



**Reports on the Proficiency Testing for *Trichinella*
spp. organised by the EURLP for the NRLs**

March 2017

Table of contents

A Report of the NRL Proficiency Testing to detect *Trichinella spiralis* larvae in pork and/or horse meat samples according to the EU directive 1375/2015

1	Introduction	3
2	Scope	3
3	PT organization	3
4	Time frame	3
5	Test material	3
6	Instructions to participants	4
7	Qualitative evaluation	4
8	Participating laboratories	4
9	Results	4
	11.1 Delivery of the package to NRLs	4
	11.2 Digestion methods	4
	11.3 Type of meat samples	4
	11.4 Qualitative results	4
	11.5 Overtime comparison	5
10	Conclusions	5
11	References	5

B Report of the NRL Proficiency Testing on *Trichinella* spp. larva identification at the species level by a molecular method

1	Introduction	6
2	Scope	6
3	Time frame	6
4	Participating laboratories	6
5	Test material	7
6	Results	7
	6.1 Type of samples	7
	6.2 Methods of analysis	7
	6.3 Molecular identification	7
	6.3.1 PCR products	7
	6.3.2 Species identification	7
	6.3.3 Overtime comparison	7
7	Conclusions	7
8	References	8
	Annex 1	9
	Annex 2	10
	Annex 3	12
	Annex 4	14
	Annex 5	15
	Annex 6	16
	Annex 7	18

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1 Introduction

Nematode worms of the genus *Trichinella* are zoonotic parasites circulating in most European countries in both wild and domestic animals (Pozio et al., 2009). Humans acquire the infection by the consumption of raw or undercooked meat from pigs, horses, wild boar and other game animals (Pozio et al., 2003). According to the Commission Regulation (EC) No 1375/2015 and amendments, all animals which are potential carrier of *Trichinella* spp. infective larvae should be tested at the slaughterhouse according to one of the approved test.

2 Scope

One of the core duties of the EURL for Parasites is to organise proficiency testing, as it is stated in the Regulation (EU) 2017/625 of the European Parliament and of the Council (Commission Regulation No. 2017/625). The scope of this comparison is to test the competence of the appointed NRLs to detect *Trichinella* larvae in pork and/or horse meat samples according to one of the approved methods reported in the Annex 1 of the Commission Regulation EC No 1375/2015 and amendments.

3 Proficiency testing organization

The proficiency testing (PT) registration, result submission, and reporting, was organized online on a dedicated section (*restricted area*) of the EURLP web site (<http://www.iss.it/crlp/index.php?lang=2&id=53&tipo=10>).

4 Time frame

The PT was announced to NRLs by email on February 6, 2017 and the deadline to make the online registration was February 27, 2017. On March 13, 2017, the samples were dispatched to participants by an international courier. Reporting deadline was March 21, 2017.

5 Test material

The test material forwarded to each laboratory consisted of 3 meat balls made with 100 ± 5 grams (or 35 ± 2 grams) of minced pork or 3 meat balls made with 100 ± 5 grams (or 35 ± 2 grams) of minced horse meat. One meat ball was spiked with 5 viable *Trichinella spiralis* larvae each and two meatballs were spiked with no larvae (negative controls).

Larvae were obtained by a partial artificial digestion of *T. spiralis*-infected mice (isolate code ISS003), according to the EURLP POP-02. Experimental infection of mice by *Trichinella* spp. muscle stage larvae. Larvae were counted under a stereo-microscope using a watch glass of 2 cm of diameter and transferred to the meatball rinsing the watch glass with PBS. To ensure that no larva remained on the glass, it was examined twice under the stereo-microscope and rinsed with PBS allowing the PBS to reach the core of the ball (see Annex 2).

Each meat ball was close in a plastic bag and under vacuum sealed, a code was added on the envelop. Each envelope containing the meat ball was then stored at +4 °C until the forwarding.

The 3 meat balls under vacuum were forwarded in a polystyrene box containing ice packs. In the box, ice packs were separated from the meat samples by a cardboard separator to

avoid a direct contact. The packages were forwarded according to the international forwarding regulations by an international courier.

To check the sample stability over time, and to estimate the suitability of the packing and forwarding conditions under which the meat balls were sent, two groups of 3 meat balls each were packaged as those forwarded, stored at room temperature, and tested at the EURLP three and five days after packaging.

Each participant lab was invited to enter the information about package content and its condition of preservation at opening in the online "shipment form".

6 Instructions to participants

Instructions were available to all participants at the "instruction" page of the web site.

7 Qualitative evaluation

To successfully pass the PT, each participant had to correctly identify all the samples.

8 Participating laboratories

Of the 28 MS, Luxembourg appointed the Belgium NRL for parasites, all the other NRLs (#27) participated in the PT. In addition, NRLs from Former Yugoslav Republic of Macedonia, Iceland, Norway, Serbia and Switzerland, agreed to participate. Consequently, a total of 32 labs were involved in the PT.

9 Results

11.1 Delivery of the package to NRLs

Out of 31 packages (Italian package not included), 21 were delivered within 24 h, 9 within 48 h, 1 within 72 h, and one was the NRL of Italy located in the same Institute of the EURLP. At delivery, the internal temperature of packages delivered within 48 h was less than 10 °C, whereas for packages delivered within 72 h the internal temperature was between 10 °C and 15 °C. The time elapsed from the arrival of the package at the NRL and the control of its content was within 3 h for all NRLs.

11.2 Digestion methods

The magnetic stirred method for the pooled sample digestion was the most used (28 NRLs, 87.3%); the mechanically assisted pooled sample digestion method/sedimentation technique was used in 1 NRLs (3.1 %), and the automatic digestion method for pooled samples up to 35 g was used in 3 NRLs (9.4%).

11.3 Type of meat samples

Out of 32 participating laboratories, 29 labs (90.6%) requested pork samples of 100 ± 5 g, 2 labs (6.3%) pork samples of 35 ± 2 g and 1 lab (3.1%) horse meat samples of 35 ± 2 g.

11.4 Qualitative results

All the 32 participating laboratories passed the PT (Annex 3).

11.5 Overtime comparison

In the 2007-2010 period, the percentage of labs that passed the PT raised from 83.3% to 96.5%, witnessing an improvement in the ability of labs to perform the artificial digestion test. In the 2011-2017 period, the percentage of labs that passed the PT fluctuated from 86.2% to 100% (Annex 4).

10 Conclusions

All the participants passed the PT, nevertheless the presence of two negative samples, no false positives have been reported. A similar result was obtained in 2012 and 2014 only (Annex 4).

11 References

Pozio E., Rinaldi L., Marucci G., Musella V., Galati F., Cringoli G., Boireau P., La Rosa G. (2009) Hosts and habitats of *Trichinella spiralis* and *Trichinella britovi* in Europe. Int. J. Parasitol. 39:71-79.

Pozio E., Gomez Morales M.A., Dupouy Camet J. (2003). Clinical aspects, diagnosis and treatment of trichinellosis. Expert Review of Anti-infective Therapy 1:471-482.

Commission Implementing Regulation (EU) 2015/1375 of 10 August 2015 laying down specific rules on official controls for *Trichinella* in meat. Off. J. E. U. L212, 7-34.

Commission Regulation (EC) No. 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products, amending Regulations (EC) No 999/2001, (EC) No 396/2005, (EC) No 1069/2009, (EC) No 1107/2009, (EU) No 1151/2012, (EU) No 652/2014, (EU) 2016/429 and (EU) 2016/2031 of the European Parliament and of the Council, Council Regulations (EC) No 1/2005 and (EC) No 1099/2009 and Council Directives 98/58/EC, 1999/74/EC, 2007/43/EC, 2008/119/EC and 2008/120/EC, and repealing Regulations (EC) No 854/2004 and (EC) No 882/2004 of the European Parliament and of the Council, Council Directives 89/608/EEC, 89/662/EEC, 90/425/EEC, 91/496/EEC, 96/23/EC, 96/93/EC and 97/78/ EC and Council Decision 92/438/EEC (Official Controls Regulation). OJ L95/1-142.

Community Reference Laboratory for Parasites (2007). Guideline for the detection of *Trichinella* larvae at the slaughterhouse or connected laboratory in a Quality Assurance System, pp. 1-14, www.iss.it/crlp/docu/.

B Report of the NRL Proficiency Testing on *Trichinella* spp. larva identification at the species level by a molecular method

1 Introduction

In the MS of the European Union, four species of the genus *Trichinella* are circulating among domestic and/or wild animals: *Trichinella spiralis*, *Trichinella nativa*, *Trichinella britovi* and *Trichinella pseudospiralis*. *Trichinella britovi* is the most widespread species infecting prevalently carnivore mammals but also wild boar; whereas, it is seldom detected in domestic pigs. This species is circulating in most of MS excluding Cyprus, Denmark, Ireland, Luxembourg, Malta and UK (EFSA, 2016). *Trichinella spiralis* infecting prevalently domestic pigs and wild boar is more scattered in single foci present in Austria, Bulgaria, Czech Republic, Estonia, Finland, Germany, Hungary, Latvia, Lithuania, Poland, Romania, Ireland and North Ireland (UK), Slovak Rep., Spain and Sweden (EFSA, 2016). *Trichinella nativa* is circulating among carnivore mammals living in cold regions (Estonia, Finland, Latvia, Lithuania and Sweden and Norway) but recently it has been detected in one red fox of Poland and in three red foxes of Germany. *Trichinella pseudospiralis* is the only species infecting both mammals and birds. The main reservoir host is the wild boar; seldom this species has been detected in carnivore mammals (foxes and raccoon dogs). This species has been detected in 18 MS (excluding Belgium, Cyprus, Greece, Ireland, Latvia, Luxembourg, Malta, Portugal, Romania, and Slovenia) (EFSA, 2016). The identification of the *Trichinella* species is extremely important for epidemiological investigation and to trace back the origin of infections in animals and humans. These parasites can be distinguished among them only by molecular methods (Pozio and La Rosa, 2010). Several protocols are today available in the literature, but only few of them allow to identify single organisms (Identification of *Trichinella* Muscle Stage Larvae at the species level by Multiplex PCR).

2 Scope

According to of the Commission Regulation (EC) No 1375/2015 (Annex 1, Chapter I), when *Trichinella* spp. larvae are detected by digestion of animal muscles, the larvae should be stored in 90% ethyl alcohol and identified at the species level at the EURLP or NRLs. During the NRL Workshop of 2014, participants requested the EURLP to organise a PT on the identification of *Trichinella* spp. larvae at the species level. The scope of this PT is to test the competence of NRLs to correctly identify the species circulating in Europe and those which can be introduced from other continents.

3 Time frame

The proficiency testing (PT) was announced to NRLs by email on February 6, 2017 and the dead line to send the participation form was February 27, 2017. On March 13, 2017, the samples were dispatched to participants by an international courier. Reporting deadline was April 5, 2017.

4 Participating laboratories

Of the 28 MS, Luxembourg appointed the Belgium NRL for parasites, 19 MS agreed to participate at the PT (Austria, Belgium, Croatia, Cyprus, Estonia, Finland, France, Germany, Greece, Hungary, Latvia, Lithuania, Netherland, Poland, Portugal, Romania, Slovak Rep., Slovenia and Spain). In addition, 1 lab from Iceland and 1 NRL from Norway, agreed to participate (see Annex 1). A total of 21 NRLs participated in the PT.

5 Test material

The test material forwarded to each laboratory consisted of *Trichinella* muscle larvae in ethanol. According to the lab requests, two different type of samples were forwarded: pool of larvae or single larvae. The panel of pooled larvae consisted of four vials containing 10 larvae of *T. spiralis*, *T. pseudospiralis*, *T. nelsoni* and *T. papuae*. The single larva panel consisted of 12 vials containing one single larva each (i.e., three vials for each of the four species). Larvae were obtained by artificial digestion of mouse carcasses infected with *T. spiralis* (isolate code ISS003), *T. pseudospiralis* (isolate code ISS013), *T. nelsoni* (isolate code ISS037) and *T. papuae* (isolate code ISS572), according to the EURLP POP-02. Participating labs were invited to use one of the published methods available in the international literature. Each laboratory received, together with samples, the appropriate form to register the results (Annex 5).

6 Results

6.1 Type of samples

Out of 21 participating labs, 13 labs (62%) requested a pool of larvae and 8 labs (38%) requested single larvae.

6.2 Methods of analysis

Out of 21 labs which received PT samples, 18 labs used the multiplex PCR protocol (Zarlenga et al., 1999; Pozio and la Rosa, 2010), 2 labs used the method based on PCR amplification and sequencing of 5S DNA region (Rombout et al., 2001; De Brunye et al., 2005) and 1 lab did not specify the method used.

6.3 Molecular identification

6.3.1 PCR products

Only one lab failed to amplify DNA because of technical problems encountered during the DNA purification step.

6.3.2 Species identification

Three labs independently of the type of sample (single larva or pool of larvae) failed to identify *T. papuae*. One lab failed to identify all the four species (supplied as pool of larvae). One lab failed to analyze samples because of technical problems. (Annex 6).

6.3.3 Overtime comparison

The comparison of results obtained in the 2011-2017 period do not show an evident trend toward improvement, the percentage of labs that passed the PT fluctuated from a minimum of 57% in 2011 to a maximum of 88% in 2015 (Annex 7).

7 Conclusions

Over a total of 20 labs which sent result, 16 (76%) correctly identified all the larvae at the species level; of them, 10 labs analyzed pools of larvae and 6 labs single larvae. The reasons for the PT failure have been identified in lack of experience in the interpretation of the multiplex PCR band pattern, especially that obtained from the analysis of the non-European species *T. papuae*.

8 References

De Bruyne A, Yera H, Le Guerhier F, Boireau P, Dupouy-Camet J., 2005. Simple species identification of *Trichinella* isolates by amplification and sequencing of the 5S ribosomal DNA intergenic spacer region. *Vet Parasitol.* 132, 57-61.

EFSA, 2016. The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2015. *EFSA Journal* 14, 4634.

Pozio E, La Rosa G, 2010. *Trichinella*. In: Dongyou, L. (ed.), *Molecular detection of foodborne pathogens*. Taylor and Francis, CRC Press, Boca Raton, London, New York, pp. 851-863.

Pozio E, Zarlenga DS, 2013. New pieces of the *Trichinella* puzzle. *Int J Parasitol* 43, 983-997.

Rombout, Y.B., Bosch, S., Van Der Giessen, J.W.B., 2001. Detection and identification of eight *Trichinella* genotypes by reverse line blot hybridization. *J. Clin. Microbiol.* 39, 642–646.

Zarlenga DS, Chute MB, Martin A, Kapel CM, 1999. A multiplex PCR for unequivocal differentiation of all encapsulated and non-encapsulated genotypes of *Trichinella*. *Int J Parasitol.* 29, 1859-1867.



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Annex 1

National Reference Laboratories (NRL) participating at the proficiency testing for *Trichinella*

NRL for parasites	Country	PT digestion	PT PCR
Institut für Veterinärmedizin, Innsbruck	Austria	yes	yes
Institute of Tropical Medicine, Antwerp	Belgium	yes	yes
National Diagnostic and Research Veterinary Institute, Sofia	Bulgaria	yes	no
Croatian Veterinary Institute Vinkovci	Croatia	yes	yes
State Veterinary Laboratory, Nicosia	Cyprus	yes	yes
State Veterinary Institute, Olomouc	Czech Rep	yes	no
National Veterinary Institute, Copenhagen	Denmark	yes	no
Estonian Veterinary and Food Laboratory, Tartu	Estonia	yes	yes
Research Unit Finnish Food Safety Authority, Evira, Oulu	Finland	yes	yes
Food borne parasite NRL & UMR BIPAR ANSES, ENVA, UPEC, ANSES-Laboratoire de Santé Animale, Maison Alfort	France	yes	yes
Federal Institute for Risk Assessment, Berlin	Germany	yes	yes
Centre of Athens Veterinary Institutions, Athens	Greece	yes	yes
Central Veterinary Institute, Budapest	Hungary	yes	yes
Central Meat Control Laboratory, Celbridge	Ireland	yes	no
Istituto Superiore di Sanità, Rome	Italy	yes	no
Laboratory of Food and Environmental Investigations, Riga	Latvia	yes	yes
National Food and Veterinary Risk Assessment Institute, Vilnius	Lithuania	yes	yes
National Veterinary Laboratory, Albertown, Marsa	Malta	yes	no
National Institute of Public Health and the Environment, Bilthoven	Netherlands	yes	yes
National Veterinary Research Institute, Pulawy	Poland	yes	yes
Laboratório Nacional de Investigação Veterinária, Lisboa	Portugal	yes	yes
Hygiene and Public Veterinary Health Institute, Bucharest	Romania	yes	yes
State Veterinary and Food Institute, Bratislava	Slovakia	yes	yes
National Veterinary Institute, Ljubljana	Slovenia	yes	yes
Centro Nacional de Alimentación, Agencia Española de Seguridad Alimentaria y Nutrición, Majadahonda	Spain	yes	yes
Statens Veterinärmedicinska Anstalt, Uppsala	Sweden	yes	no
Veterinary Laboratories Agency, Weybridge	UK	yes	no
Keldur - Institute for Experimental Pathology, Reykjavik	Iceland	yes	yes
Norwegian Veterinary institute, Oslo	Norway	yes	yes
Institute for Laboratory Diagnostic INEP, Belgrade	Serbia	yes	no
Ss. Cyril and Methodius University in Skopje, Skopje	FYROM	yes	no
Institute of Parasitology, University of Bern, Bern	Switzerland	yes	no

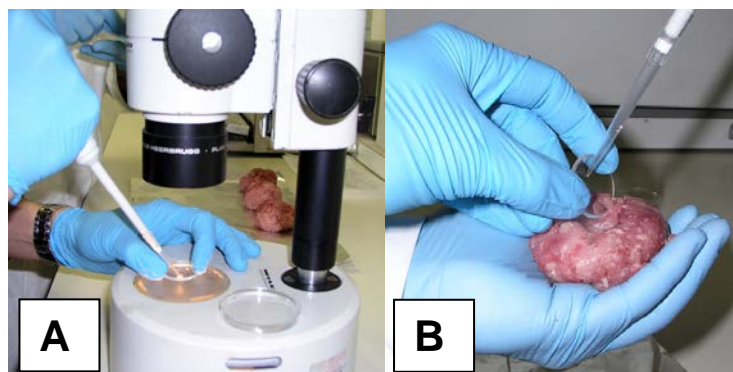
Annex 2



Meatball samples (35g and 100g)



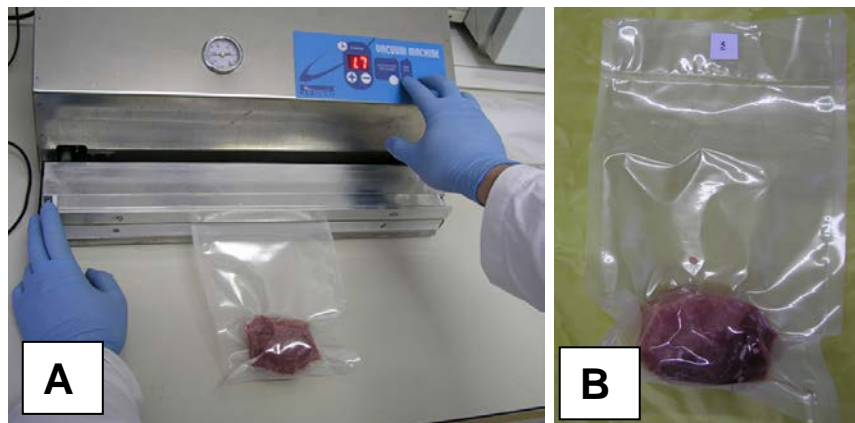
An hollow is made in the center of each meatball to house the larvae



Larvae are counted under a stereo-microscope using a watch glass (A) and transferred to the meatball rinsing the watch glass with 200 μ l of PBS (B)



The watch glass is examined under the stereo-microscope to ensure that no larva remains on it



Each sample is under vacuum sealed (A) and labeled with a numeric code (B)

Annex 3

**PT to detect *Trichinella spiralis* larvae in pork and/or horse meat samples
according to the EU Directive 1375/2015**

2017 results

Lab code	False negatives	False positives	PT final evaluation
NRL1	0	0	positive
NRL2	0	0	positive
NRL3	0	0	positive
NRL4	0	0	positive
NRL5	0	0	positive
NRL6	0	0	positive
NRL7	0	0	positive
NRL8	0	0	positive
NRL9	0	0	positive
NRL10	0	0	positive
NRL11	0	0	positive
NRL12	0	0	positive
NRL13	0	0	positive
NRL14	0	0	positive
NRL15	0	0	positive
NRL16	0	0	positive
NRL17	0	0	positive
NRL18	0	0	positive
NRL19	0	0	positive
NRL20	0	0	positive
NRL21	0	0	positive
NRL22	0	0	positive
NRL23	0	0	positive
NRL24	0	0	positive
NRL25	0	0	positive
NRL26	0	0	positive



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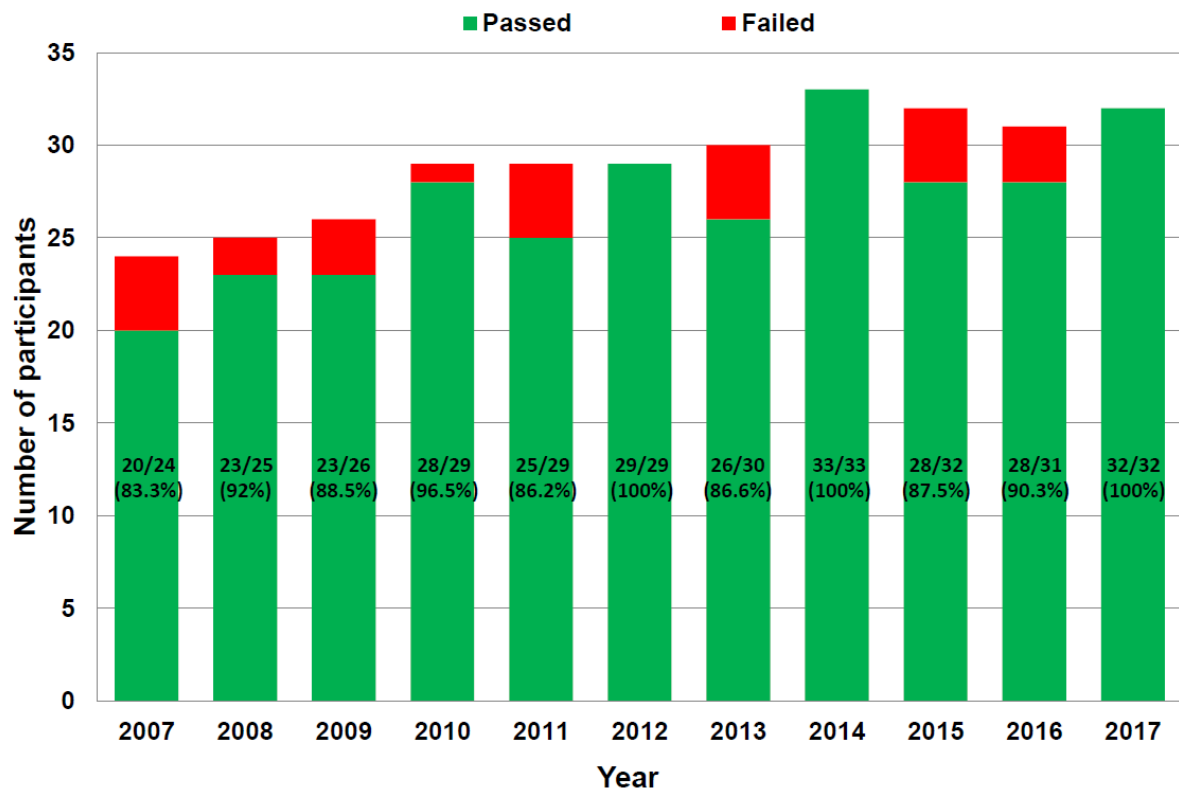
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NRL34	0	0	positive
NRL35	0	0	positive
NRL40	0	0	positive
NRL42	0	0	positive
TLE6	0	0	positive

Annex 4

PT to detect *Trichinella spiralis* larvae in pork and/or horse meat samples according to the EU Directive 1375/2015

Overtime comparison of PT results





Annex 5

Form 6A Laboratory _____

Proficiency test to identify Trichinella larvae at the species level by a molecular method

Identification of pool of larvae

Results

Table with 5 columns: Sample code, Molecular Method¹, Date (dd/mm), Identified species, Notes

1) Explain briefly or add a reference for the molecular method used.

Date _____

Technician (name/sign): _____

Form 6B Laboratory _____

Proficiency test to identify Trichinella larvae at the species level by a molecular method

Identification of single larvae

Results

Table with 5 columns: Sample code, Molecular Method¹, Date (dd/mm), Identified species, Notes

1) Explain briefly or add a reference for the molecular method used.

Date _____

Technician (name/sign): _____

Annex 6

PT on *Trichinella* spp. larva identification at the species level by a molecular method

2017 results

Lab code	Sample type	Method used	N. correct identification	N. incorrect identification	N. missed identification	Final evaluation
NRL1	single	EURLP protocol	9	3	0	negative
NRL2	pool	EURLP protocol	4	0	0	positive
NRL3	single	EURLP protocol	9	3	0	negative
NRL6	pool	Raubout et al. 2001	4	0	0	positive
NRL7	single	EURLP protocol	12	0	0	positive
NRL8	pool	Pozio and La Rosa 2003	4	0	0	positive
NRL10	single	EURLP protocol	12	0	0	positive
NRL12	pool	Pozio and La Rosa 2003 EURLP protocol	4	0	0	positive
NRL14	pool	Not specified	0	4	0	negative
NRL16	pool	Zarlenga et al. 1999, EURLP protocol	3	1	0	negative
NRL17	pool	EURLP protocol	4	0	0	positive
NRL18	pool	EURLP protocol	4	0	0	positive
NRL21	pool	Pozio and La Rosa 2003 with modifications	4	0	0	positive
NRL22	single	EURLP protocol	12	0	0	positive
NRL23	pool	EURLP protocol	4	0	0	positive
NRL24	single	EURLP protocol	12	0	0	positive
NRL25	pool	Zarlenga et al. 1999, EURLP protocol	4	0	0	positive



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NRL40	single	De Brunye et al. 2005	12	0	0	positive
NRL42	pool	Technical problem	0	0	4	negative
NRL46	single	EURLP protocol	12	0	0	positive
TLE6	pool	EURLP protocol	4	0	0	positive

Annex 7

PT on *Trichinella* spp. larva identification at the species level by a molecular method

Overtime comparison of PT results

