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Cryptosporidium tyzzeri and Cryptosporidium pestis: which name is valid?

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Slapeta has raised the issue on the validity of *Cryptosporidium tyzzeri* recently proposed by Ren et al. (2011) because the name was used by Levine (1961) for a *Cryptosporidium* sp. in chickens originally described by Tyzzer, (1929), while *C. tyzzeri* Levine, 1961 is considered a synonym of *Cryptosporidium meleagridis* Slavin, 1955. Thus, he has suggested that the name *Cryptosporidium tyzzeri* by Ren et al. is both a primary homonym and a junior synonym. However, homonymy and synonymy refer to the application of the same name to different taxa and different names to the same taxon, respectively. Because the taxon *C. tyzzeri* Levine, 1961 is not an established one, the homonymy and synonymy suggested by Slapeta do not exist.

The *nomen nudum* nature of *C. tyzzeri* Levine, 1961 was previously pointed out in several reviews of *Cryptosporidium* taxonomy (Upton, 2003; Fayer, 2008), and was stated clearly in the Etymology section of *Cryptosporidium tyzzeri* Ren, Zhao, Zhang, Ning, Jian, Wang, Lv, Wang, Arrowood & Xiao, 2011. This was supported by the fact that *C. tyzzeri* Levine, 1961 was based on the description of *Cryptosporidium* developmental stages in the caeca of three chickens by Tyzzer (1929). However, in his two-short-paragraph descriptions of the parasite, Tyzzer (1929) provided neither measurements nor morphological descriptions of the developmental stages he observed, and only stated “these appeared to be morphologically identical with the corresponding forms of *C. parvum*.” He did not observe any oocysts and identified the parasite as *C. parvum*. According to Article 13 (for names published after 1930, which *C. tyzzeri* Levine, 1961 belongs to) of the International Code of Zoological Nomenclature (ICZN), “when describing a new nominal taxon, an author should make clear his or her purpose to differentiate the taxon by including with it a diagnosis, that is to say, a summary of the characters that differentiate the new nominal taxon from related or similar taxa.” Therefore, because of the lack of description of the morphology and unique features, *Cryptosporidium tyzzeri* Levine, 1961 has
to be considered a nomen nudum, and as a result, the name Cryptosporidium tyzzeri is available for the description of the Cryptosporidium mouse genotype I in domestic mice. The only uncertainty associated with this is the identity of the parasite detected by Tyzzer (1929). Some thought it could be C. baileyi (Upton, 2003), whereas others suggested it might be C. meleagris (Fayer, 2008).

Much of the dispute on C. tyzzeri stems from the identity of C. parvum originally described by Tyzzer (1912) and the validity of Cryptosporidium pestis (Slapeta, 2006, Slapeta, 2011, Xiao, et al., 2004, Xiao, et al., 2007). Using the ICZN Principal of Priority, Slapeta has proposed to rename as C. parvum as C. pestis and retain C. parvum for mouse genotype I on the basis that Tyzzer was probably describing mouse genotype I (Slapeta, 2006, Slapeta, 2011). However, because most animals are infected with multiple species and genotypes of Cryptosporidium spp., we will never know what Tyzzer originally described. It may have been mouse genotype I, but may also have been any of the other Cryptosporidium species and genotypes that have been found in naturally infected domestic mice (Ren, et al., 2011), including mouse genotype II and C. parvum. Thus, the name C. pestis has been challenged because of the uncertainty regarding the identity of the parasite originally described by Tyzzer, and ICZN provisions allowing flexibilities in applying the Principal of Priority.

In proposing the name C. pestis, Slapeta has used a rigid interpretation of the ICZN Principal of Priority. The fourth edition of the ICZN, which governs the taxonomy of protozoan parasites and other animals, took effect on 1 January 2000 (http://www.nhm.ac.uk/hosted-sites/iczn/code/). Within the Introduction, Ride et al. (1999) list a series of underlying principles that are pertinent to this discussion. The fourth principal clearly states “Nomenclatural rules are tools that are designed to provide the maximum stability compatible with taxonomic freedom.
Accordingly, the Code recognises that the rigid application of the Principle of Priority may, in certain cases, upset a long-accepted name in its accustomed meaning through the validation of a little-known, or even long-forgotten, name. Therefore the rules must enable the Principle of Priority to be set aside on occasions when its application would be destructive of stability or universality, or would cause confusion.” This concept of flexible use of the Principal of Priority is reinforced in the short Preamble of the code, and again in Article 23.2 on the purpose of the Principle of Priority: “In accordance with the objects of the Code (see Preamble), the Principle of Priority is to be used to promote stability and it is not intended to be used to upset a long-accepted name”. In a recent publication (Slapeta, 2011), Slapeta asserts that the “guidance” of the ICZN Secretariat was used to support the validity of C. pestis, even though the first underlying principal of the ICZN clearly states “The Code refrains from infringing upon taxonomic judgment, which must not be made subject to regulation or restraint.”

The Cryptosporidium community in general has taken a conserved approach in using Cryptosporidium species names. Although C. parvum-like oocysts have been seen in over 150 species of mammals since the initial description of C. parvum (see Fayer, 2008), the name was seldom used for the description of these parasites until 1985 when Upton and Current (1985) made a full taxonomic re-description of C. parvum for isolates from calves and a bovine-infective isolate from an AIDS patient. Because mice are known to be naturally infected with C. parvum and have been used widely as a laboratory model for C. parvum, the taxonomic re-description of C. parvum was done following ICZN rules, and is accepted by almost all researchers in the community (a recent PubMed search of Cryptosporidium parvum found no publications before 1985 and over 3,000 publications since 1985). In contrast, the new name C. pestis still lacks a full taxonomic description, and has only been used by the proposing author in
three publications since 2006. To re-name *C. parvum* as *C. pestis* would be confusing to not only *Cryptosporidium* researchers but also the wider veterinary and medical community and water industry who struggle to keep up with the taxonomy as it is. It would also be in violation of the underlying principals of the ICZN.

Because of the *nomen nudum* nature of *C. tyzzeri* Levine, 1961 and the validity of *C. parvum* Tyzzer, 1912 for the use of species commonly found in cattle and humans, the description of *C. tyzzeri* Ren, Zhao, Zhang, Ning, Jian, Wang, Lv, Wang, Arrowood & Xiao, 2011 is done in accordance with the ICZN code.

**References:**

6. Slapeta, J., 2011. Naming of *Cryptosporidium pestis* is in accordance with the ICZN Code and the name is available for this taxon previously recognized as *C. parvum* 'bovine genotype'. Vet Parasitol 177, 1-5.


