Research on paratuberculosis: Analysis of publications 1994–2004[1]

K. Hruska

Veterinary Research Institute[2], Brno, Czech Republic

ABSTRACT: The Web of Knowledge Results Analysis of papers published on paratuberculosis in 1994–2004 demonstrated the increasing interest in *Mycobacterium avium* subsp. *paratuberculosis* (MAP). In the analyzed period 1 032 papers published by 2 519 authors affiliated with 738 institutions were indexed in the Web of Science database. The papers were published in 238 journals, 25 of which contained more than 55% of articles. The Top 50 authors, Top 50 institutions and Top 50 most frequently cited papers are listed in this review. The contribution of OIE Reference Laboratory for Paratuberculosis established in the Veterinary Research Institute, Brno, is assessed according to the number of publications (29), number of authors participating (79), number of institutions collaborating (41 from 17 countries) and their positions in the Top 50 lists. It is evident that the number of papers on *Mycobacterium avium* subsp. *paratuberculosis*, a species causing paratuberculosis in ruminants and possibly having a role in the development of Crohn's disease in at least some humans is significantly increasing.

Keywords: Web of Knowledge; Web of Science; Crohn's disease; paratuberculosis

The present computerized approach to comprehensive databases of papers published in peer reviewed journals allows readers to access particular fields of interest according to a number of criteria. The recently updated Web of Knowledge (ISI Thomson, Philadelphia) offers records providing important data for comprehensive analysis of all relevant journals when a "search" is performed. Such analysis of the papers published on paratuberculosis confirms that this disease affects mostly cattle and ruminants. It is the centre of interest not only due to the economical impact on dairy and beef farmers but also because of the possible risks for consumers of such products. *Mycobacterium avium* subsp. *paratuberculosis* (MAP) is increasingly suspected to have some involvement in the etiology of Crohn's disease, a chronic inflammatory bowel disease with autoimmune pathogenesis.

MATERIAL AND METHODS

Web of Knowledge (ISI Thomson, Philadelphia) version 3.0 (2004) updated on 11 July 2004 and Web of Science, Science Citation Index Expanded database were used to search for relevant journal articles using "PARATUBERCULOSIS" and "CROHN*" as the topic words. The time span within which the search was performed was 1994–2004 (last updated on 16 July 2004). For the number of "times cited" analysis a subsequent search with the number of records stated as less than 500 (1994–1999, 2000–2002 and 2003–2004) was necessary.

Abbreviated names of institutions, listed as a result of the analysis are expressed in expanded forms with the city or country of location stated for easier identification by readers. In the case of "Natl Vet Inst" papers were divided as needed between the

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National Veterinary Institute, Oslo and the National Veterinary Institute, Uppsala. In Table 2, Moredun Research Institute and International Research Centre are listed as a single institution and in Table 5 MICROBIOLOGY-UK and MICROBIOLOGY-SGM are listed as a single journal. Other possible imperfections resulting from the address used in publication, error in entering the record to the database or possible errors in the names of authors or to inconsistent forms of the names of authors were not checked.

Table 1. Top 50 authors (* staff member of OIE Reference Laboratory)

	No. of records	(%)	Author		No. of records	(%)	Author
1	44	4.3	Stabel J.R.	35–41	9	0.9	Coussens P.M.
2	40	3.9	Collins M.T.		9	0.9	Czuprynski C.J.
3	**29**	**2.8**	**Pavlik I.***		9	0.9	Daniels M.J.
4	28	2.7	Whittington R.J.		9	0.9	Hutchings M.R.
5	24	2.3	Stevenson K.		9	0.9	Olsen I.
6	22	2.1	Sharp J.M.		9	0.9	Shulaw W.P.
7-9	18	1.7	Grant I.R.		9	0.9	Storset A.K.
	18	1.7	Hermon-Taylor J.	42–49	**8**	**0.8**	**Bartos M.***
	18	1.7	Naser S.A.		8	0.8	Cocito C.
10	17	1.6	Rowe M.T.		8	0.8	Djonne B.
11	16	1.6	Whitlock R.H.		8	0.8	Hesselink J.W.
12	15	1.5	Graham D.Y.		8	0.8	Hulten K.
13–14	14	1.4	Gerlach G.F.		8	0.8	Murray A.
	14	1.4	Shafran I.		8	0.8	Muskens J.
15–17	13	1.3	Barletta R.G.		8	0.8	Sweeney R.W
	13	**1.3**	**Dvorska L.***	50–64	7	0.7	Ackermann M.R.
	13	1.3	Greig A		7	0.7	Ahrens P.
18–23	12	1.2	Bannantine J.P.		7	0.7	Cetinkaya B.
	12	**1.2**	**Bartl J.***		7	0.7	Cousins D.V.
	12	1.2	Bull TJ.		7	0.7	De Lisle G.W.
	12	1.2	Clarke C.J.		7	0.7	Eamens G.J.
	12	1.2	Marsh I.		7	0.7	Harris N.B.
	12	1.2	Nielsen S.S.		7	0.7	Inglis N.F.
24–31	11	1.1	Bakker D.		7	0.7	Kalis CH.J.
	11	1.1	Ball H.J.		7	0.7	Manning E.J.B.
	11	1.1	El-Zaatari F.A.		7	0.7	Marshall D.J.
	11	1.1	Kapur V.		7	0.7	Naser S.
	11	1.1	Marin J.F.G.		7	0.7	Reitan L.J.
	11	**1.1**	**Matlova L.***		7	0.7	Schwartz D.
	11	1.1	Perez V.		7	0.7	Valentin-Weigard P.
	11	**1.1**	**Svastova P.***				
32–34	10	1.0	Anon	2519		100	All authors
	10	1.0	Reddacliff L.A.				
	10	1.0	Wells S.J.				

Table 2. Top 50 institutions, in total 738 (* OIE Reference Laboratory)

	No. of records	(%)	Institution
1	48	4.7	University of Wisconsin
2	45	4.4	US Department of Agriculture
3	19 and 12	3.0	Moredun Research Institute and Intern. Res. Center
4	**29**	**2.8**	**Veterinary Research Institute, Brno***
5–6	25	2.4	National Veterinary Institute, Oslo
	25	2.4	University of Minnestota
7–9	23	2.2	Queens University Belfast
	23	2.2	University of Central Florida, Orlando
	23	2.2	University of Pennsylvania
10	22	2.1	Baylor College of Medicine
11–12	21	2.0	Cornell University
	21	2.0	New South Wales Department of Agriculture, Australia
13	20	1.9	University of Edinburgh
14–15	18	1.7	Animal Health Service, Netherlands
	18	1.7	St. George Hospital, London
16–17	15	1.5	Michigan State University
	15	1.5	University of California, Davis
18–21	14	1.4	Tierarztlichen Hochschule Hannover
	14	1.4	University of Nebraska
	14	1.4	US Department of Agriculture
	14	1.4	Veterans Affairs Medical Center
22–27	13	1.3	Iowa State University
	13	1.3	Massey University, New Zealand
	13	1.3	Ohio State University
	13	1.3	Royal Vet and Agr University, Frederiksberg
	13	1.3	University of Guelph
	13	1.3	University of Sydney
28–30	12	1.2	Norwegian School of Veterinary Sciences
	12	1.2	University of Utrecht
	12	1.2	Victorian Institute of Animal Sciences, Australia
31–33	11	1.1	Colorado State University
	11	1.1	Institute Pasteur, Paris
	11	1.1	Scottish Agricultural College
34	10	1.0	University of Georgia
35–37	9	0.9	Danish Dairy Board
	9	0.9	Université catholique de Louvain
	9	0.9	University of Florida
38–40	8	0.8	Agriculture Research, New Zealand
	8	0.8	Department of Agriculture, North Ireland
	8	0.8	University of Bern
41–50	7	0.7	ARS, US Department of Agriculture
	7	0.7	Danish Veterinary Institute
	7	0.7	Indian Veterinary Research Institute
	7	0.7	National Institute of Animal Health, Iowa
	7	0.7	New South Wales Department of Agriculture
	7	0.7	University of California, Los Angeles
	7	0.7	University of Leon
	7	0.7	University of Missouri
	7	0.7	University of Surrey
	7	0.7	Washington State University

Table 3. Language of publications

No. of records	(%)	
952	92.2	English
35	3.4	German
18	1.7	French
7	0.7	Dutch
6	0.6	Hungarian
5	0.5	Spanish
3	0.3	Czech
2	2.0	Polish
2	0.2	Turkish
1	0.1	Portugeese
1	0.1	Russian

Table 4. Document type

No. of records	(%)	Document Type
870	84.3	Article
58	5.6	Review
38	3.7	Meeting Abstract
21	2.0	Editorial Material
21	2.0	Letter
11	1.1	Note
4	0.4	Correction
4	0.4	News Item
3	0.3	Reprint
1	0.1	Correction, Addition
1	0.1	Item About an Individual

RESULTS

Using "PARATUBERCULOSIS" as the topic word, 1 032 results were found in the time span between 1994–2004, including 6 and 65 papers published in 1993 and 2004, respectively. Search results are summarized as "Top 50 authors" in Table 1, "Top 50 institutions" in Table 2, "Language of publication" in Table 3, "Document type" in Table 4, and "Top 25 sources" in Table 5. "Top 50 most frequently cited papers" are listed in Table 6.

Using "CROHN*" as the topic word, 12 526 results were found in the period of 1994–2003 (Figure 1). The search results demonstrate an increasing interest in Crohn's disease. Using "CROHN* AND PARATUBERCULOSIS" as the topic words, 325 results were found. Table 7 lists the publications published from the Veterinary Research

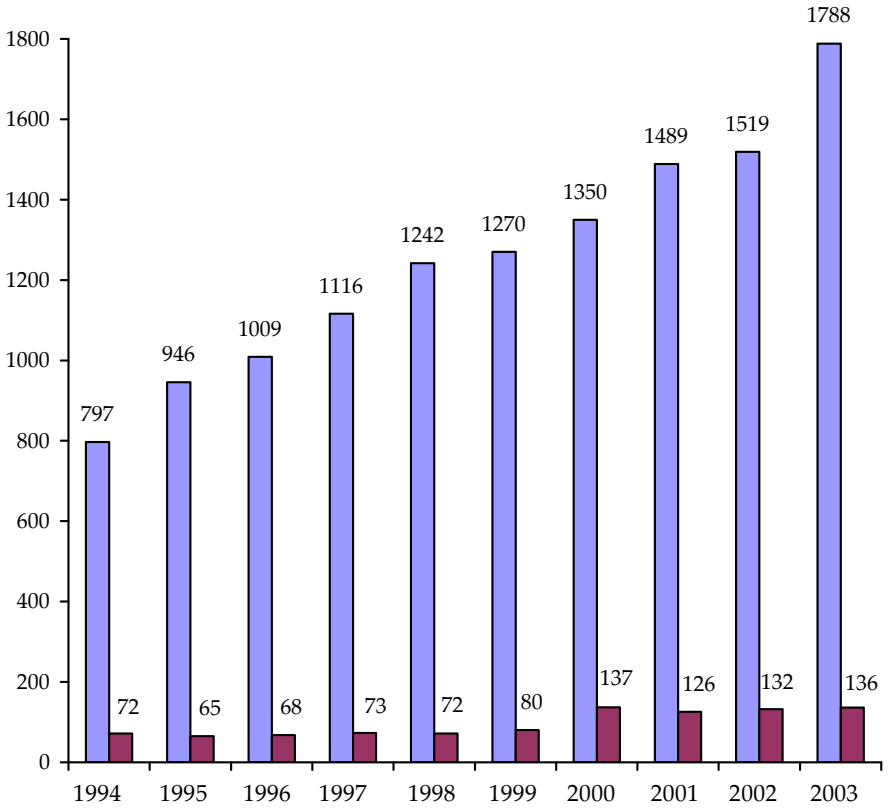

Figure 1. "Crohn*" (■) and "paratuberculosis" (■) publications search

Table 5. Top 25 sources (total number 238). Number of papers from OIE Reference Laboratory in parenthesis (24 of 29 papers published in top 25 journals)

	No. of records	(%)	Source	Impact factor 2003
1	72	7.0	Veterinary Microbiology (5)	1.571
2	47	4.6	Journal of Clinical Microbiology (2)	3.489
3	31	3.0	Preventive Veterinary Medicine	1.063
4	30	2.9	Veterinary Immunology and Immunopathology	1.652
5	29	2.8	Australian Veterinary Journal	0.668
6–8	28	2.7	Infection and Immunity	3.875
	28	2.7	Journal of Veterinary Diagnostic Investigation	1.005
	28	2.7	Veterinary Record	1.172
9	27	2.6	Gastroenterology	12.718
10	25	2.4	Journal of the American Veterinary Medical Association	1.404
11–12	20	1.9	Acta Veterinaria Scandinavica	0.515
	14 and 6	1.4	Microbiology-UK (1) and Microbiology-SGM (1)	3.044
13	19	1.8	Applied and Environmental Microbiology	3.820
14	18	1.7	Journal of Dairy Science	2.139
15	17	1.6	American Journal of Veterinary Research	1.182
16–17	16	1.6	Journal of Comparative Pathology	1.310
	16	1.6	Veterinarni Medicina (13)	0.608
18–19	15	1.5	Deutsche Tierarztliche Wochenschrift	0.413
	15	1.5	Veterinary Clinics of North America – Food Animal Practice	0.691
20	14	1.4	Molecular and Cellular Probes	1.345
21–23	13	1.3	Clinical and Diagnostic Laboratory Immunology	1.809
	13	1.3	Gut	5.883
	13	1.3	Journal of Wildlife Diseases	0.793
24	12	1.2	Journal of Microbiological Methods (3)	2.015
25	11	1.1	Letters in Applied Microbiology	1.164
Total	571	55.6		

Institute, Brno, Czech Republic (OIE Reference Laboratory for Paratuberculosis). Papers were published by 79 authors from 41 institutions from 17 countries (Australia, Brazil, Croatia, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Poland, Slovak Republic, Slovenia, Switzerland, The Netherlands, United Kingdom, and USA).

DISCUSSION

It is evident that there has been a growth in the interest of paratuberculosis. Seventy two to 80 papers were published yearly in 1994 to 1999, but from 2000 to 2003 this number rose to 126 to 137 publications yearly (Figure 1). The increasing trend of the number of publications is also evident in Crohn's disease. The index 2003/1994 is 2.24 and 1.89 for publications on Crohn's disease and paratuberculosis, respectively. It means the increase of the number of publications on Crohn's disease to 224 percent and publications on paratuberculosis to 189 percent during the last 10 years. In the period analysed, 1 032 papers on paratuberculosis were published by 2 519 authors, affiliated with 738 institutions (Tables 1 and 2). Papers were mostly published in English (92.2%) as articles (84.3%) and reviews (5.6%) in 238 journals (Tables 3, 4, and 5). 571 pa-

Table 6. Top 50 most frequently cited papers (papers with OIE Reference Laboratory participation are in bold)

Times cited	
181	Current Concepts of the Etiology and Pathogenesis of Ulcerative-Colitis and Crohns-Disease (Sartor, 1995)
106	Epithelial antibiotic induced in states of disease (Stolzenberg et al., 1997)
100	Paratuberculosis (Cocito et al., 1994)
80	IS*900* PCR to detect *Mycobacterium paratuberculosis* in retail supplies of whole pasteurized cows' milk in England and Wales (Millar et al., 1996)
78	Detection of Mycobacterium-Paratuberculosis by Polymerase Chain-Reaction in Children with Crohns-Disease (Dellisola et al., 1994)
70	Inactivation of *Mycobacterium paratuberculosis* in cows' milk at pasteurization temperatures (Grant et al., 1996)
69	Specific Detection of Mycobacterium-Paratuberculosis DNA Associated with Granulomatous Tissue in Crohns-Disease (Fidler et al., 1994)
67	The pathology and pathogenesis of paratuberculosis in ruminants and other species (Clarke, 1997)
65	Isolation of Mycobacterium-Paratuberculosis from Colostrum and Milk of Subclinically Infected Cows (Streeter et al., 1995)
63	Mycobacterium-Paratuberculosis in Intestinal Tissue from Patients with Crohns-Disease Demonstrated by A Nested Primer Polymerase Chain-Reaction (Lisby et al., 1994)
60	The Tuberculin Test (Monaghan et al., 1994)
58	Manure and microbes: Public and animal health problem? (Pell, 1997)
55	On the etiology of Crohn disease (Mishina et al., 1996)
53	Two-year-outcomes analysis of Crohn's disease treated with rifabutin and macrolide antibiotics (Gui et al., 1997)
51	Thermal tolerance of *Mycobacterium paratuberculosis* (Sung and Collins, 1998)
51	Causation of Crohn's disease by *Mycobacterium avium* subspecies *paratuberculosis* (Hermon-Taylor et al., 2000)
50	Polyclonal Infections Due to Mycobacterium-Avium Complex in Patients with Aids Detected by Pulsed-Field Gel-Electrophoresis of Sequential Clinical Isolates (Slutsky et al., 1994)
48	Identification of a novel bacterial sequence associated with Crohn's disease (Sutton et al., 2000a)
47	Evaluation of a Commercial Enzyme-Linked-Immunosorbent-Assay for the Diagnosis of Paratuberculosis in Dairy-Cattle (Sweeney et al., 1995)
47	**Epidemiological study of paratuberculosis in wild rabbits in Scotland** (Greig et al., 1999)
47	Mycobacterium-Paratuberculosis DNA Not Detected in Crohns-Disease Tissue by Fluorescent Polymerase Chain-Reaction (Rowbotham et al., 1995)
46	Preclinical and clinical manifestations of paratuberculosis (including pathology) (Whitlock and Buergelt, 1996)
46	Diagnosis of paratuberculosis (Collins, 1996)
46	Paratuberculosis in wild rabbits (*Oryctolagus cuniculus*) (Greig et al., 1997)
46	Herd Prevalence and Geographic-Distribution of, and Risk-Factors for, Bovine Paratuberculosis in Wisconsin (Collins et al., 1994)
46	Enteric microflora in IBD: Pathogens or commensals? (Sartor, 1997)
45	Epidemiologic issues in the validation of veterinary diagnostic tests (Greiner and Gardner, 2000)
45	Purification, Characterization, Gene Sequence, and Significance of a Bacterioferritin from Mycobacterium-Leprae (Pessolani et al., 1994)
44	The pathology of ovine paratuberculosis: Gross and histological changes in the intestine and other tissues (Clarke and Little, 1996)
44	Herd-level economic losses associated with Johne's disease on US dairy operations (Ott et al., 1999)
43	Familial expression of anti-Saccharomyces cerevisiae mannan antibodies in affected and unaffected relatives of patients with Crohn's disease (Sutton et al., 2000b)
43	Heat inactivation of *Mycobacterium paratuberculosis* in raw milk: Are current pasteurization conditions effective? (Stabel et al., 1997)

Table 6 continued

Times cited	
42	Transmission of paratuberculosis (Sweeney, 1996)
42	Mycobacteria in the Intestine of Japanese Patients with Inflammatory Bowel-Disease (Suenaga et al., 1995)
42	**Characterization by Restriction-Endonuclease Analysis and DNA Hybridization Using IS*900* of Bovine, Ovine, Caprine and Human Dependent Strains of Mycobacterium-Paratuberculosis Isolated in Various Localities** (Pavlik et al., 1995)
42	Genotypic Characterization of Mycobacterium-Avium Strains Recovered from Animals and Their Comparison to Human Strains (Bono et al., 1995)
40	Molecular characterization of *Mycobacterium paratuberculosis* isolates from sheep, goats, and cattle by hybridization with a DNA probe to insertion element IS*900* (Bauerfeind et al., 1996)
39	Use of IS*901* and IS*1245* in RFLP typing of *Mycobacterium avium* complex: relatedness among serovar reference strains, human and animal isolates (Ritacco et al., 1998)
39	Solid-Phase Hybridization Capture of Low-Abundance Target DNA-Sequences – Application to the Polymerase Chain-Reaction Detection of Mycobacterium-Paratuberculosis and Mycobacterium-Avium Subsp. Silvaticum (Millar et al., 1995)
38	Identification of *Mycobacterium avium* complex in sarcoidosis (ElZaatari et al., 1996)
38	Rapid detection of *Mycobacterium paratuberculosis* in clinical samples from ruminants and in spiked environmental samples by modified BACTEC 12B radiometric culture and direct confirmation by IS*900* PCR (Whittington et al., 1998)
38	Recombinant BCG Expressing the Leishmania Surface-Antigen Gp63 Induces Protective Immunity Against Leishmania-Major Infection in Balb/C Mice (Abdelhak et al., 1995)
38	Nucleotide-Sequence Comparison of the Mycobacterial DNA Gene and PCR-Restriction Fragment Length Polymorphism Analysis for Identification of Mycobacterial Species (Takewaki et al., 1994)
38	Description and classification of different types of lesion associated with natural paratuberculosis infection in sheep (Perez et al., 1996)
38	Evaluation of modified BACTEC 12B radiometric medium and solid media for culture of *Mycobacterium avium* subsp. *paratuberculosis* from sheep (Whittington et al., 1999)
37	**IS*1245* restriction fragment length polymorphism typing of *Mycobacterium avium* isolates: Proposal for standardization** (Van Soolingen et al., 1998)
37	Typing of *Mycobacterium avium* isolates by PCR (Picardeau and Vincent, 1996)
36	Production of gamma-interferon by peripheral blood mononuclear cells: An important diagnostic tool for detection of subclinical paratuberculosis (Stabel, 1996)
36	Nucleotide-Sequence and Secondary Structures of Precursor 16S Ribosomal-RNA of Slow-Growing Mycobacteria (Ji et al., 1994)
35	**Standardisation of restriction fragment length polymorphism analysis for *Mycobacterium avium* subspecies *paratuberculosis*** (Pavlik et al., 1999)

pers (55.6%) were published in the Top 25 journals (Table 6) of 238 total sources.

Most frequently cited papers (listed in Table 7) were mainly oriented on:

– diagnostic methods and characterization of MAP (18 papers, 853 times cited)
– possible roles of MAP in Crohn's disease (11 papers, 698 times cited)
– transmission, pathogenesis and pathology of paratuberculosis (6 papers, 343 times cited)
– detection and inactivation of MAP in milk and dairy products (4 papers, 229 times cited)
– MAP in environment and wild animals (3 papers, 151 times cited)

OIE Reference Laboratory for Paratuberculosis, established at the Veterinary Research Institute, Brno, in 2001, contributed to the Top 50 most frequently cited papers (Table 6) with a total of four articles (8%) published. The number of publications by this laboratory places the institute in the 3rd position of 738 institutions. Staff members of the laboratory are on positions 3 (Pavlik), 15–17 (Dvorska), 18–23 (Bartl), 24–31 (Matlova, Svastova) and 42 to 49 (Bartos) of the Top 50 authors (Table 1). 25 of

Table 7. Papers from OIE Reference Laboratory for Paratuberculosis

1. Incidence, Economic Importance and Diagnosis of Paratuberculosis (Pavlik et al., 1994)
2. Characterization by Restriction-Endonuclease Analysis and DNA Hybridization Using IS*900* of Bovine, Ovine, Caprine and Human Dependent Strains of Mycobacterium-Paratuberculosis Isolated in Various Localities (Pavlik et al., 1995)
3. The occurrence of mycobacteria in invertebrates and poikilothermic animals and their role in the infection of other animals and man (Matlova et al., 1998)
4. IS*1245* restriction fragment length polymorphism typing of *Mycobacterium avium* isolates: Proposal for standardization (Van Soolingen et al., 1998)
5. Insertion sequences of mycobacteria and their use in the study of epidemiology of mycobacterial infections (Dvorska et al., 1999)
6. Leukocyte counts and lymphocyte subpopulations in the peripheral blood of pygmy goats from herd infected with *Mycobacterium avium* subspecies *paratuberculosis* (Faldyna et al., 1999)
7. Changes in the mucopolysaccharide composition of mucus in ileal mucosal goblet cells from cattle infected with *Mycobacterium avium* subspecies *paratuberculosis* (Fischer et al., 1999)
8. Epidemiological study of paratuberculosis in wild rabbits in Scotland (Greig et al., 1999)
9. Standardisation of restriction fragment length polymorphism analysis for *Mycobacterium avium* subspecies *paratuberculosis* (Pavlik et al., 1999)
10. Characterization of IS*900* loci in *Mycobacterium avium* subsp. *paratuberculosis* and development of multiplex PCR typing (Bull et al., 2000a)
11. Characterization of IS*900* loci in *Mycobacterium avium* subsp. *paratuberculosis* and development of multiplex PCR typing (vol 146, pg 2185, 2000) (Bull et al., 2000b)
12. Findings of mycobacteria in insectivores and small rodents (Fischer et al., 2000)
13. Parallel faecal and organ *Mycobacterium avium* subsp. *paratuberculosis* culture of different productivity types of cattle (Pavlik et al., 2000b)
14. Epidemiology of paratuberculosis in wild ruminants studied by restriction fragment length polymorphism in the Czech Republic during the period 1995–1998 (Pavlik et al., 2000a)
15. Control of paratuberculosis in five cattle farms by serological tests and faecal culture during the period 1990–1999 (Pavlik et al., 2000c)
16. The transmission and impact of paratuberculosis infection in domestic and wild ruminants (Ayele et al., 2001)
17. Strategies for differentiation, identification and typing of medically important species of mycobacteria by molecular methods (Dvorska et al., 2001)
18. Diptera as vectors of mycobacterial infections in cattle and pigs (Fischer et al., 2001)
19. Incidence of bovine tuberculosis in wild and domestic animals other than cattle in six Central European countries during 1990–1999 (Pavlik et al., 2002b)
20. Molecular epidemiology of bovine tuberculosis in the Czech Republic and Slovakia in the period 1965–2001 studied by spoligotyping (Pavlik et al., 2002a)
21. Rapid differentiation of *Mycobacterium avium* subsp. *avium* and *Mycobacterium avium* subsp. *paratuberculosis* by amplification of insertion element IS*901* (Svastova et al., 2002)
22. A standardised restriction fragment length polymorphism (RFLP) method for typing *Mycobacterium avium* isolates links IS*901* with virulence for birds (Dvorska et al., 2003)
23. Earthworms (Oligochaeta, Lumbricidae) and mycobacteria (Fischer et al., 2003a)
24. Nymphs of the Oriental cockroach (*Blatta orientalis*) as passive vectors of causal agents of avian tuberculosis and paratuberculosis (Fischer et al., 2003b)
25. Wild boar (*Sus scrofa*) as a possible vector of mycobacterial infections: review of literature and critical analysis of data from Central Europe between 1983 to 2001 (Machackova et al., 2003)

Table 7 continued

26.	Immunological characteristics of cattle with *Mycobacterium avium* subsp. *paratuberculosis* infection (Toman et al., 2003)
27.	Study of *Mycobacterium avium* complex strains isolated from cattle in the Czech Republic between 1996 and 2000 (Dvorska et al., 2004)
28.	Blowflies *Calliphora vicina* and *Lucilia sericata* as passive vectors of *Mycobacterium avium* subsp. *avium*, *M-a. paratuberculosis* and *M-a. hominissuis* (Fischer et al., 2004)
29.	Comparative evaluation of PCR assays for the robust molecular detection of *Mycobacterium avium* subsp. *paratuberculosis* (Ikonomopoulos et al., 2004)

Papers were published in collaboration with 79 authors of 41 institutions from 17 countries.

29 papers were published in the Top 25 journals (Table 5). Others were published in Medical and Veterinary Entomology (3) and Folia Microbiologica (1). Impact factors of these journals are 1.040 and 0.857, respectively.

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Corresponding Author

Professor Karel Hruska, Veterinary Research Institute, Hudcova 70, 621 32 Brno, Czech Republic
Tel. +420 5 3333 2014, fax +420 5 4121 1229, e-mail: hruska@vri.cz