

Mature *Paragonimus heterotremus* found from a man in Laos*

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Introduction

Occurrence of human paragonimiasis has been known in Laos (Constant & Lagarde, 1962), but insofar as the authors are aware, no taxonomical study has ever been performed on the causative agent of the disease. Recently, human paragonimiasis has become fairly common in Laos, and actually, five or six cases are in hospital in many parts of Vientiane at present, most of them being soldiers. In September 1969, the junior author obtained some lung flukes from a Laotian male who had suffered from paragonimiasis and died in consequence of the stomach cancer. Two flukes as well as the sputum of the patient were sent to the senior author for taxonomical study. After careful observations, it was clarified that both flukes were unexpectedly not *P. westermani* but *P. heterotremus* Chen et Hsia, 1964, which was originally found on the mainland of China. By the present finding, *P. heterotremus* was proved, for the first time, to be able to fully mature in the human body.

Materials and Methods

The patient named Nai Kouang was a Laotian male and 39 years of age, who lived at Muong Kassy, a village on the hills between Vientiane and Luang-Prabang. He presented typical symptoms of paragonimiasis

such as cough, hemoptysis, eggs in the sputum. Three months treatment with 'Bithionol' improved the condition, but he subsequently died of the stomach cancer. At necropsy, lung flukes were obtained from worm-cysts of the lungs (Fig. 8). They were preserved in 10% formalin without flattening their body, and two of them were sent to Japan together with the sputum of the same patient that was also preserved in 10% formalin.

Of the two flukes, one was fully mature and the other was immature, having no eggs in the uterus. In Japan, both were re-fixed with 70% alcohol under high pressure, stained with carmine and mounted in balsam. As the flukes had already been fixed in formalin without pressure, it was difficult to prepare well-flattened specimens. In particular, the specimen of the mature fluke (Fig. 1) was too thick to observe the ovary and testes clearly. Therefore, the cuticle and vitellaria of the posterior half of the body as well as eggs in the uterus covering right testis were removed to demonstrate morphology of the internal organs in detail. The removed cuticle was used for photographing cuticular spines. Fifty eggs from the uterus and forty eggs in the sputum of the patient were respectively measured without pressure.

Results

Mature fluke (Fig. 1): The body was thicker than usual due to inadequate fixation, measuring 8.9 mm in length and 5.2 mm in width. The oral sucker measured 1.05 by

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0.99 mm and the ventral sucker 0.54 by 0.46 mm in diameter, that of the former being twice as long as that of the latter (Fig. 2). The ovary (Fig. 7) was delicately branched and situated on the left side of the body, measuring 1.43 by 1.31 mm in outline. The uterus was filled with eggs and highly coiled on the right side of the body. As stated above, most eggs were removed to show the right testis clearly. Vitellaria were widely and densely distributed all over the body, but the posterior half was removed, as mentioned previously, to demonstrate details of internal organs. The left testis measured 2.63 by 2.10 mm and the right 1.81 by 1.65 mm in outline, being larger in size and less delicate in branching than the ovary (Fig. 7). Cuticular spines (Fig. 4) were singly spaced, the tip of which was mostly serrated.

Immature fluke (Fig. 3): The body measured 6.3 mm long and 3.3 mm wide, and was covered with single spines all over. The oral sucker measured 0.78 by 0.63 mm and the ventral sucker 0.53 by 0.46 mm, the latter being much smaller than the former. The ovary was situated on the right side and the uterus on the left side of the body, containing no eggs. The ovary and testes were delicately branched, and vitellaria were scarcely recognized, since the fluke was too young.

The egg was oval in shape, yellowish in color and provided with an operculum at one pole. The eggshell was smooth and uniform in thickness; in particular, no gradual thickening was recognized at non-operculated end. Fifty eggs from the uterus measured without pressure 73.1 to 90.3 μ in length and 38.7 to 50.8 μ in width, averaging 82.9 by 44.2 μ . On the other hand, forty eggs in the sputum of the patient averaged 81.5 by 44.2 μ , ranging from 73.1 to 92.5 μ long and from 38.7 to 49.5 μ wide, when free from pressure.

Discussion

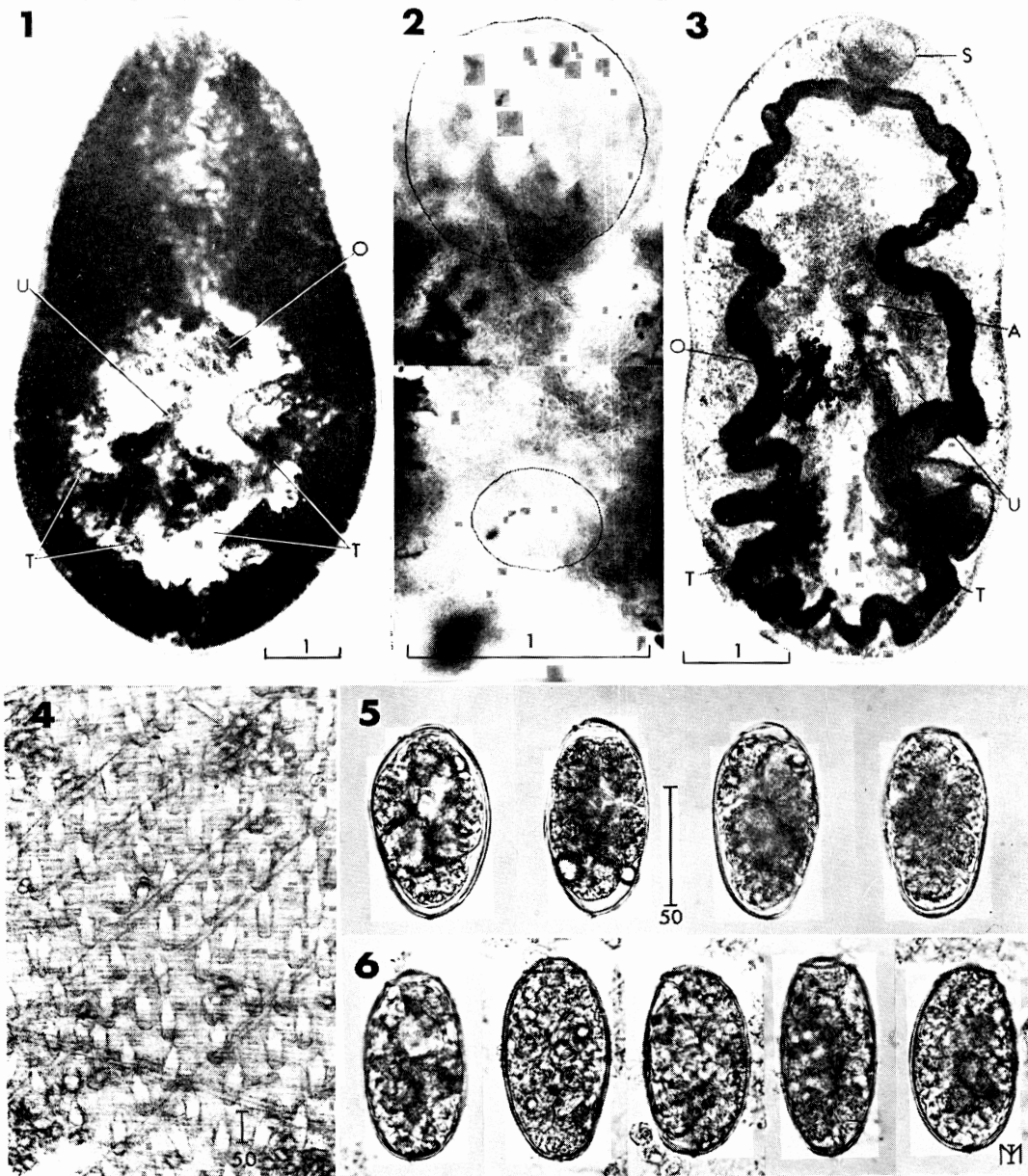
The present flukes were easily identified as *P. heterotremus* for the following reasons: (1) the oral sucker was much larger than the

ventral sucker; (2) cuticular spines were singly spaced all over; (3) the ovary was delicately branched and smaller than the testes; (4) both testes were less delicately branched than the ovary. The similar characters can be seen also in *P. tuanshanensis* Chung et al., 1964 and *P. africanus* Voelker et Vogel, 1965. But, the former is regarded to be the same with *P. heterotremus*, and the latter has a smaller oral sucker and larger testes as compared with the present species.

P. heterotremus was originally found by Chen & Hsia (1964) from rats in Kwangsi and Yunnan Province, China, and then recognized by Miyazaki & Vajrasthira (1967) from cats and dogs in an endemic area of paragonimiasis in Nakorn-nayok Province near Bangkok, Thailand. The first human infection with this fluke was reported by Miyazaki & Harinasuta (1966) from a Thai boy residing in the same endemic area. As a matter of fact, they obtained two immature flukes of this species from subcutaneous nodules of the boy, but it has been so far unknown whether or not *P. heterotremus* can fully mature in the human body. By the present finding it was proved for the first time that this fluke was able to mature in man, making the wormcyst in the lungs.

It is generally difficult to identify the species of *Paragonimus* by the character of eggs in the sputum. In the present case, however, eggs in the sputum belong with certainty to *P. heterotremus*, because their character is similar to its uterine eggs and the patient harbored no other species of *Paragonimus*. The egg of *P. heterotremus* can be separated from that of *P. westermani* and *P. harinasutai* Miyazaki et Vajrasthira, 1968 by the characteristic of the non-operculated end of eggshell, and from that of *P. caliensis* Little, 1968 and *P. peruvianus* Miyazaki, Ibáñez et Miranda, 1969 by the fact that the eggshell of these South American species shows irregularly undulating contour.

The source of infection in the present case has not been decided as yet, since the crab host of *Paragonimus* is unknown in Laos on the one hand, and it is not always secure to



(Scale: in millimeters in Figs. 1-3; in micra in Figs. 4 and 5)

Fig. 1. Mature *P. heterotremus* from a Laotian male. Ventral view. Cuticle, vitellaria and uterus partly removed. (O: ovary, T: testis, U: uterus)

Fig. 2. Oral (upper) and ventral sucker of Fig. 1 under the same magnification. Ventral view. Outline of the suckers shown with black circle.

Fig. 3. Immature *P. heterotremus* from the same patient. Ventral view. No eggs in the uterus. (A: ventral sucker, O: ovary, S: oral sucker, T: testis, U: uterus)

Fig. 4. Cuticular spines on ventro-posterior part of the mature fluke (Fig. 1).

Fig. 5. Uterine eggs of *P. heterotremus* under the same magnification. Note uniform thickness of the shell at non-operculated end (bottom).

Fig. 6. Eggs in the sputum of the patient who harbored *P. heterotremus*. Magnification is the same as Fig. 5.

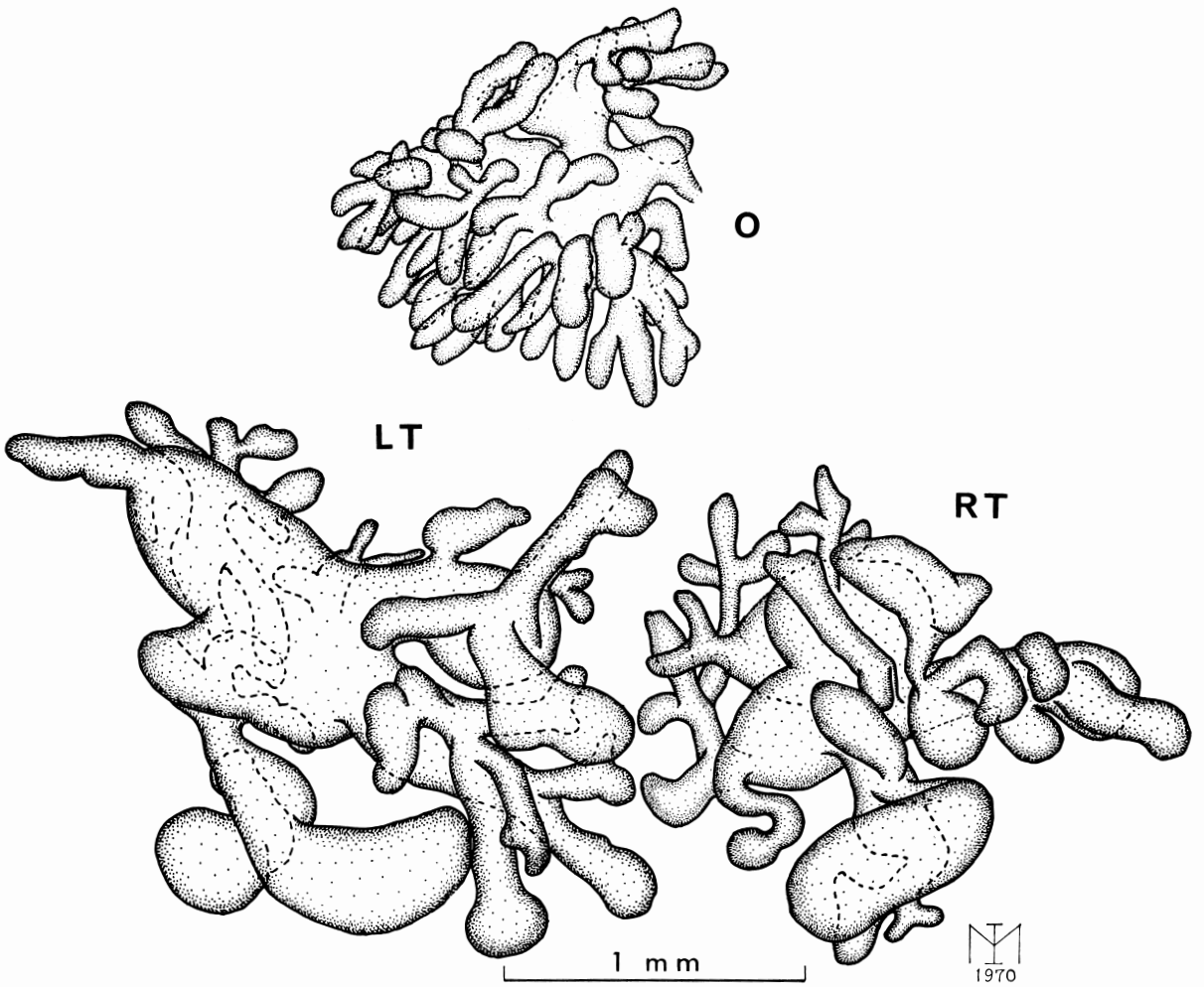


Fig. 7. Details of ovary and testes of the mature *P. heterotremus* (Fig. 1) under the same magnification. Dorsal view. (O: ovary, LT: left testis, RT: right testis)

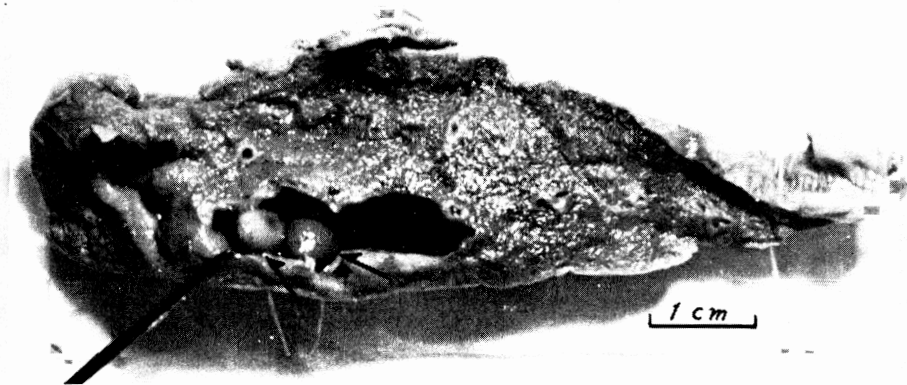


Fig. 8. Inferior lobe of the right lung of the Laotian male. Two lung flukes are shown by the arrow.

travel outside Vientiane at present time on the other hand. From geographical point of view, it may be affirmed that *P. heterotremus* is occurring in Laos, although it has not been settled where the patient was infected with this fluke. As cases of paragonimiasis are fairly common in the hospitals in Vientiane, it is likely that *P. heterotremus* is one of the important human parasites in Laos.

Summary

Human paragonimiasis is fairly common in the hospitals in Vientiane, Laos, and two lung flukes were reported from the lungs of a 39-year-old Laotian male who died of the stomach cancer. The flukes were identified as *P. heterotremus* Chen et Hsia, 1964, and one of them was fully mature, having numerous eggs in the uterus. Finally, this lung fluke was first proved to be able to mature in the human body.

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ラオスでヒトからえられたヒロクチハイキュウチュウの成虫 (特別掲載)

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この肺吸虫は、陳と夏(1964)によつて、中国の広西および雲南省で発見され、ついで、Miyazaki & Vajrasthira (1967)によつて、タイ国バンコック近くの肺吸虫症流行地で確認された。ヒトからとりだされたのはMiyazaki & Harinasuta (1966)が同じ流行地にすむ少年の皮下から2匹報告したのが最初である。しかし、2つとも非常に若いので、果して人体内で成熟しうるかどうかは、わからなかつた。一方、その流行地の患者に寄生するものも、卵の性質などから、本種であることは充分考えられたが、成熟虫体がえられないために、確認がつかめなかつた。

ところが、昨年9月、ビエンチャンで胃癌のために死亡した39才の男の肺から、本種の成虫がえられて、人体でも充分成熟することが、はじめて明らかになつた。最近、ラオスでは肺吸虫症が、かなり発生しつつあるが、その病原として本種が重要な関係をもっているように思われる。現在の情勢下では、この患者が、どこで、何から感染したかを確かめることは困難であるが、ラオスにこの肺吸虫が分布していることは、まず、まちがいないであろう。この虫は、ラオスやタイ国では、かなり注目すべき人体寄生虫になりそうである。