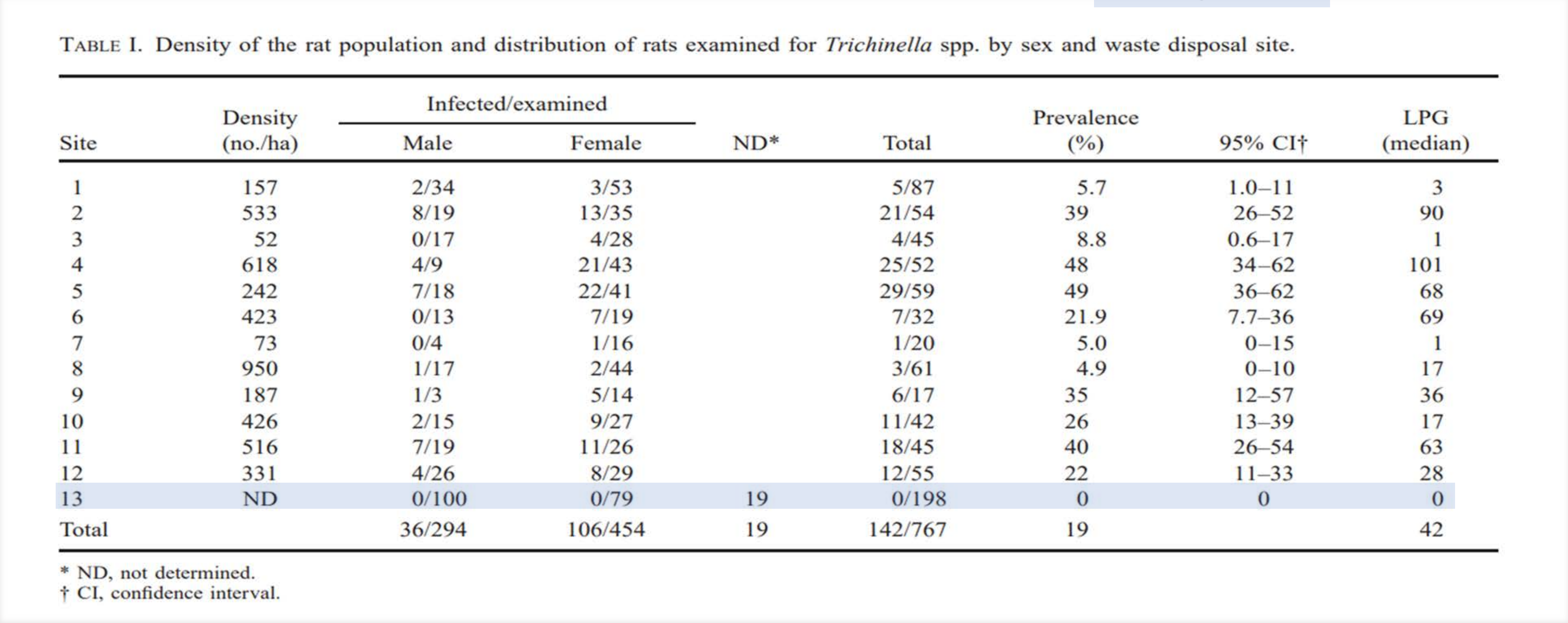

TABLE I. Density of the rat population and distribution of rats examined for *Trichinella* spp. by sex and waste disposal site.

Site	Density (no./ha)	Infected/examined		ND*	Total	Prevalence (%)	95% CI†	LPG (median)
		Male	Female					
1	157	2/34	3/53		5/87	5.7	1.0–11	3
2	533	8/19	13/35		21/54	39	26–52	90
3	52	0/17	4/28		4/45	8.8	0.6–17	1
4	618	4/9	21/43		25/52	48	34–62	101
5	242	7/18	22/41		29/59	49	36–62	68
6	423	0/13	7/19		7/32	21.9	7.7–36	69
7	73	0/4	1/16		1/20	5.0	0–15	1
8	950	1/17	2/44		3/61	4.9	0–10	17
9	187	1/3	5/14		6/17	35	12–57	36
10	426	2/15	9/27		11/42	26	13–39	17
11	516	7/19	11/26		18/45	40	26–54	63
12	331	4/26	8/29		12/55	22	11–33	28
13	ND	0/100	0/79	19	0/198	0	0	0
Total		36/294	106/454	19	142/767	19		42

* ND, not determined.
† CI, confidence interval.

HELSINKI
URBAN
RAT
PROJECT

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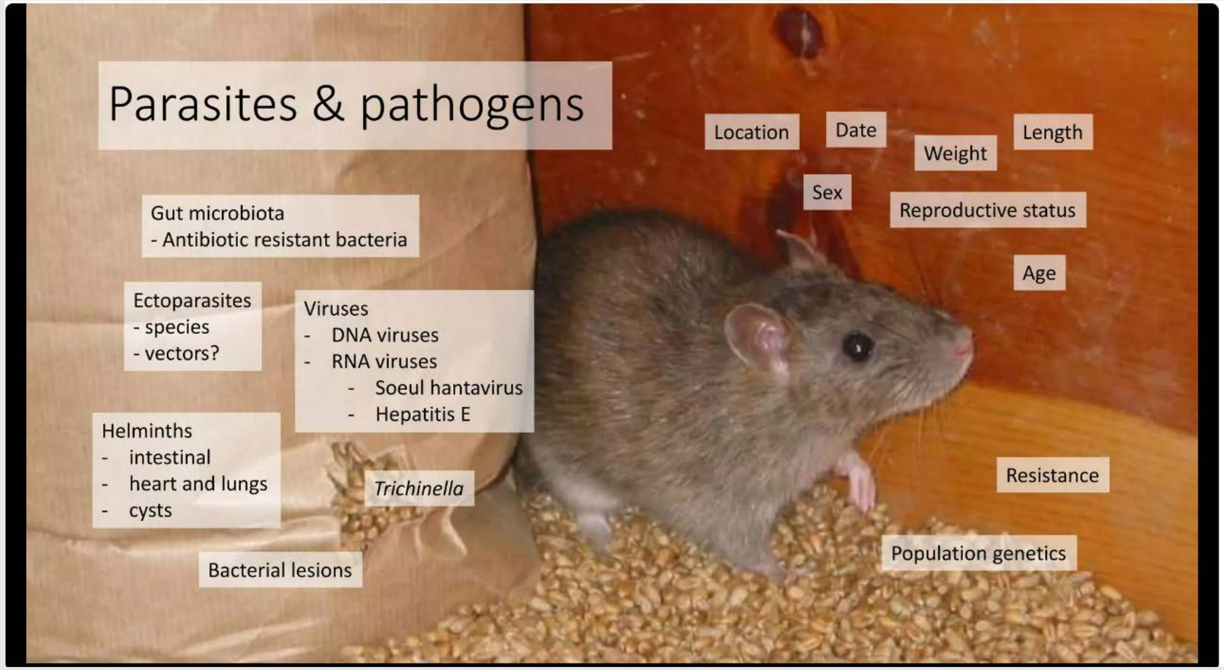
Aivelo, Tuomas et al. (in prep): Potentially zoonotic pathogens and parasites in opportunistically sourced urban brown rats (*Rattus norvegicus*) within and around Helsinki, Finland, 2018-2023

288 rats, all found *Trichinella* negative.

Urban rats in Helsinki

Tuomas Aivelo, @aivelo

Organismal and Evolutionary Biology / UH



Parasites & pathogens

Gut microbiota
- Antibiotic resistant bacteria

Ectoparasites
- species
- vectors?

Viruses
- DNA viruses
- RNA viruses
  - Soeul hantavirus
  - Hepatitis E

Helminths
- intestinal
- heart and lungs
- cysts

Trichinella

Bacterial lesions

Location

Date

Weight

Length

Sex

Reproductive status

Age

Resistance

Population genetics

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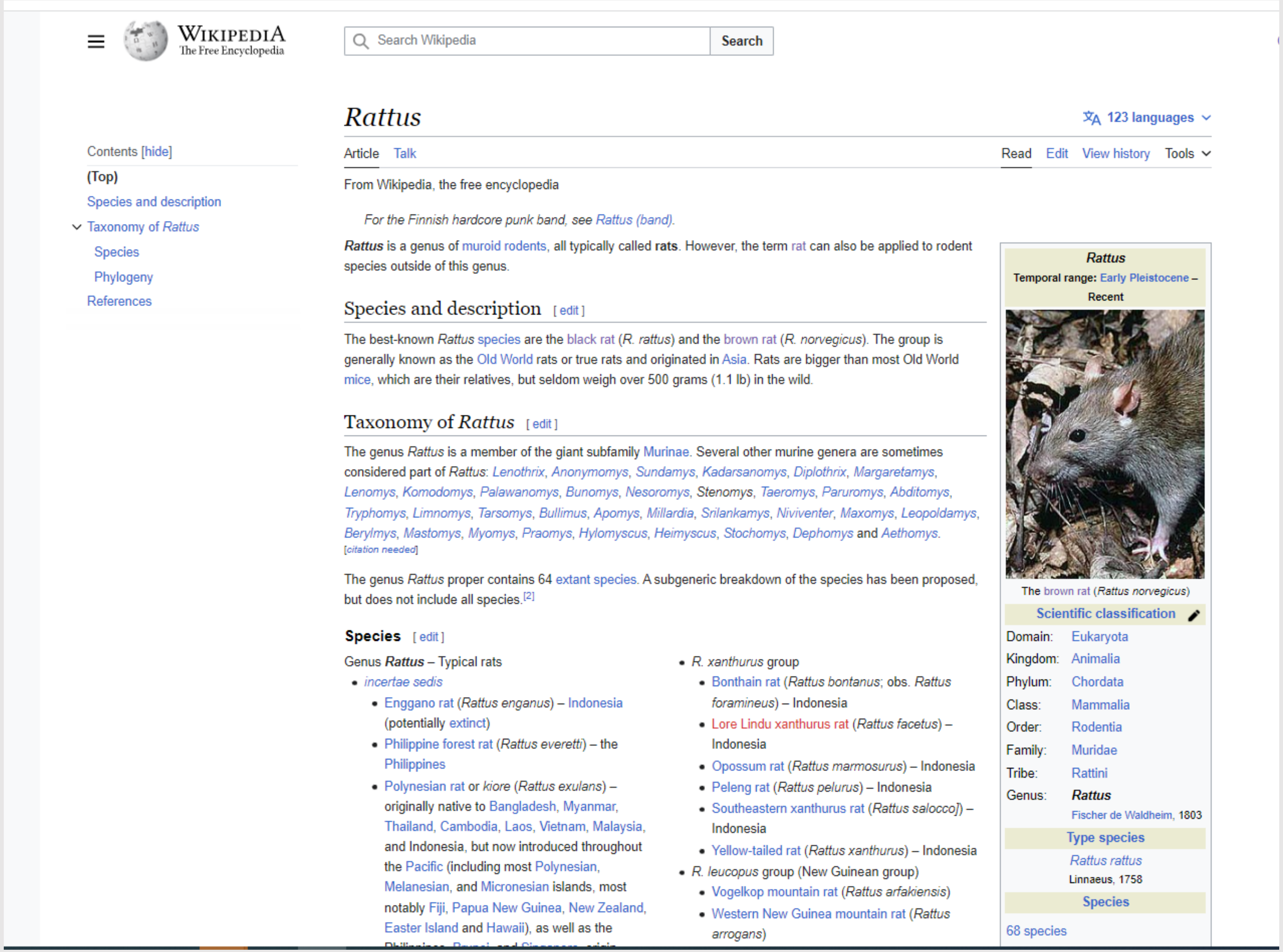


Rattus

From Wikipedia, the free encyclopedia

For the Finnish hardcore punk band, see Rattus (band).

Rattus is a genus of muroid rodents, all typically called **rats**. However, the term rat can also be applied to rodent species outside of this genus.

Species and description [edit]

The best-known *Rattus* species are the black rat (*R. rattus*) and the brown rat (*R. norvegicus*). The group is generally known as the Old World rats or true rats and originated in Asia. Rats are bigger than most Old World mice, which are their relatives, but seldom weigh over 500 grams (1.1 lb) in the wild.

Taxonomy of *Rattus* [edit]

The genus *Rattus* is a member of the giant subfamily Murinae. Several other murine genera are sometimes considered part of *Rattus*: *Lenothrix*, *Anonymomys*, *Sundamys*, *Kadarsanomys*, *Diplothrix*, *Margaretamys*, *Lenomys*, *Komodomys*, *Palawanomys*, *Bunomys*, *Nesoromys*, *Stenomys*, *Taeromys*, *Paruromys*, *Abditomys*, *Tryphomys*, *Limnomys*, *Tarsomys*, *Bullimus*, *Apomys*, *Millardia*, *Srilankamys*, *Niviventer*, *Maxomys*, *Leopoldamys*, *Berylmys*, *Mastomys*, *Myomys*, *Praomys*, *Hylomyscus*, *Heimyscus*, *Stochomys*, *Dephomys* and *Aethomys*.
[*citation needed*]

The genus *Rattus* proper contains 64 extant species. A subgeneric breakdown of the species has been proposed, but does not include all species.[2]

Species [edit]

Genus ***Rattus*** – Typical rats

- *incertae sedis*
  - Enggano rat (*Rattus enganus*) – Indonesia (potentially extinct)
  - Philippine forest rat (*Rattus everetti*) – the Philippines
  - Polynesian rat or *kiore* (*Rattus exulans*) – originally native to Bangladesh, Myanmar, Thailand, Cambodia, Laos, Vietnam, Malaysia, and Indonesia, but now introduced throughout the Pacific (including most Polynesian, Melanesian, and Micronesian islands, most notably Fiji, Papua New Guinea, New Zealand, Easter Island and Hawaii), as well as the
- *R. xanthurus* group
  - Bonthain rat (*Rattus bontanus*; obs. *Rattus foramineus*) – Indonesia
  - Lore Lindu xanthurus rat (*Rattus facetus*) – Indonesia
  - Opossum rat (*Rattus marmosurus*) – Indonesia
  - Peleng rat (*Rattus pelurus*) – Indonesia
  - Southeastern xanthurus rat (*Rattus salocco*]) – Indonesia
  - Yellow-tailed rat (*Rattus xanthurus*) – Indonesia
- *R. leucopus* group (New Guinean group)
  - Vogelkop mountain rat (*Rattus arfakiensis*)
  - Western New Guinea mountain rat (*Rattus arrogans*)

Rattus

Temporal range: Early Pleistocene – Recent

The brown rat (*Rattus norvegicus*)

Scientific classification

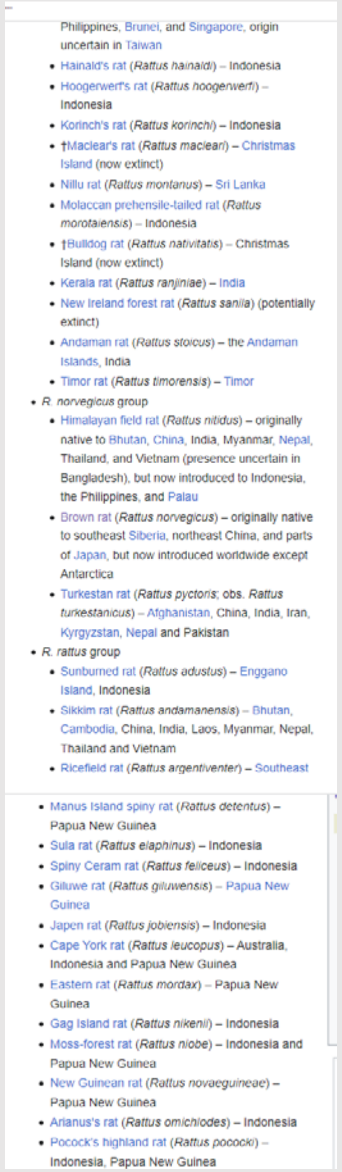
Domain:	Eukaryota
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Rodentia
Family:	Muridae
Tribe:	Rattini
Genus:	***Rattus*** Fischer de Waldheim, 1803

Type species

Rattus rattus
Linnaeus, 1758

Species

68 species



Philippines, Brunei, and Singapore, origin uncertain in Taiwan

- Hainald's rat (*Rattus hainaldi*) – Indonesia
- Hoogerwerf's rat (*Rattus hoogerwerfi*) – Indonesia
- Korinch's rat (*Rattus korinchi*) – Indonesia
- †Maclear's rat (*Rattus macleari*) – Christmas Island (now extinct)
- Nillu rat (*Rattus montanus*) – Sri Lanka
- Molaccan prehensile-tailed rat (*Rattus morotaiensis*) – Indonesia
- †Bulldog rat (*Rattus nativitatis*) – Christmas Island (now extinct)
- Kerala rat (*Rattus ranjiniae*) – India
- New Ireland forest rat (*Rattus sanila*) (potentially extinct)
- Andaman rat (*Rattus stoicus*) – the Andaman Islands, India
- Timor rat (*Rattus timorensis*) – Timor

- *R. norvegicus* group
  - Himalayan field rat (*Rattus nitidus*) – originally native to Bhutan, China, India, Myanmar, Nepal, Thailand, and Vietnam (presence uncertain in Bangladesh), but now introduced to Indonesia, the Philippines, and Palau
  - Brown rat (*Rattus norvegicus*) – originally native to southeast Siberia, northeast China, and parts of Japan, but now introduced worldwide except Antarctica
  - Turkestan rat (*Rattus pyctoris*; obs. *Rattus turkestanicus*) – Afghanistan, China, India, Iran, Kyrgyzstan, Nepal and Pakistan
- *R. rattus* group
  - Sunburned rat (*Rattus adustus*) – Enggano Island, Indonesia
  - Sikkim rat (*Rattus andamanensis*) – Bhutan, Cambodia, China, India, Laos, Myanmar, Nepal, Thailand and Vietnam
  - Ricefield rat (*Rattus argentiventer*) – Southeast

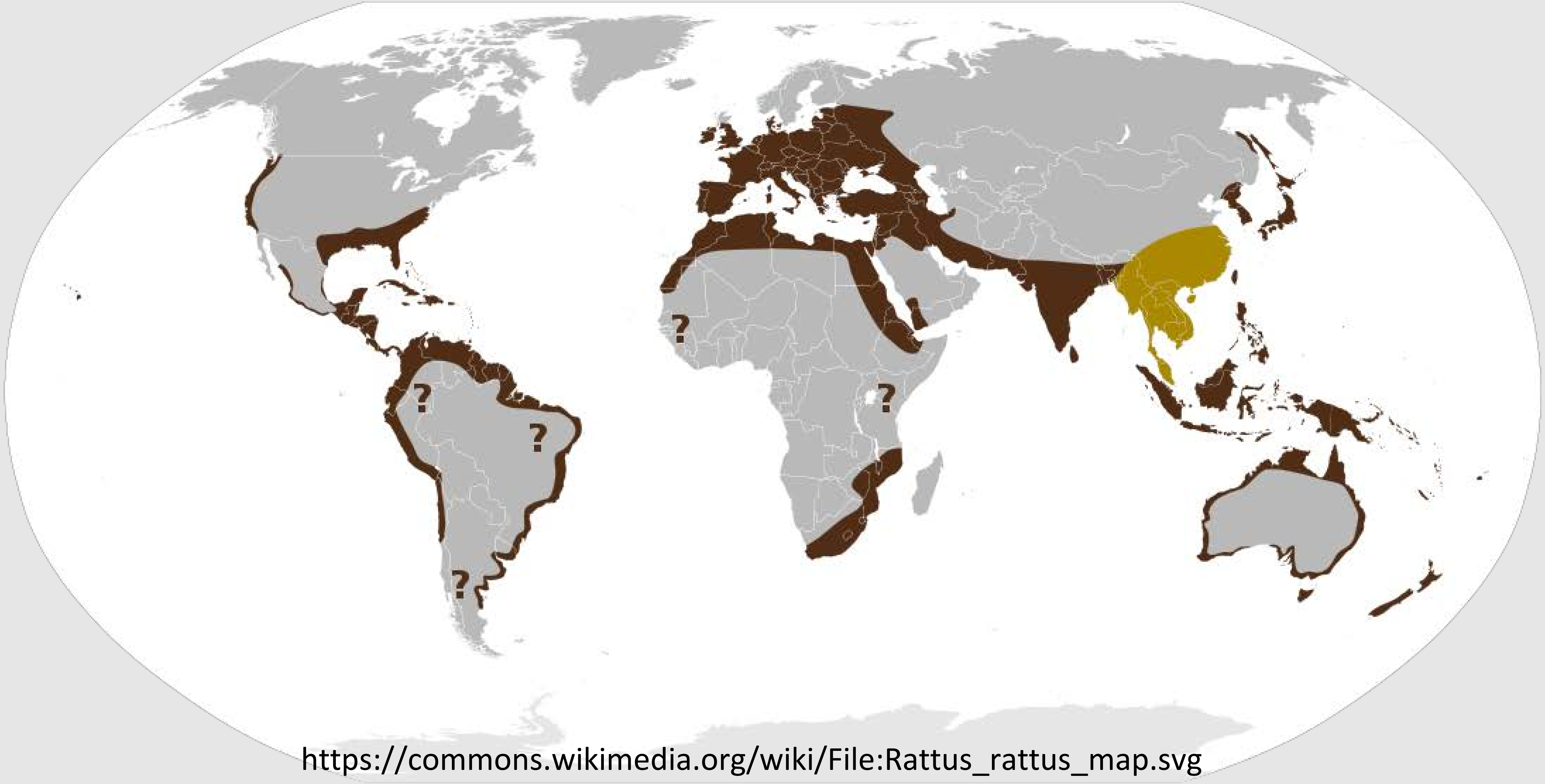
- Manus Island spiny rat (*Rattus detentus*) – Papua New Guinea
- Sula rat (*Rattus elaphinus*) – Indonesia
- Spiny Ceram rat (*Rattus feliceus*) – Indonesia
- Giluwe rat (*Rattus giluwensis*) – Papua New Guinea
- Japen rat (*Rattus jobiensis*) – Indonesia
- Cape York rat (*Rattus leucopus*) – Australia, Indonesia and Papua New Guinea
- Eastern rat (*Rattus mordax*) – Papua New Guinea
- Gag Island rat (*Rattus nikenii*) – Indonesia
- Moss-forest rat (*Rattus niobe*) – Indonesia and Papua New Guinea
- New Guinean rat (*Rattus novaeguineae*) – Papua New Guinea
- Arianus's rat (*Rattus omichlodes*) – Indonesia
- Pocock's highland rat (*Rattus pococki*) – Indonesia, Papua New Guinea

- Pocock's highland rat (*Rattus pococki*) – Indonesia, Papua New Guinea
- Large New Guinea spiny rat (*Rattus praetor*) – Indonesia, Papua New Guinea and the Solomon Islands
- Glacier rat (*Rattus richardsoni*) – Indonesia
- Stein's rat (*Rattus steini*) – Indonesia and Papua New Guinea
- Van Deusen's rat (*Rattus vandeuseni*) – Papua New Guinea
- Slender rat (*Rattus verecundus*) – Indonesia and Papua New Guinea
- *R. fuscipes* group (Australian group)
  - Dusky rat (*Rattus colletti*) – Australia
  - Bush rat (*Rattus fuscipes*) – Australia
  - Australian swamp rat (*Rattus lutreolus*) – Australia
  - Dusky field rat (*Rattus sordidus*) – Australia, Indonesia and Papua New Guinea
  - Pale field rat (*Rattus tunneyi*) – Australia
  - Long-haired rat (*Rattus villosissimus*) – Australia

Asia

- Summit rat (*Rattus baluensis*) – Malaysia
- Aceh rat (*Rattus blangorum*) – Indonesia
- Nonsense rat (*Rattus burrus*) – Nicobar Islands, India
- Hoffmann's rat (*Rattus hoffmanni*) – Indonesia
- Koopman's rat (*Rattus koopmani*) – Indonesia
- Lesser ricefield rat (*Rattus losea*) – China, Laos, Taiwan, Thailand and Vietnam
- Mentawai rat (*Rattus lugens*) – Indonesia
- Mindoro black rat (*Rattus mindorensis*) – the Philippines
- Little soft-furred rat (*Rattus mollicomulus*) – Indonesia
- Osgood's rat (*Rattus osgoodi*) – Vietnam
- Palm rat (*Rattus palmarum*) – Nicobar Islands, India
- Black rat (*Rattus rattus*) – originally native to western India and Pakistan, but now introduced worldwide except Antarctica
- Little Indochinese field rat (*Rattus sakeratensis*) – Thailand and Laos
- Sahyadris forest rat (*Rattus satarae*) – India
- Simalur rat (*Rattus simalurensis*) – Indonesia
- Tanezumi rat (*Rattus tanezumi*) – Afghanistan, Bangladesh, Cambodia, China, Cocos (Keeling) Islands, Fiji, India, Indonesia, Japan, North Korea, South Korea, Laos, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, Taiwan, Thailand and Vietnam
- Tawitawi forest rat (*Rattus tawitawiensis*) – the Philippines
- Malayan field rat (*Rattus tiomanicus*) – Indonesia, Malaysia, the Philippines and Thailand

Black rat, *Rattus rattus*



https://commons.wikimedia.org/wiki/File:Rattus_rattus_map.svg

Parasitology Research (2020) 119:2383–2397
https://doi.org/10.1007/s00436-020-06776-3

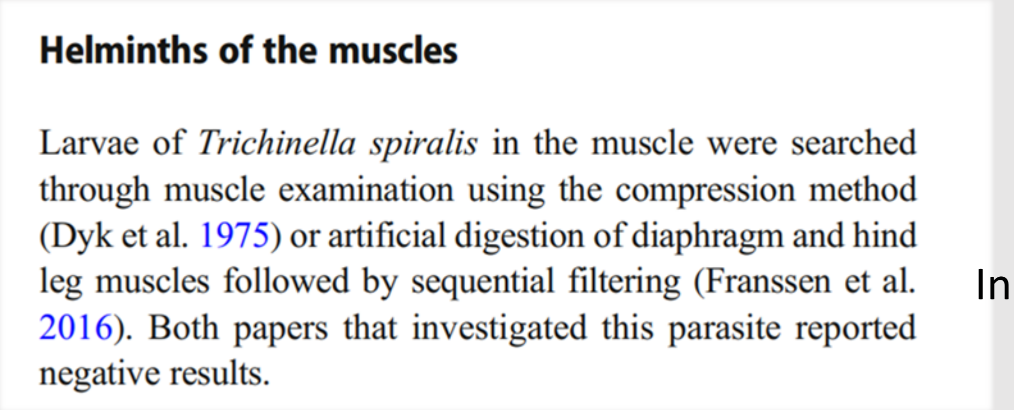
HELMINTHOLOGY - REVIEW

Helminths of urban rats in developed countries: a systematic review to identify research gaps

Diana S. Gliga[1] • Benoît Pisanu[2] • Chris Walzer[1,3] • Amélie Desvars-Larrive[1,4,5]

Received: 27 February 2020 / Accepted: 17 June 2020 / Published online: 30 June 2020

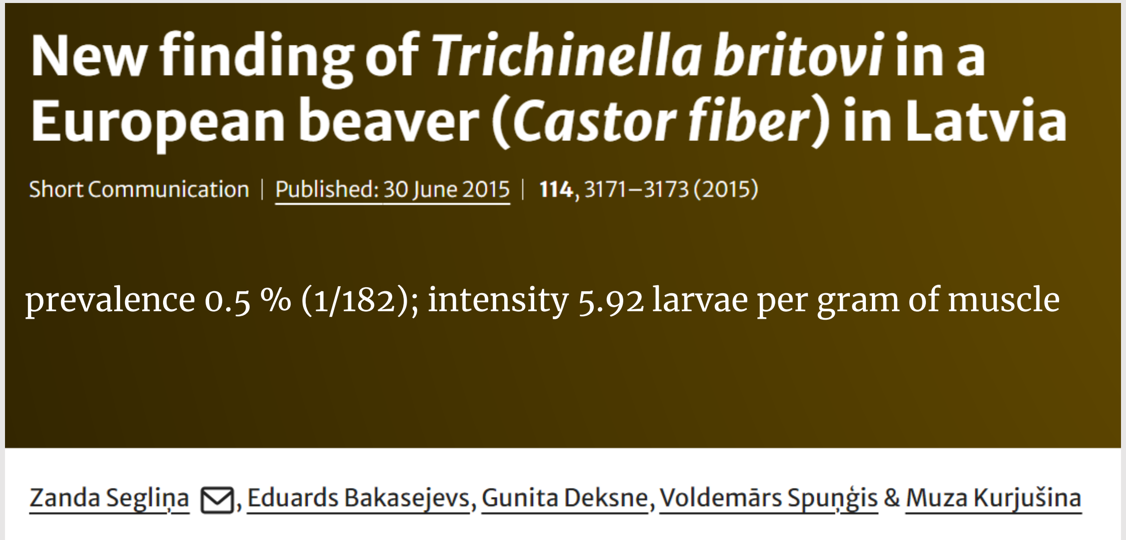
Abstract



Helminths of the muscles

Larvae of *Trichinella spiralis* in the muscle were searched through muscle examination using the compression method (Dyk et al. 1975) or artificial digestion of diaphragm and hind leg muscles followed by sequential filtering (Franssen et al. 2016). Both papers that investigated this parasite reported negative results.

Incl. 44 black rats

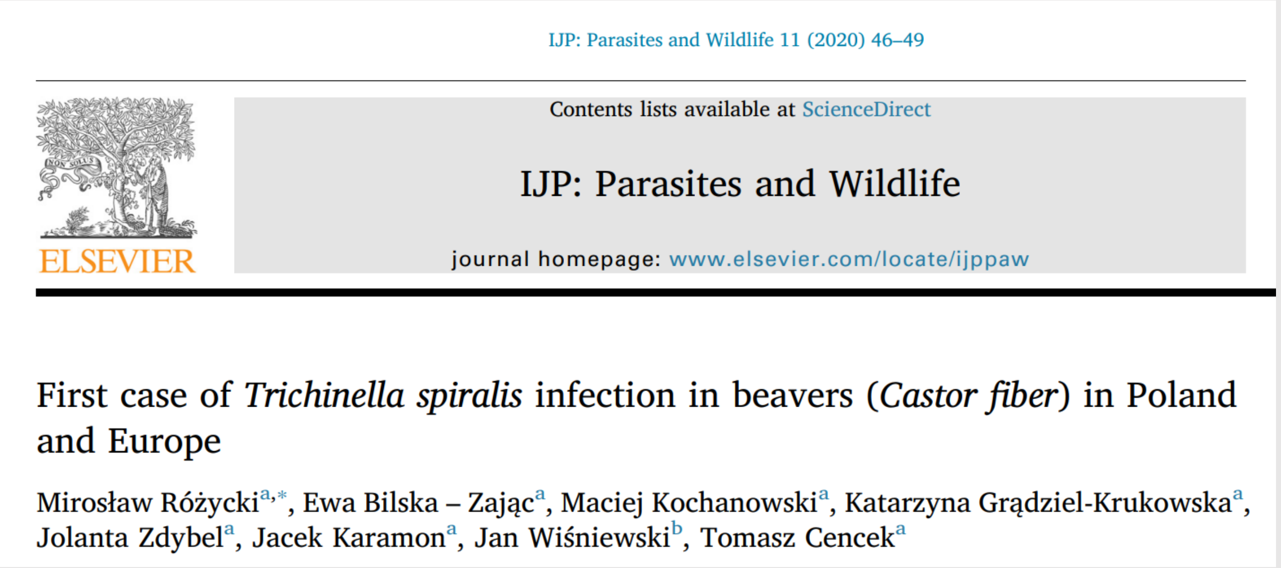


New finding of *Trichinella britovi* in a European beaver (*Castor fiber*) in Latvia

Short Communication | Published: 30 June 2015 | **114**, 3171–3173 (2015)

prevalence 0.5 % (1/182); intensity 5.92 larvae per gram of muscle

Zanda Seglina, Eduards Bakasejevs, Gunita Deksne, Voldemārs Spuņģis & Muza Kurjušina



IJP: Parasites and Wildlife 11 (2020) 46–49

Contents lists available at ScienceDirect

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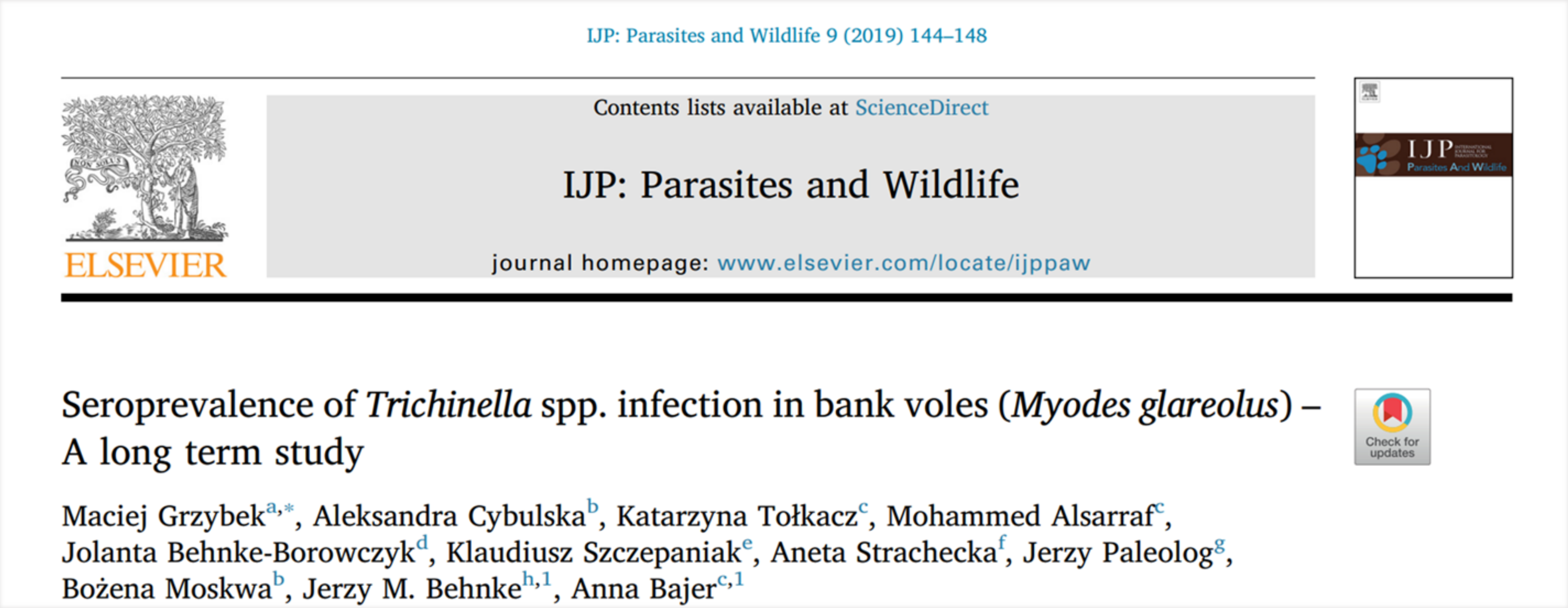
journal homepage: www.elsevier.com/locate/ijppaw

ELSEVIER

First case of *Trichinella spiralis* infection in beavers (*Castor fiber*) in Poland and Europe

Mirosław Różycki[a,*], Ewa Bilska – Zając[a], Maciej Kochanowski[a], Katarzyna Grądziel-Krukowska[a], Jolanta Zdybel[a], Jacek Karamon[a], Jan Wiśniewski[b], Tomasz Cencek[a]

prevalence 1.4 % (1/69); intensity 0.02 lpg (1 larva per 50 gram of muscle)



IJP: Parasites and Wildlife 9 (2019) 144–148

Contents lists available at ScienceDirect

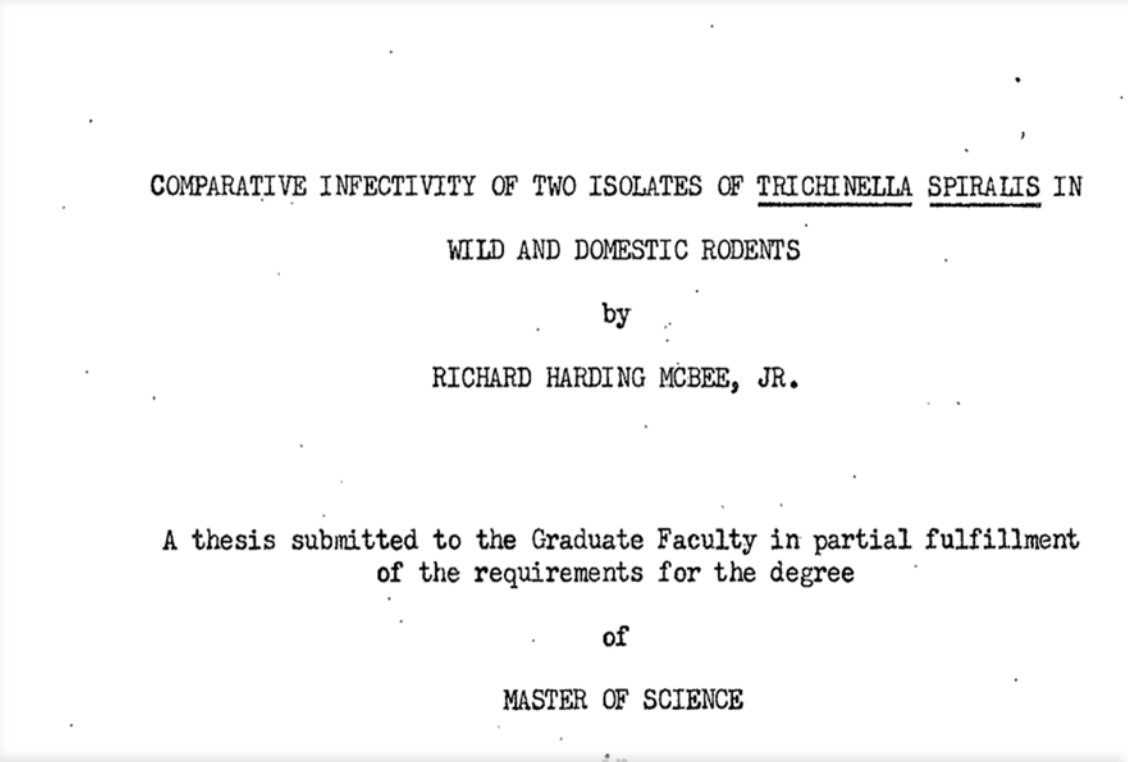
IJP: Parasites and Wildlife

journal homepage: www.elsevier.com/locate/ijppaw

Seroprevalence of *Trichinella* spp. infection in bank voles (*Myodes glareolus*) – A long term study

Maciej Grzybek[a,*], Aleksandra Cybulska[b], Katarzyna Tołkacz[c], Mohammed Alsarraf[c], Jolanta Behnke-Borowczyk[d], Klaudiusz Szczepaniak[e], Aneta Strachecka[f], Jerzy Paleolog[g], Bożena Moskwa[b], Jerzy M. Behnke[h,1], Anna Bajer[c,1]

1.4% seroprevalence



COMPARATIVE INFECTIVITY OF TWO ISOLATES OF TRICHINELLA SPIRALIS IN

WILD AND DOMESTIC RODENTS

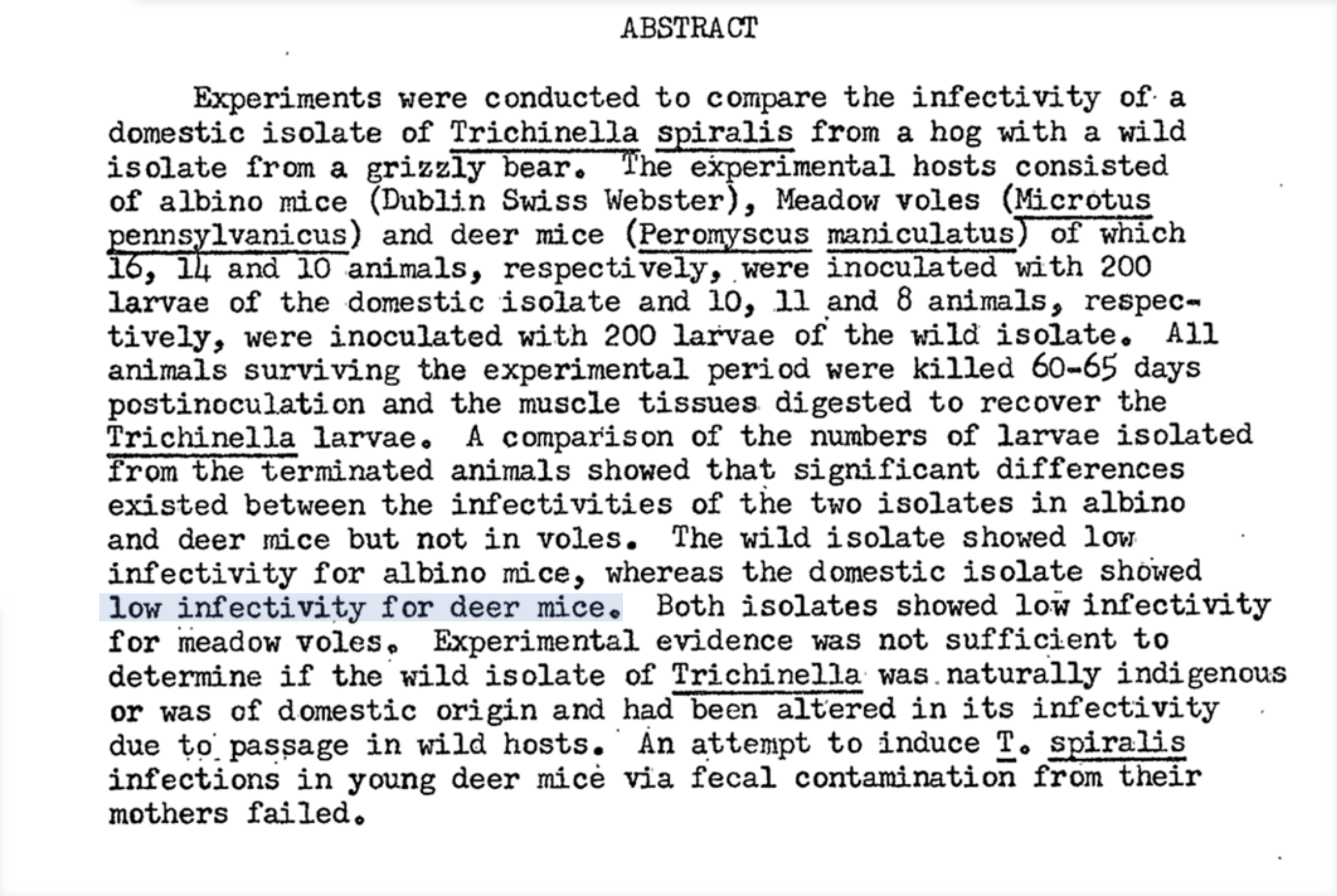
by

RICHARD HARDING MCBEE, JR.

A thesis submitted to the Graduate Faculty in partial fulfillment
of the requirements for the degree

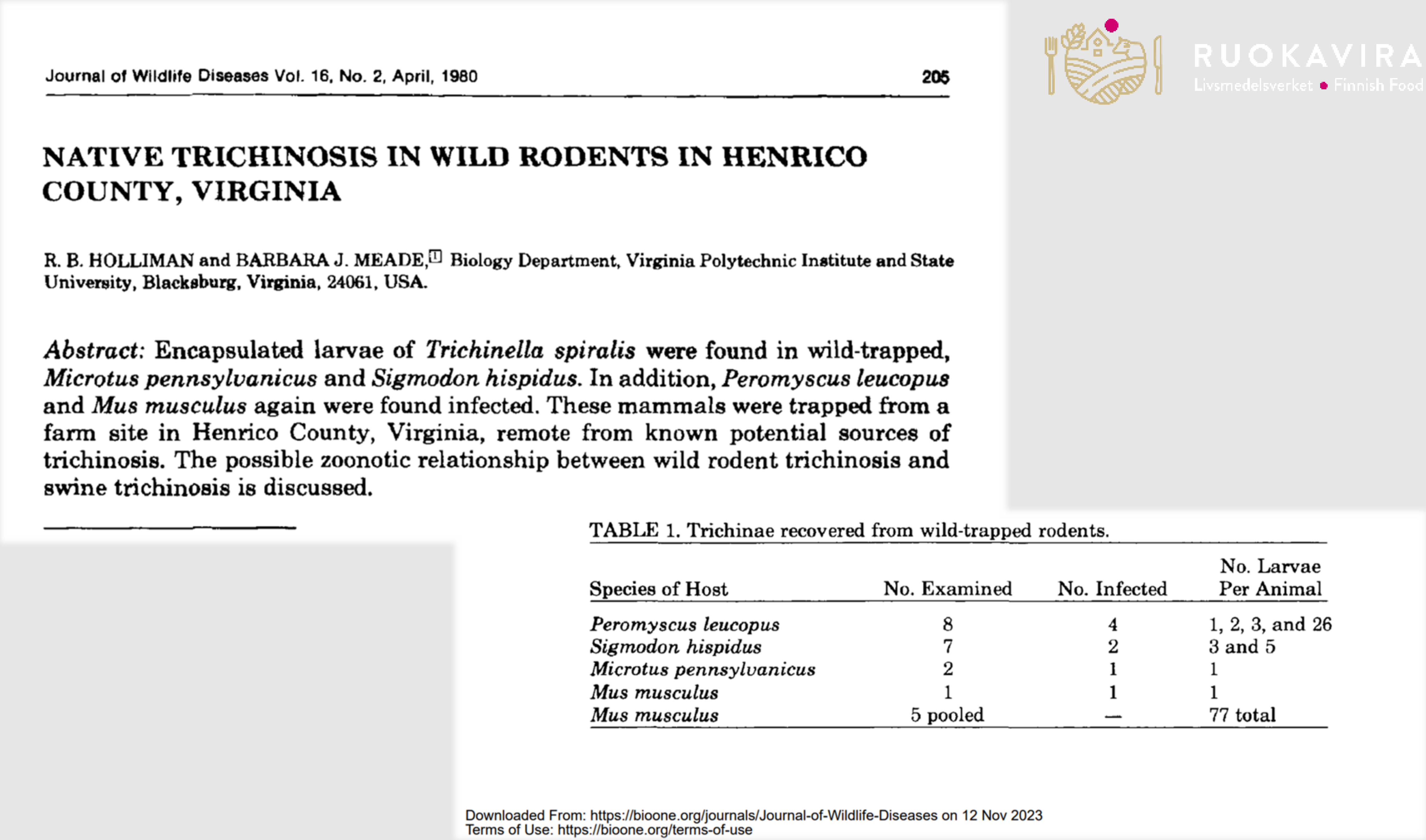
of

MASTER OF SCIENCE



ABSTRACT

Experiments were conducted to compare the infectivity of a domestic isolate of *Trichinella spiralis* from a hog with a wild isolate from a grizzly bear. The experimental hosts consisted of albino mice (Dublin Swiss Webster), Meadow voles (*Microtus pennsylvanicus*) and deer mice (*Peromyscus maniculatus*) of which 16, 14 and 10 animals, respectively, were inoculated with 200 larvae of the domestic isolate and 10, 11 and 8 animals, respectively, were inoculated with 200 larvae of the wild isolate. All animals surviving the experimental period were killed 60-65 days postinoculation and the muscle tissues digested to recover the *Trichinella* larvae. A comparison of the numbers of larvae isolated from the terminated animals showed that significant differences existed between the infectivities of the two isolates in albino and deer mice but not in voles. The wild isolate showed low infectivity for albino mice, whereas the domestic isolate showed low infectivity for deer mice. Both isolates showed low infectivity for meadow voles. Experimental evidence was not sufficient to determine if the wild isolate of *Trichinella* was naturally indigenous or was of domestic origin and had been altered in its infectivity due to passage in wild hosts. An attempt to induce *T. spiralis* infections in young deer mice via fecal contamination from their mothers failed.



Journal of Wildlife Diseases Vol. 16, No. 2, April, 1980 205

NATIVE TRICHINOSIS IN WILD RODENTS IN HENRICO COUNTY, VIRGINIA

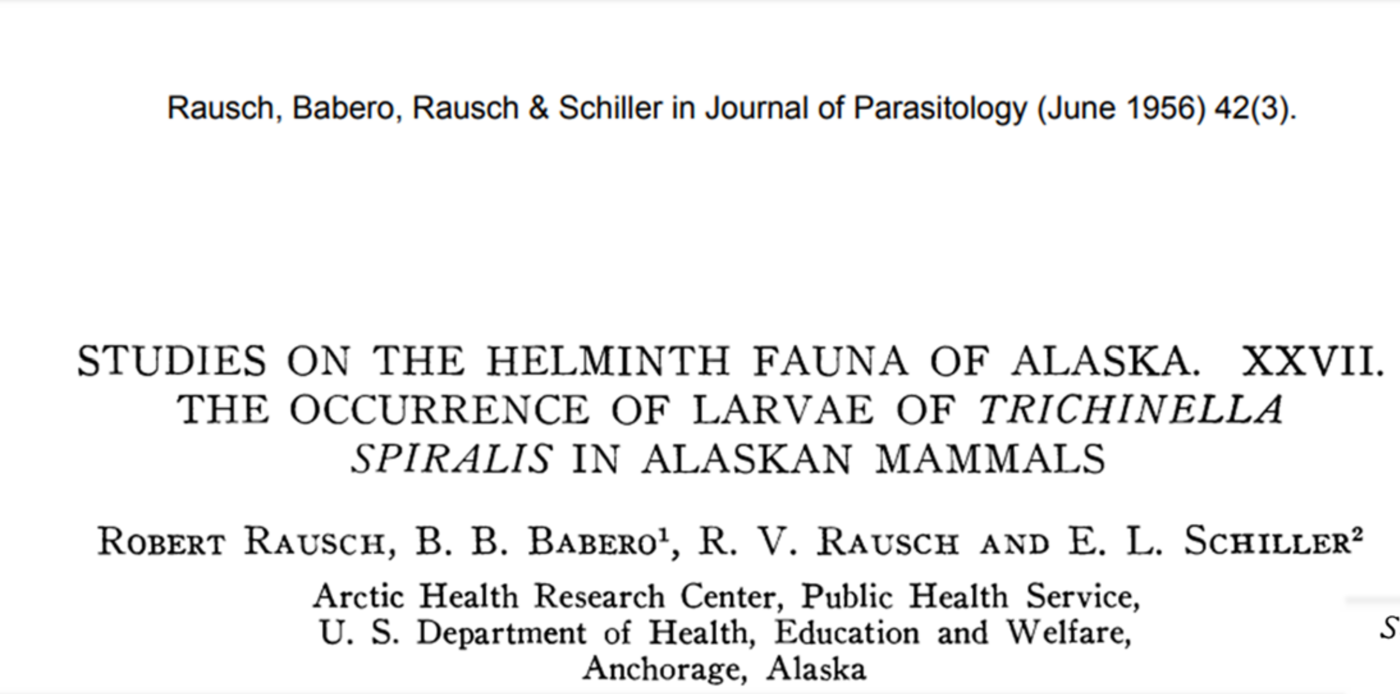
R. B. HOLLIMAN and BARBARA J. MEADE,[1] Biology Department, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, 24061, USA.

Abstract: Encapsulated larvae of *Trichinella spiralis* were found in wild-trapped, *Microtus pennsylvanicus* and *Sigmodon hispidus*. In addition, *Peromyscus leucopus* and *Mus musculus* again were found infected. These mammals were trapped from a farm site in Henrico County, Virginia, remote from known potential sources of trichinosis. The possible zoonotic relationship between wild rodent trichinosis and swine trichinosis is discussed.

TABLE 1. Trichinae recovered from wild-trapped rodents.

Species of Host	No. Examined	No. Infected	No. Larvae Per Animal
Peromyscus leucopus	8	4	1, 2, 3, and 26
Sigmodon hispidus	7	2	3 and 5
Microtus pennsylvanicus	2	1	1
Mus musculus	1	1	1
Mus musculus	5 pooled	—	77 total

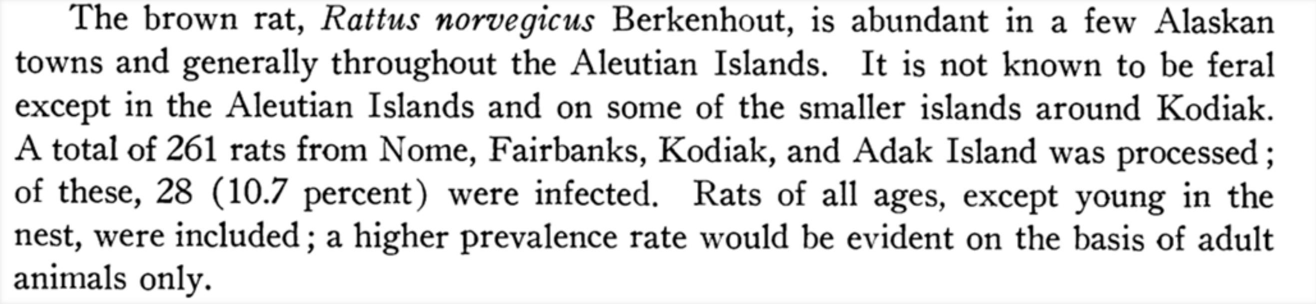
Rausch, Babero, Rausch & Schiller in Journal of Parasitology (June 1956) 42(3).



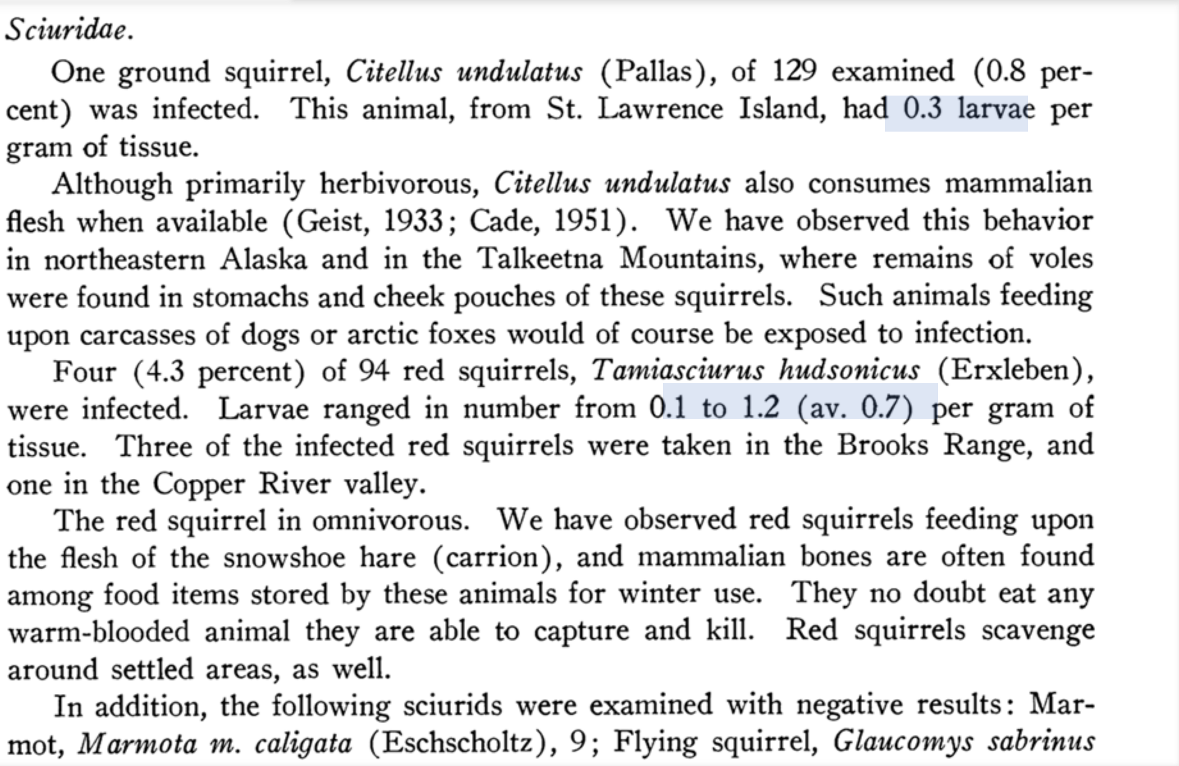
STUDIES ON THE HELMINTH FAUNA OF ALASKA. XXVII. THE OCCURRENCE OF LARVAE OF *TRICHINELLA SPIRALIS* IN ALASKAN MAMMALS

ROBERT RAUSCH, B. B. BABERO[1], R. V. RAUSCH AND E. L. SCHILLER[2]

Arctic Health Research Center, Public Health Service,
U. S. Department of Health, Education and Welfare,
Anchorage, Alaska



The brown rat, *Rattus norvegicus* Berkenhout, is abundant in a few Alaskan towns and generally throughout the Aleutian Islands. It is not known to be feral except in the Aleutian Islands and on some of the smaller islands around Kodiak. A total of 261 rats from Nome, Fairbanks, Kodiak, and Adak Island was processed; of these, 28 (10.7 percent) were infected. Rats of all ages, except young in the nest, were included; a higher prevalence rate would be evident on the basis of adult animals only.



Sciuridae.

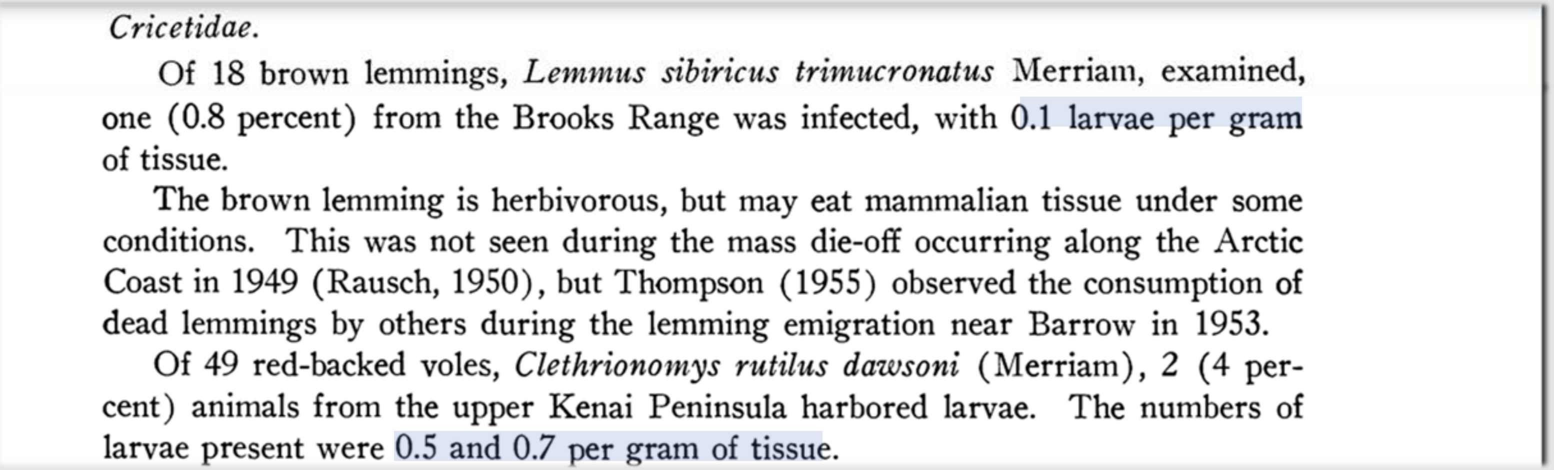
One ground squirrel, *Citellus undulatus* (Pallas), of 129 examined (0.8 percent) was infected. This animal, from St. Lawrence Island, had 0.3 larvae per gram of tissue.

Although primarily herbivorous, *Citellus undulatus* also consumes mammalian flesh when available (Geist, 1933; Cade, 1951). We have observed this behavior in northeastern Alaska and in the Talkeetna Mountains, where remains of voles were found in stomachs and cheek pouches of these squirrels. Such animals feeding upon carcasses of dogs or arctic foxes would of course be exposed to infection.

Four (4.3 percent) of 94 red squirrels, *Tamiasciurus hudsonicus* (Erxleben), were infected. Larvae ranged in number from 0.1 to 1.2 (av. 0.7) per gram of tissue. Three of the infected red squirrels were taken in the Brooks Range, and one in the Copper River valley.

The red squirrel in omnivorous. We have observed red squirrels feeding upon the flesh of the snowshoe hare (carrion), and mammalian bones are often found among food items stored by these animals for winter use. They no doubt eat any warm-blooded animal they are able to capture and kill. Red squirrels scavenge around settled areas, as well.

In addition, the following sciurids were examined with negative results: Marmot, *Marmota m. caligata* (Eschscholtz), 9; Flying squirrel, *Glaucomys sabrinus*

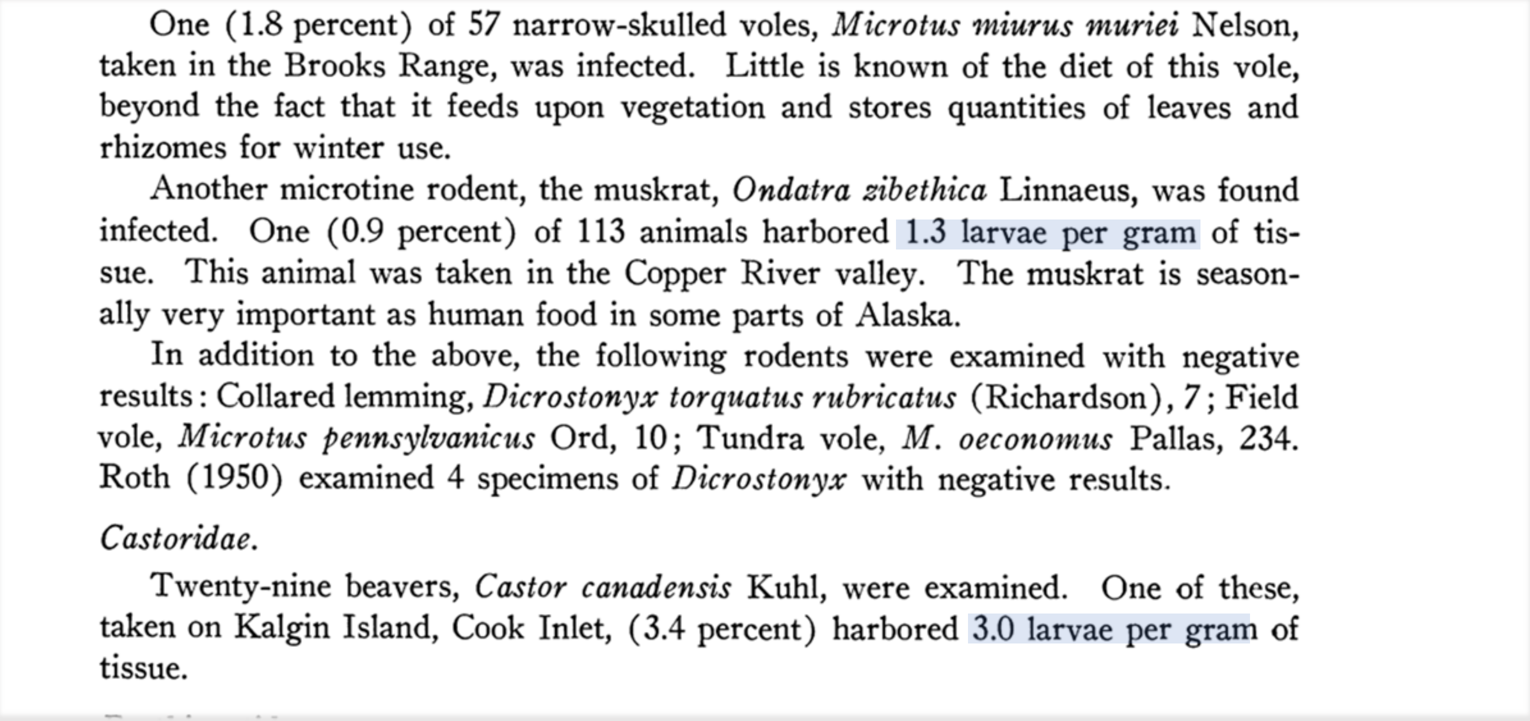


Cricetidae.

Of 18 brown lemmings, *Lemmus sibiricus trimucronatus* Merriam, examined, one (0.8 percent) from the Brooks Range was infected, with 0.1 larvae per gram of tissue.

The brown lemming is herbivorous, but may eat mammalian tissue under some conditions. This was not seen during the mass die-off occurring along the Arctic Coast in 1949 (Rausch, 1950), but Thompson (1955) observed the consumption of dead lemmings by others during the lemming emigration near Barrow in 1953.

Of 49 red-backed voles, *Clethrionomys rutilus dawsoni* (Merriam), 2 (4 percent) animals from the upper Kenai Peninsula harbored larvae. The numbers of larvae present were 0.5 and 0.7 per gram of tissue.



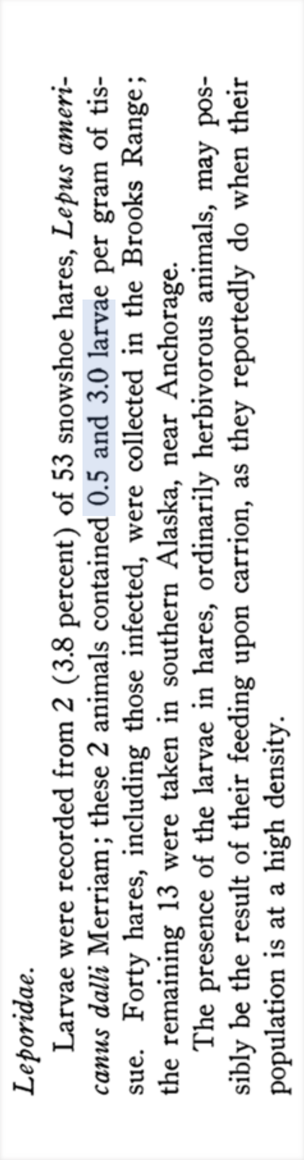
One (1.8 percent) of 57 narrow-skulled voles, *Microtus miurus muriei* Nelson, taken in the Brooks Range, was infected. Little is known of the diet of this vole, beyond the fact that it feeds upon vegetation and stores quantities of leaves and rhizomes for winter use.

Another microtine rodent, the muskrat, *Ondatra zibethica* Linnaeus, was found infected. One (0.9 percent) of 113 animals harbored 1.3 larvae per gram of tissue. This animal was taken in the Copper River valley. The muskrat is seasonally very important as human food in some parts of Alaska.

In addition to the above, the following rodents were examined with negative results: Collared lemming, *Dicrostonyx torquatus rubricatus* (Richardson), 7; Field vole, *Microtus pennsylvanicus* Ord, 10; Tundra vole, *M. oeconomus* Pallas, 234. Roth (1950) examined 4 specimens of *Dicrostonyx* with negative results.

Castoridae.

Twenty-nine beavers, *Castor canadensis* Kuhl, were examined. One of these, taken on Kalgin Island, Cook Inlet, (3.4 percent) harbored 3.0 larvae per gram of tissue.



Leporidae.

Larvae were recorded from 2 (3.8 percent) of 53 snowshoe hares, *Lepus americanus dalli* Merriam; these 2 animals contained 0.5 and 3.0 larvae per gram of tissue. Forty hares, including those infected, were collected in the Brooks Range; the remaining 13 were taken in southern Alaska, near Anchorage.

The presence of the larvae in hares, ordinarily herbivorous animals, may possibly be the result of their feeding upon carrion, as they reportedly do when their population is at a high density.

Välimaa *et al. Acta Veterinaria Scandinavica* 2010, **52**(Suppl 1):S15
http://www.actavetscand.com/content/52/S1/S15

AVS Acta Veterinaria Scandinavica ACTA VETERINARIA SCANDINAVICA

POSTER PRESENTATION **Open Access**

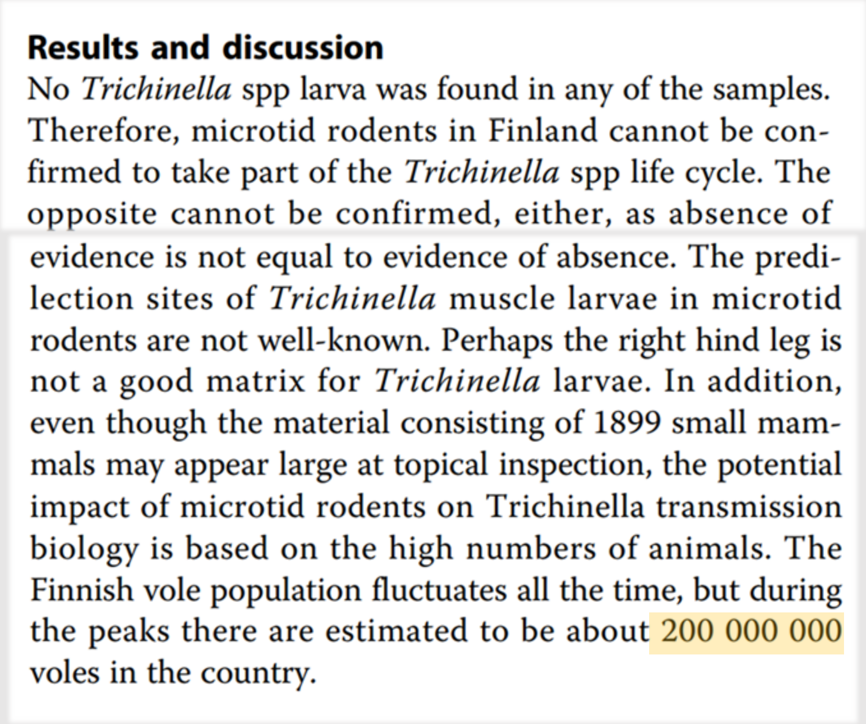
Sylvatic *Trichinella* reservoir not found among voles in Finland

Hanna Välimaa[1*], Jukka Niemimaa[2], Antti Oksanen[1], Heikki Henttonen[2]

RUOKAVIRASTO
Livsmedelsverket • Finnish Food Authority

Myodes glareolus, by Heikki Henttonen

Microtus agrestis, by Fer boei, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=1760168



Results and discussion

No *Trichinella* spp larva was found in any of the samples. Therefore, microtid rodents in Finland cannot be confirmed to take part of the *Trichinella* spp life cycle. The opposite cannot be confirmed, either, as absence of evidence is not equal to evidence of absence. The predilection sites of *Trichinella* muscle larvae in microtid rodents are not well-known. Perhaps the right hind leg is not a good matrix for *Trichinella* larvae. In addition, even though the material consisting of 1899 small mammals may appear large at topical inspection, the potential impact of microtid rodents on Trichinella transmission biology is based on the high numbers of animals. The Finnish vole population fluctuates all the time, but during the peaks there are estimated to be about 200 000 000 voles in the country.

Food and Waterborne Parasitology 27 (2022) e00156

Contents lists available at ScienceDirect

Food and Waterborne Parasitology

journal homepage: www.elsevier.com/locate/fawpar

The International Trichinella Reference Centre database. Report on thirty-three years of activity and future perspectives

G. Marucci[a,*], D. Tonanzi[a], M. Interisano[a], P. Vatta[a], F. Galati[b], G. La Rosa[a]

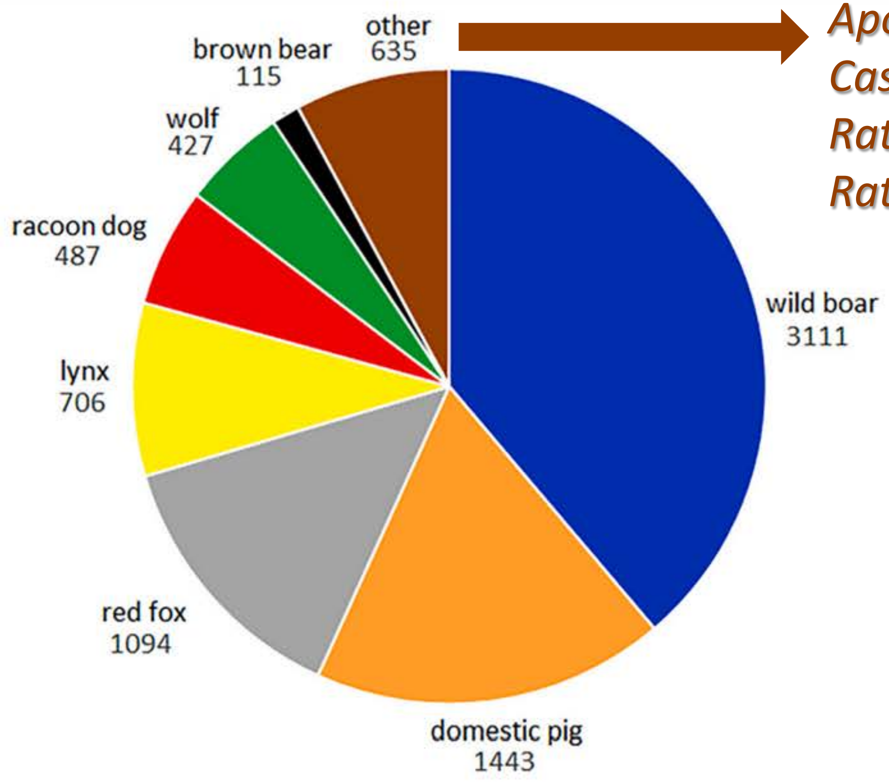


Fig. 2. Main mammalian host species reported in the database and number of associated infections.

Apodemus sylvaticus,	field mouse	2
Castor fiber,	European beaver	1
Rattus norvegicus,	brown rat	49
Rattus rattus,	black rat	5

Brown rat: low to high larval burden, only *T. spiralis* and *T. pseudospiralis* (?)

Black rat: ? ?

Wild mice: ?

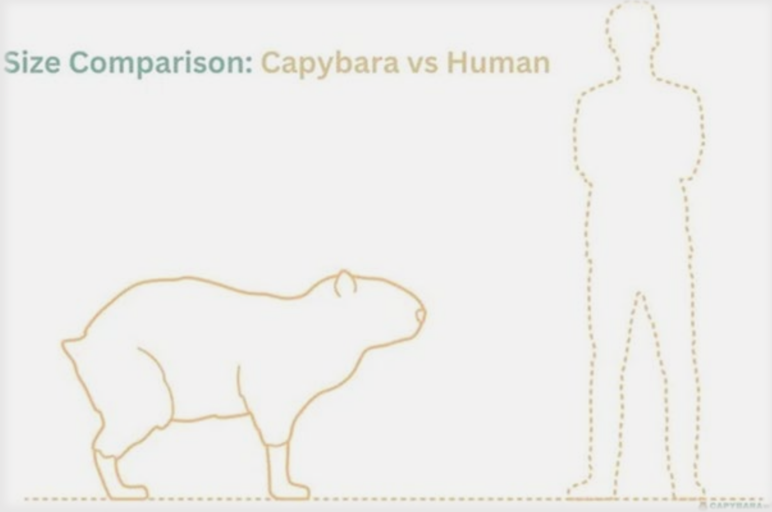
Squirrels, lemmings, voles: low larval burden, *T.* species ?

Beaver: very low to low larval burden, *T. spiralis* and *T. britovi*

Prevalence low
Number of potential hosts high

City says Rome is home to seven million rats.

“estimated 1.3 million coypus (nutria) in the northern Lombardy region alone.”



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