Which is the true cercaria of *Paragonimus mexicanus*?

Yasumasa TONGU

Summary

The true cercaria of *Paragonimus mexicanus* is the cercaria reported by Malek *et al.* in 1985 as a cercaria of *P. peruvianus*. However, there is a question whether the flame cell formula of $2((3+3+3+3+3)+(3+3+3+3+3))=60$ is justified. Therefore, I question the possibility of the cercaria of *P. mexicanus* reported by Ito *et al.* in 1985. If it has a pseudo-sucker, it belongs to another species of *Paragonimus* cercaria. The cercaria reported by Tongu *et al.* in 1990 from Venezuela was eliminated the possibility of a new species. It is probable that this cercaria belongs to *P. mexicanus*. Ibanez revived the name of *P. peruvianus* in 1990 by the differences in the cercaria and adults. However, I disagree with his opinion.

Key words: *Paragonimus mexicanus, Paragonimus peruvianus*, cercaria, taxonomy, Latin America

Introduction

After *Paragonimus mexicanus* was reported by Miyazaki and Ishii from Mexico in 1968, five species have been recognized in Central and South America. Shortly thereafter, *P. peruvianus* and probably *P. eucadoriensis* proved to be synonymous with *P. mexicanus*. Brenes *et al.* also asserted that *P. peruvianus* was synonymous with *P. mexicanus* in 1980. Their discussions on the species were due to the morphological criteria of the metacercaria and adult. Ito *et al.* described the morphological features of the cercaria of *P. mexicanus* from Colima, Mexico, for the first time. They used the cercaria naturally infected in *Aroapyrgus alleei*. On the other hand, Malek *et al.* reported the cercaria from the *Aroapyrgus colombiensis* experimentally infected miracidium of *P. peruvianus* (synonym of *P. mexicanus*) in Peru in 1985. This cercaria had no pseudo-sucker and 8 pairs of penetration gland cells in contrast to the cercaria of *P. mexicanus* reported by Ito *et al.* *Tongu et al.* described the cercaria from Venezuela using a scanning electron microscope in 1990. This cercaria had 7 pairs of penetration gland cells and no pseudo-sucker. Therefore, they suggested that this cercaria might be a new species. However, this cercaria was obtained from naturally infected *Aroapyrgus* sp.

Ibanez observed the differences in the testis, spermatheca and Laurer's canal of the adult *Paragonimus mexicanus* from Peru. He then revived the name of *P. peruvianus* in 1990 by the differences in the cercaria and adults. However, I disagree with his opinion.

Description of *Paragonimus cercariae* in Central and South America

1. Cercaria of *Paragonimus mexicanus* by Ito *et al.* (Fig. 1)
   - snail host: naturally infected *Aroapyrgus alleei*
   - locality: Colima, Mexico
   - flame cell formula: $2((3+3+3+3+3)+(3+3+3+3+3))=60$
   - pseudo-sucker: present
   - penetration gland cells: 7 pairs

2. Cercaria of *Paragonimus peruvianus* by Malek *et al.* (Fig. 2)
Yasumasa Tongu

Fig. 1 Cercaria of *Paragonimus mexicanus*

snail host: experimentally infected *Aroapyrgus colombiensis*
locality: Condebamba, Peru
flame cell formula: $2((3+3+3+3)+(3+3+3+3)) = 60$
pseudo-sucker: absent
penetration gland cells: 8 pairs

3. Cercaria of *Paragonimus sp.* by Tongu *et al.*$^{10}$ (Fig. 3)

snail host: naturally infected *Aroapyrgus* sp.

locality: El Algarrobo de Buenos Aires, Venezuela
flame cell formula: unknown
pseudo-sucker: absent
penetration gland cells: 7 pairs

**Discussion**

*Paragonimus* species have been mainly distinguished by the morphological differences in the spine and ovary. However, there is no appropriate criteria for the identification of the *Paragonimus* species. The spine varies based on the site or age of the parasite. The branch of the ovary also increases in number according to age. This internal organ can not be observed on a level due to its cubic body. The shape and size of the egg shell are significantly different even in the same adult$^{10,13}$. Furthermore, the pits on the egg surface have different depths for each individual in the same parasite. In Central and South America, many new *Paragonimus* species have been classified using the morphology of only the metacercaria and adult. Among them, only *P. mexicanus*$^{10}$ has been widely distributed and clearly identified by its shape.

Based on the metacercaria, *P. caliensis*$^{2}$ was identified from other species due to the presence of a cyst wall and 96 flame cells. However, there has been no further reports on this *Paragonimus*. 

---

- 64 -
In general, it is difficult to count the number of flame cells over 60 in the cercaria of *Paragonimus* because of its small body. I could not observe the complete formula of the flame cells in one body even for metacercaria. Moreover, it is unbelievable that the flame cell number is the same between the cercarial and metacercarial stages, because the flame cell increases in number as the worm grows older in trematoda. Concerning the flame cell of the cercaria, Malek et al.\(^9\) reported the same number of 60 that Ito et al.\(^8\) observed in the cercaria of *P. mexicanus*. However, I can not believe this result.

*P. amazonicus*\(^4\) has a longer body than other *Paragonimus* species. However, there has been no report since Miyazaki et al. in 1973. In general, the fresh body of *Paragonimus* repeatedly lengthens and contracts in physiological saline solution. This fact complicates the taxonomy of *Paragonimus*. Among them, *Paragonimus mexicanus* is widely prevalent in Central and South America. Although the morphological features of this cercaria was first reported by Ito et al.\(^8\), it is another species of *Paragonimus* cercaria. The true cercaria of *P. mexicanus* was reported by Malek et al.\(^9\) as the cercaria of *P. peruvianus* (synonym of *P. mexicanus*), because his examination was credited with obtaining the cercaria. He did not observe a pseudo-sucker. Hata et al.\(^13\) also reported the cercaria without a pseudo-sucker from an experimentally infected snail (Oncomelania nosophila).

The *Paragonimus* cercaria from Venezuela by Tongu et al.\(^10\) is morphologically similar to that reported by Malek et al.\(^9\) except for the number of penetration gland cells. It may be contain some errors due to unfavorable observation conditions. In 1990, Ibanez\(^11\) revived the name *P. peruvianus*, which was recognized as a synonym of *P. mexicanus*, by Miyazaki\(^9\). He emphasized the differences in the testis, seminal vesicle, spermatheca, Laurer's canal and egg size between *P. mexicanus* and *P. peruvianus* including the differences in the cercarial stage. However, these differences, particularly in the adult worm, were regarded as variations in species. Therefore, the true cercaria of *P. mexicanus* is the cercaria reported by Malek et al.\(^9\).

**Acknowledgments**

The author wishes to thank Professor Moriyasu Tsuji (Kyorin University) for providing research opportunities. Thanks are also due to Professor Rafael Lamothe A. (Universidad National Autonoma de Mexico), Professor Pedro Morera (Universidad de Costa Rica), Professor Mario R. Pinto (Universidad de San Carlos de Guatemala), Professors Oscar Noya-G. and Belkisyole Alarcon de Noya (Universidad Central de Venezuela), and Dr. Hidekazu Hata and Dr. Hitoshi Kobayashi (Chiba University) for their kind support throughout the study. This research was supported by grants in aid for the International Scientific Research Program (1983, 1985, 1988, 1995) from the Ministry of Education, Science, Sports and Culture in Japan.

**References**

8) Ito, J., Yokogawa, M., Lamothe-A, R. and Hata, H.: Studies on the cercaria of *Paragonimus mexicanus* in *Arogyrus allei* from Colima, Mexico, with special reference to its morphology (Trematoda : Trog-


メキシコ肺吸虫のセルカリアはどれか？

頓宮廉正

メキシコ肺吸虫の真のセルカリアは実験方法から考察して、Malekらが1985年にペルー肺吸虫のセルカリアとして報告したものである。ただしその flame cell 式は信用できない。したがって伊藤らが1985年にメキシコ肺吸虫として報告してきたセルカリアは、事実 pseudo-sucker が存在するならば別種のセルカリアと考えられる。また頓宮らが1990年に報告したペネズエラ産肺吸虫のセルカリアは侵入数の数を誤った可能性もあり、メキシコ肺吸虫のセルカリアの可能性が強い。Ibanéz はメキシコ産肺吸虫とペルー産肺吸虫の成虫における違いからペルー肺吸虫の名前の復活を主張したが、それは適当ではない。成虫における内部器官の違いはむしろ種内の変異と捉えるべきである。

キーワード：メキシコ肺吸虫、ペルー肺吸虫、セルカリア、分類、中南米