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Cestode Development Research in China: A Review

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1. Introduction

Adult cestode is parasitic in the intestine of the vertebrate and/or Human being. It contains a series of parasites in the world. The taxonomy position of the parasites is as follows: Platyhelminthes, Cestoda. Cestodes parasitic in human and vertebrates can cause parasitic diseases. Chinese ancestors in Tang dynasty had already concerned about this. Chao Yuanfang recorded that "… the worm is an inch in length with white colour…" ["Discussion of disesase origins", 610 A.D. From Zhao,1983] and it is infected by eating the beef that roasted by porking with mulberry twigs. So we can see that the Chinese ancestors had cestode knowledge very earlier. The little problem is that ancestors took the gravid proglottids as the whole worm and had no complete idea about this worm, nor had the life-history recognition. The report and research work of cestodes are just modern history and the work is a little later than foreign scientists.

Taenia saginata and *Taenia solium* are parasites of the human intestine, they may cause diseases. The more serious condition is that the cestode larvae parasitic in the liver, brain and other important organs, especially the *Echinococcus* which contain *Echinococcus granulosus* and *E. multilocularis.* These parasites take human and sheep as the intermediate host but cat and dog as the final host. The development of *E. multilocularis* larva in the host liver can cause serious result as a cancer. *Echinococcus* cause the disease called Echinococcosis and it was spreaded broadly in pasturing area of China. So we need to propagandize to those people that they cannot feed the dogs and cats with the bowels of the goats and cattles so that they may cut the mechanisms for transmission of the disease.

The studies of cestode is mainly with taxonomy level before 1960 but there are some other research of them as the life-cycle (Liao & Shi, 1956; Tang, 1982; Li, 1962a; Lin, 1962b,etc) and ultrastructure (Li & Arai,1991) as well as molecular biology (Liao & Lu, 1998).

According to Professor Lin Yuguang, cestodes species found in China was 213 in 1979 and it reached about 400 recorded by Cheng Gonghuang (2002).

Here we mainly discuss the life-history researches of cestode in China. These research works can be mainly divided into the following 4 aspects: Cestodes of Fishes (Liao & Shi, 1956; Tang, 1982.); Cestodes of Snakes (Cheng, Wu et Lin, 2008) ; Cestodes of chicken and ducks (Lin, 1959; Su et Lin, 1987); Cestodes of mammals (Lin, 1962a; Lin, 1962b; Lin & He,1975). It is to say common species of cestodes from fishes, snakes, birds, and mammals in China have all been studied with their life-history and it takes long time and hard work to finish these jobs.

2. Brief introduction to the works done by scientists in China

2.1 Life cycle of *Polyonchobothrium ophiocephalina* Dubinina (Tang C. C.,1982)

The cestode was collected from *Monopterus albus* (Zuiew), but ever collected by Tseng Shen from *Ophiocephalus agrus* and named as *Anchistrocephalus ophiocephalina*. And it was transferred to Genus *Polyonchobothrium* by Dubinina (1962).

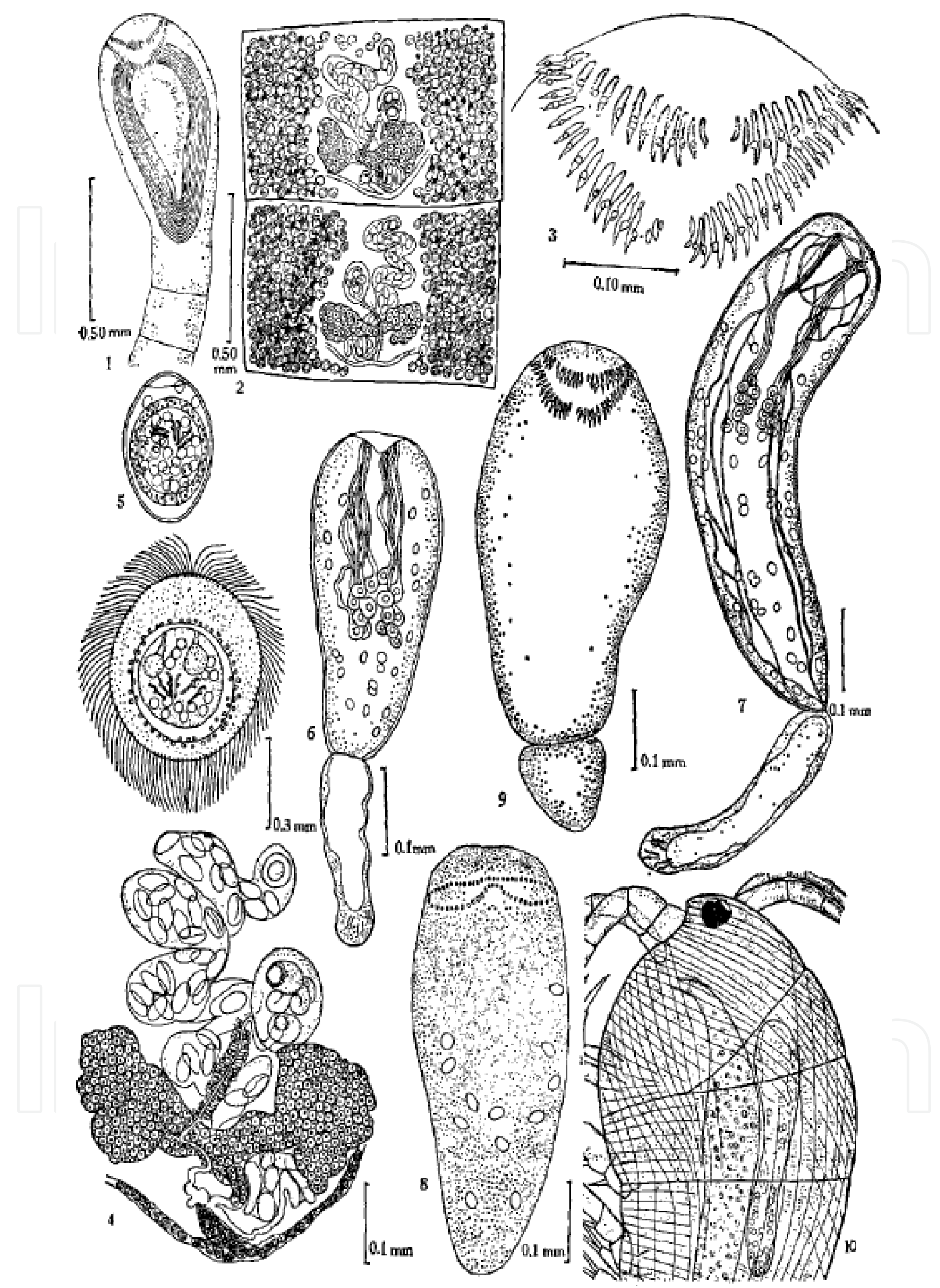
Description for the adult (Plate 1: Fig 1-4): worm length is 15.5 cm, scolex, 1.2x0.6 mm. Scolex rectangular. Bothria shallow in both ventral and dorsal; apical disc present, armed with 48-62 hooks arranged in 2 and a half cycles. External segmentation present but feebly demarcated. Mature proglottid, 1x1.6 mm. Genital pore median, dorsal, pre-equatorial. Testes medullary, in two lateral fields. Ovary posterior, bilobed, 0.14x0.44 mm, transversed, elongated. Vitelline follicles cortical, in lateral bands dorsaly and ventrally, occasionally continuous around lateral margins of proglottid. Uterus loops forward, forms small uterine sac which opens midventrally when laid. In freshwater teleosts.

Development: the eggs were obtained from uterus of the cestode and put in a culture dish with fresh water for 3 days at temperature of 22-29°C. The coracidium turned out to swim. It measured 65μm in diameter with a cilia membrane 5-16μm outside. There is a spherical hexacanth in it, 60-64μm. In the development the front part of the worm is more active while old tissue is left in late part. Hexacanth had 2 granula unicellular penetrated glands with ducts to edge at the front of it. Reid ever reported hexacanth of *Raillitina cesticillus* also has the same glands.

Infection experiments show that *Mesocyclops leuckartii* Claus and *Thermocyclops hyalinus* (Rehberg) can serve as intermediate host of the cestodes. These 2 species of cyclops were put in the dish with the coracidium and coracidium were eaten. The hexacanth pierced into the body cavity of the cyclops and developed into a spherical larva then become narrow. 15 days later there comes a tail of the worm, 18 days later it turned to procercoid (Plate 1: Fig 7-8) as the mature larva of the worm at the temperature of 21-23°C. Procercoid larva measured 0.40x0.18 mm in the body, and 0.24x0.07 mm for tail. The front of the body swollened with a pit, following part is narrow and slender, penetrated glands are spherical with bulbed neucleus.

After 18 days of development the procercoid become mature, measured 067×0.16 mm for the body, 0.34×0.08 mm for tail. At this time the excretory system is much more obvious. collecting pipes were 4 longitudinal ducts with small cross discharging ducts at the first 1/5 of the body. It may become the discharge ducts of the adult cestode scolex. Ducts of the tail is not clear, only 4 flamming cells. 8 pairs of granula glands and buddles of tunnels are still there. Procercoid can survive for 30 days in a cyclops by experiment observation.

Final host infection: 15 *M. albus* from a negative area were used as infection plan. They were fed with cyclops infected with cestode for 18 day, dissected the M. albus after 3 days of infection and a 0.53 mm worm were found with 2 and a half cycles of hooks, but it is just a little for each hook. 7 days after infection, 3 mature worms with 50 more hooks in the scolex were found. The whole life cycle is now completed.



Explanation to Plate 1. 1. Scolex of *Polyonchobothrium ophiocephalina* 2. Mature proglottid of *P. ophiocephalina* 3. Hooks on top of the scolex 4. Genital systems of mature proglottid 5. Eggs and coracidium 6. Procercoid 7. A mature procercoid 8. Early stages of procecoid developed in a intestine of *M. albus* 9. Scolex in a intestine of *M. albus* 10. a cyclops with a procercoid in it.

2.2 The development process of *Ophiotaenia monnigi* in the copepods is as follows (Cheng, Wu et Lin, 2008)

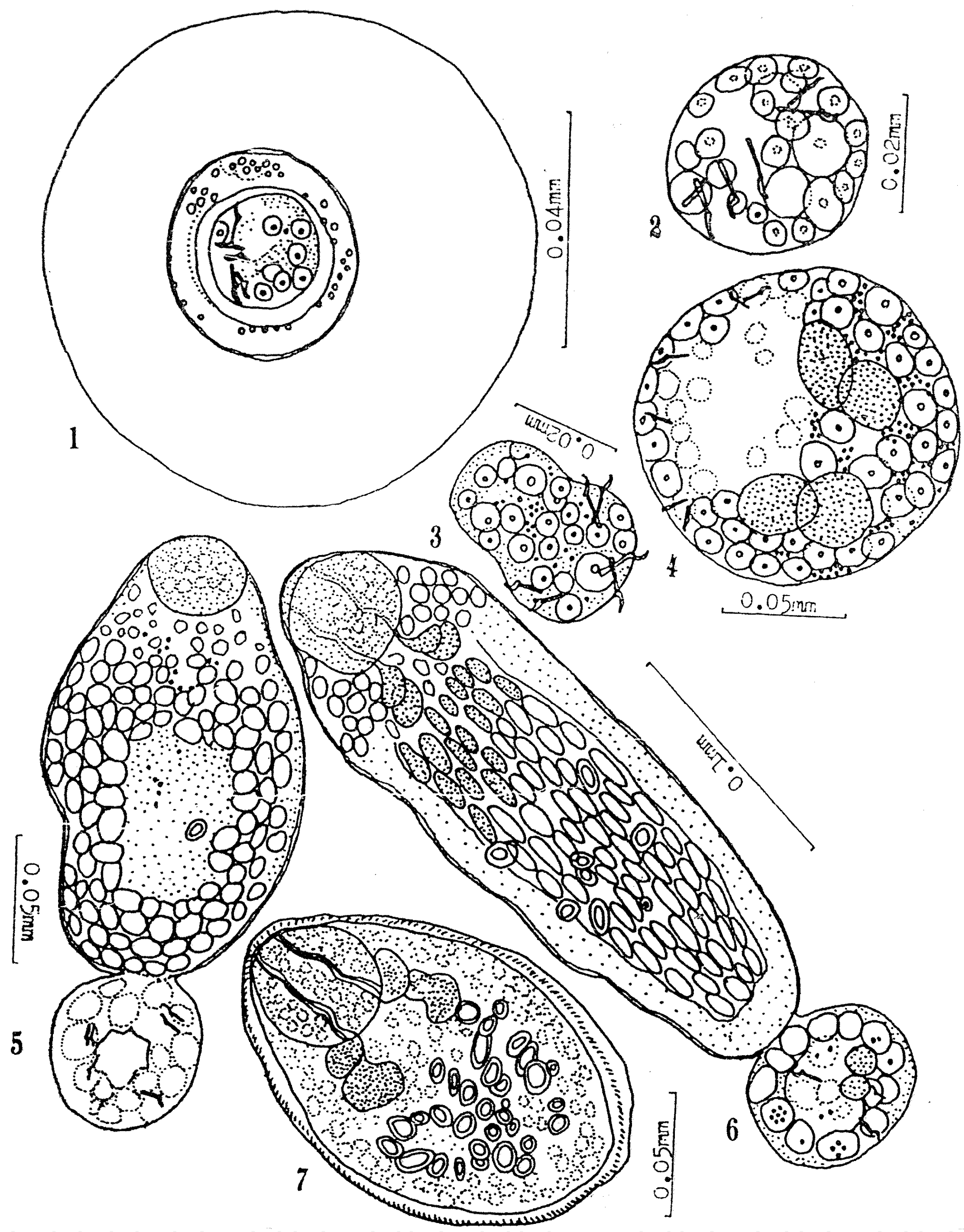
Experimental animals: Copepods (*C. leuckarti* and *C. prasinus*) were obtained from ponds and ditches in Fuzhou with dredging nets. Snakes, *Enhydris plumbae*, were bought from Markets. The research was carried out in the laboratory on September in southern China.

The freshwater snakes, *E. plumbae*, were dissected. After the cestodes were collected, their gravid proglottids were torn into very small pieces to release the eggs if mature tapeworms were found. Then, the pieces of the gravid proglottids were cultivated with water for 4–10 days and fed to the copepods. In the cultivation processes, water should be changed everyday, otherwise the eggs would be poisoned by their metabolites. To make the copepods take in more eggs, it is necessary to stop feeding the copepods for 24 h before they were fed with the pieces of the tapeworm.

Copepods were dissected after they were fed with eggs 1, 3, 6, 8, and 11 days according to the development speed of the tapeworm's larvae, the procercoid, in their host. Shapes of the larva of different stages were drawn under the microscope (Olympus) (measurement unit is μm).

The tapeworms obtained by the authors were identified as *O. monnigi* Fuhrmann, 1924. Furthermore, no more species of cestodes parasitizing the same host, the water snake (*E. plumbae*), were found. During the experiment the temperature is around 28°C.

1. One day after infection: Hexacanths with a diameter of 0.020 μm in the eggs developed into procercoid larvae with a size of 0.027 x 0.039, and the hooks became dispersing. Embryonic cells increased apparently and were larger than those in the hexacanths (Plate 2: Figs. 1, 2).
2. Three days after infection: There appeared two parts in the procercoids. Hooks were in the larger part, which became the cercomere (tail) gradually and came off in the future. Embryonic cells luxuriantly developed, where the larger ones measured 0.010 x 0.008 and the smaller only 0.005 in diameter. The procercoid measured 0.024 x 0.020 and 0.037 x 0.029 in *C. prasinus* and *C. leuckarti* respectively, and the embryonic cells developed slower in the former host. The following description is based on the development of procercoid larvae in *C. leuckarti* (Plate 2: Fig. 3).
3. Five days after infection: Procercoids measured 0.041–0.082 x 0.059–0.100. An embryonic coelom, which measured as 0.019–0.063 x 0.011–0.045, appeared. In front of the coelom, embryonic cells were densely gathered; of the cells, there were four that contain a lot of granules looking like glands. Hooks were around the later edge of the embryonic coelom (Plate 2: Fig. 4).
4. Six days after infection: Procercoids were divided into body and tail parts, measuring 0.085 x 0.137 and 0.056 x 0.059, respectively. In the body part of the procercoid larvae, there was a primary apical sucker of the tapeworm (Plate 2: Fig. 5).
5. Eight days after infection: Procercoids were the same shape as that described above. Two pairs of gland cells, whose tubules reach the front edge of the worm through the apical sucker, appeared behind the sucker. Large dark cells could be seen in the center of the body. About ten calcareous granules were in the body. The tail part was spherical and had a transparent coelom. Cells in the tail were soft and transparent. The sizes of the worm were: the body 0.096 x 0.241, the cercomere, 0.059 x 0.052 (Plate 2: Fig. 6).



Explanation to Plate 2. 1. Mature egg with a hexacanth 2. Procercoid developed after 1 day in *Cyclops leuckarti* 3. Procercoid of 3 days after infection 4. Procercoid of 5 days after infection 5. Procercoid of 6 days after infection 6. Procercoid of 8 days after infection 7. A mature procercoid in the copepod, *Cyclops leuckarti*; the cercmere had come off.

6. Eleven days after infection: Most procercoids became oval mature larvae whose cercomere dropped in the copepods. There were crowded fibers on the surface of the worm. An apical sucker was in front of the procercoid. Two pairs of gland cells were behind the sucker. Some cell might be the primitive embryonic cells that will develop in the next host. The worm measured 0.195 × 0.112, while the apical sucker is 0.091 in diameter. In a high density of infected copepods, ten mature and one immature larvae with a cercomere were found. In general, three to four procercoids were parasitizing in one copepod (Plate 2: Fig. 7).

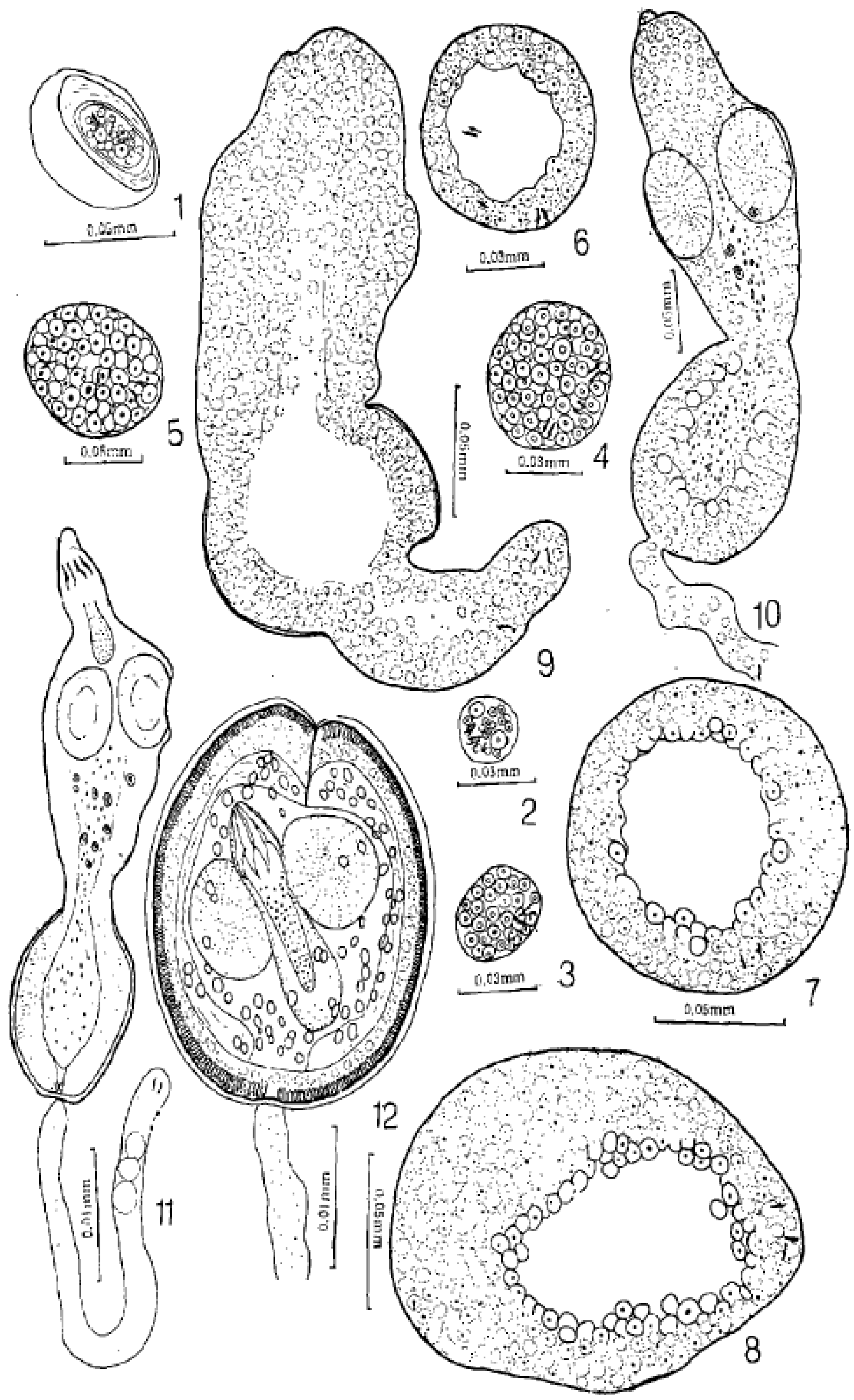
2.3 Chicken and duckcestode lifecycle (Su et Lin, 1987)

During 1981~1984,a total of 250 ducks and geese were examined in Xiamen,Fujian. It was found that 92 out of 228 ducks(40.4%) and 6 out of 22 geese(27.3%) were foud to be infected with 9 species of cestodes,such as (1) *Hymenolepis paramicrosoma*, (2) *H.gracilis*,(3) *H. venussa*,(4) *H. setigera*, (5) *H. przewalskii*,(6) *Drepanidotaenia lanceolata*, (7) *Diorchis stefanskii*, (8) *Dicranotaenia coronuna* and (9) *Fimbriaria fasciolaris*.

The development of larval stages within the hemocoele of intermediate hosts of five species of cestodes, namely *Hymenolepis vensusta*, *H. setigera*, *Fimbriaria fasciolaris*, *Drepanidotaenia lanceolata* and *Diochis stefanskii* were also studied, and the specific characters of each stage of larvae, especially their cysticercoids, were carefully studied and compared. It was revealed that they had a general pattern in the course of their oncogenesis. The process of larval growth can be divided into five stages: a.oncosphere stage,b.lacuna stage, c. cysticavity stage, d.scolex formation stage,and e.cysticercoid stage. Based on their observations, the features of these hymenolepidae cysticercoids, including the shape and size of cysticercoid, the cystic wall and fibrous membrane, the shape, size and number of rostellar hooks etc. can be identified as the specific diagnostic characters of species.Take *H. venusta* as an example to explain the development process of these cestodes.

Egg of *H. venusta* is with a feeble, transparent shell, roundish, 51-61x39-46μm, with a oval out embryomembrane, then innermembrane which enclosed the hexacanth.The intermediate host of the cestode is freshwater *Heterocypris* sp.The egg can developed into a cysticercoid in 11 days at the temperature of 26-30°C (average, 28°C) after infected with its host. At least 15 days is needed to become whole mature cysticercoid which is infective. 5 development stages can be seen in the whole developmental course.

1. stage of hexacanth (Plate 3: Fig 2-4). After 24 hours the egg is taken by its host (it is called infection, thereafter), the hexacanth can get through the gut and enter the body cavity of *Heterocypris* sp. It takes 2-3 days for the development of this stage. The worm is roundish or oval, with a diameter of 20-50μm. Sometimes the worms moved like an amoeba. The measurement for cells in it is variously changed but the cells' membrane and nucleus are very clear. The 6 hooks become to leave their position and arranged irregularly.
2. Lacunna stage (Plate 3: Fig 5-8). 4-6 days after infection hexacanth becomes bigger, 60-180μm. A transparent cavity comes out in the center of the worm and it is the primitive cavity. It increased with the growth of the worm, and become a ball body with empty center. The 6 hooks arranged in surface of the cavity, arranged irregularly. The characteristics of the stage are the worm growing fast and the primitive cavity formation.
3. cysticcavity stage (Plate 3: Fig 9). From 5 to 8 days after infection, the growth of the worm toward to 2 ends. The first part of the worm grows more fast with quite often cell division and become sturdy tissue then comes a cavity called cysticavity. Another part of the worm with little growth and showed sag states, the hooks and the primitive cavity stay there. So the worm can be divided into 2 parts, and 2 cavities at this time. In the beginning the two cavities are communicating with each other, after development, the primitive cavity with hooks is blocked with cells and it becomes the tail part of the worm. The first part of the worm developed well with fast cell division and form the organs of suckers, and rostellum etc. The length of worm is 250-330μm.



Explanation to Plate 3. Larva development of *H. venusta* 1. Egg 2. Oncosphere 2 days after infection 3 and 4. 3th day oncosphere 5 and 6. 4th day oncosphere 7. 5th day lacuna stage 8. 7th day lacuna 9.8th day cysticavity stage. 10. 9th day scolex formation stage 11. 10th day scolex formation stage 12. 12th day cysticercoid

4. Scolex formation stage (Plate 3: Fig 10-11). 9 days after infection the worm comes to this stage. In front of the worm there comes the scolex, then in the middle there is the roundish or oval cavity body, after then there is a slender tail part. 4 oval suckers can be seen in the scolex, then rostellum come into being, then hooks come at the top of the rostellum. After the scolex the neck present, there are many calcium carbonate granules. At the center of the cavity body part there is the cavity and it connected with the neck at the front. The cavity wall is composed of several layer of cells arranged tidily. The tail part is slender and with 6 hooks. Sometimes the primitive cavity still can be seen in the tail. The measurement of the worm at the time is as follows: scolex width,90-110μm; suckers, 40-50x70-72μm; cavity body width, 130-200μm; tail length, 300-400μm; rostellum 50-60μm; hooks, 14-15μm.
5. cysticercoid stage (Plate 3: Fig 12). After 11 days of infection the scolex of the worm retracted into the cavity body part and the cysticercoid is formed. It is not infective unless after 15 day of infection it becomes mature enough. The mature cysticercoid 210-237x187-205μm, is composed of three layers of body wall. Outside it is transparent cuticle, 3-5μm; the middle layer is composed of soft cells with one line of mast cells and several lines of round cells, 3.5-18μm; inner layer is with fibers, 9-15μm. The scolex is retracted in the cavity, 4 suckers, 62-64x77-81μm. Outside the rostellum there is a rostellum sac. At the top of rostellum there are 8 hooks, 39-42μm. Calcium carbonate granules ever at the neck is now around the scolex. The tail, 300-400μm. With the developedment of the worm to mature calcium carbonate granules increased with those fibers and the cysticercoid become more and more infective.

Other 4 species of cestode developed in the same course mainly but with different host, egg, development time as well as characteristics.

2.4 Studies on the developmental cycle of *Paranoplocephala ryjikovi* Spassky,1950 in the intermediate hosts (Lin, Guan, Wang et. al.,1982)

From Aug to Nov 1980 21 *Marmorta himalayana* Hodgson were dissected in Amuke River and Longriba pastures of Hongyuan County, Sichuan Province and found 3 of them infected with *Paranoplocephala ryjikovi* 95 worms (4-78). The mature segments of the worm were fed the soil mites and various stages of cysticercoids of the worm were obtained. The results are as follows:

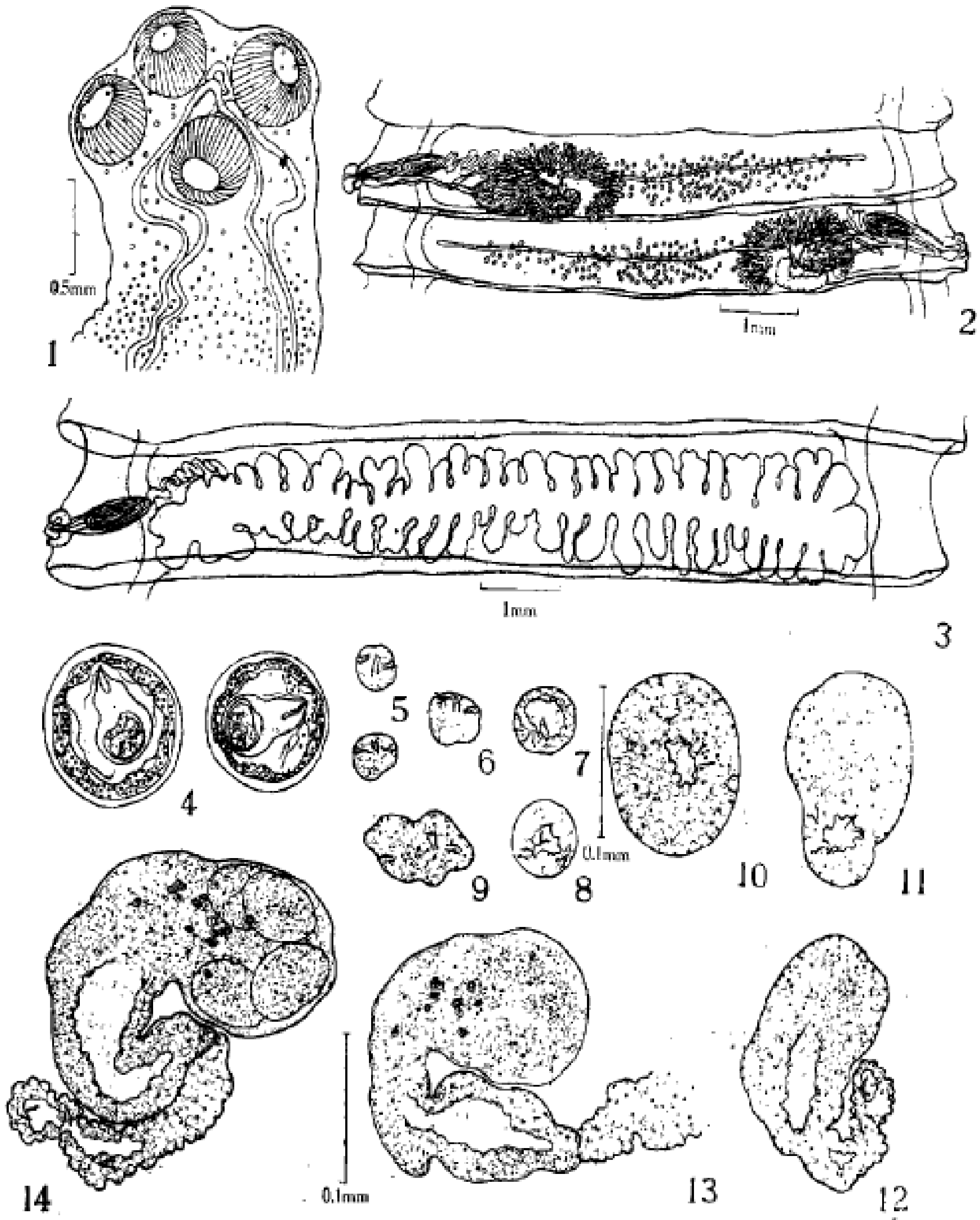
1. Materials and Method:
a. Selection of the pregnant segments: take few of the pregnant proglottids to dissect and release the eggs and observe under microscopes. To prove them is full mature by that the embryo is developed enough with quite active hexacanth. And take 5-10 pregnant proglottids to do the experiment. The pregnant segments from feces of *Marmorta himalayana* can also be used to infect the mites.
b. Collection, isolation and feed with soil mites. Same as Lin Yuguang (1962,1975). The soil mites were taken from the local place.
2. The results of study for the life cycles
a. Adult (measurement unit is mm)
The adult worm is 12-451 in length with a width of 4.5-23, and 133-184 segments. Genital pores irregularly alternate at the late 1/3 of both sites with spherical genital atrium which can turn out of the body. The scolex is square and/or spherical,0.214-

0.386×0.171-0.329. Testes 122-144, distributed around the uterus and opposite site of the genital pore, without the sperm reservoir. Cirrus sac is oval, 1.128×0.233 (1.014-1.289×0.204-0.263). Inner sperm reservoir take take the most part of the cirrus sac, 0.526×0.263. There are thorns on the cirrus surface. Ovary is fan shaped, with many lobes, 1.368×0.395. Vitelline glands are rseshoe,0.696×0.175. spermatheca is fusiform, 0.683×0.309. Early stage of uterus is a transverse tube then it becomes to enlarge with 20-30 branches in both sites. The adult worms are quite similar with the description of Spassky (1950,1951). But Spassky only got 3 specimen with the biggest worm of 190×10, and the scientists in China got 95 worms with the biggest one of 450×23.

b. The eggs
The fresh Hexacanth eggs are white, spherical with thin wall, 70.9×74.16, easy to be broken. Egg shell is transparent, 51.48×51.12, the membrane Outside embryo is transparent, ruffled, 72.12×41.04. There are many vitelline granule between the outside embryo membrane and the egg shell. Inner embryo membrane is specialized as pyriform organ, 34.2×25.2. Hexacanth, oval, 18.0×23.4.

c. Various stages of systicercoid (measurement unit is μm).
In Sep. 5-8,1980, three batches of soil mites were infected with *P. ryjikovi* but the temperature in Longriba is too low to continue the research so specimen were taken to Chengdu and put in the incubator at 29-30°C to continue the experimental study. So all the following experimental results were under this temperature condition and the development processs were observed under the fit constant temperature.

1. Hexacanth stage: after one day of infection the soil mites can be dissected and the hexacanth was found to be 21.6x28.8, with 8-12 embryo cells, the location of hooks are the same as that in eggs. Since the temperature is so low that the embryo stopped to develop without any changes from 8-16 Sep. (Plate 4: 5-6)
2. Lacuna stage: from 16 to 23 Sep, after 5 days in incubator the hexacanths are in different stages, the smallest one—36x25.5, then 43.2x32.4, the biggest one, roundish, 43.2x39.6, the lacuna is appeared in the central, with big embryo cells 6-8, small embryo cells 12-14. (Plate 4: 7)
   23-26 Sep. (8 days after incubator culture), all hexacanths developed into lacuna stage, spherical. The hexacanth is 46.8×46.8, lacuna is 18.0×28.8. hooks are changed the location to the outside of lacunna. (Plate 4: 8)
   27-30 Sep. (12 days after incubator culture): hexacanth oval,104.4×122.4, lacuna is decreased. Hexacanth developed to pear shaped, 158.4×115.2. Lacuna is locted at the narrow part of the worm, hooks are outside of lacuna. (Plate 4: 9,10,11)
   1-4 Oct. (16 days after incubator culture): An extended worm or lacuna, 162×115.2 were found in *Parakalumma lydia*, front part is blunt, with small and crowded cells, late part with the lacuna, cells are incompact around it, hooks are irregularly arranged around the lacuna. (Fig 1:12)
3. blastula stage: 4-5 Oct. (17-18 days after incubator culture): All worms are at blastula stage, the larvae are now divided into two parts—the front body and the tail. The small worm with a body of 144.0x86.4, early stage of blastula was at the center of the late half, boundary irregular. The tail, 90×28.8, has no distinct boundary with the body, more transparent. The developed ones were splitting head part,115.2x118.8, apart the body. The suckers are faintly seen. The blastula tail, 108.0x115.2. Blastula cavity is bottle shaped with irregularly boundary. Tail, slender, biggest width 64.8. (Plate 4: 13)



Explanation to Plate 4: 1. Scolex 2. mature proglottid 3. gravid proglottid 4. egg 5. Hexacanth of 24 h after infection to soil mite 6. Hexacanth of 8 days after infection 7.hexacanth of 5 days after incubator culture; 8. Lacuna stage larva of 7 days after incubator culture. 9-11 Lacuna stage larva of 12 days after incubator culture 12. Blastula stage larva of 16 days after incubator culture 13. Blastula stage larva of 17 days after incubator culture 14. Scolex formation stage larva of 20 days after incubator culture

4. Scolex formation stage:
   6-7 Oct. (20 days after incubator culture) in a *Scheloribates* sp. a worm of scolex formation stage were found. Front part of the worm are developed into a

scolex,118.8×122.4. 4 suckers are seen, 32.4×43.2. blastula cavity, 90.0×165.0, front of the blastula connected with scolex, with no distinct boundary between them. Tail part stripped,216.0×36.0. Lacuna and hooks are still at the end, there are 10 more calcium carbonate granules between scolex and the blastula cavity (Plate 4: 14). Another worm of the stage were found: scolex 108.0×116.6. Blastula cavity, 72.0×97.2, with distinct cavity in it, blastula wall 4-5 lines of cells, the cavity is fusiformis but the tail is stripped,187×46.5. (Plate 5: 15).

8 Oct. (21 days after incubator culture): the scolex extended and become active, 118.8×198.0. Suckers can be stretched, there are 11 calcium carbonate granules at the end of the tail. The blastula cavity developed mature as a bottle, 162×104.4. The balstula wall with 3-5 line of cells. There is a cuticular around the scolex and the blastula cavity. The tail are decreased to degenerate: 74.4×50.4. Hooks are arranged at the late part of the tail.

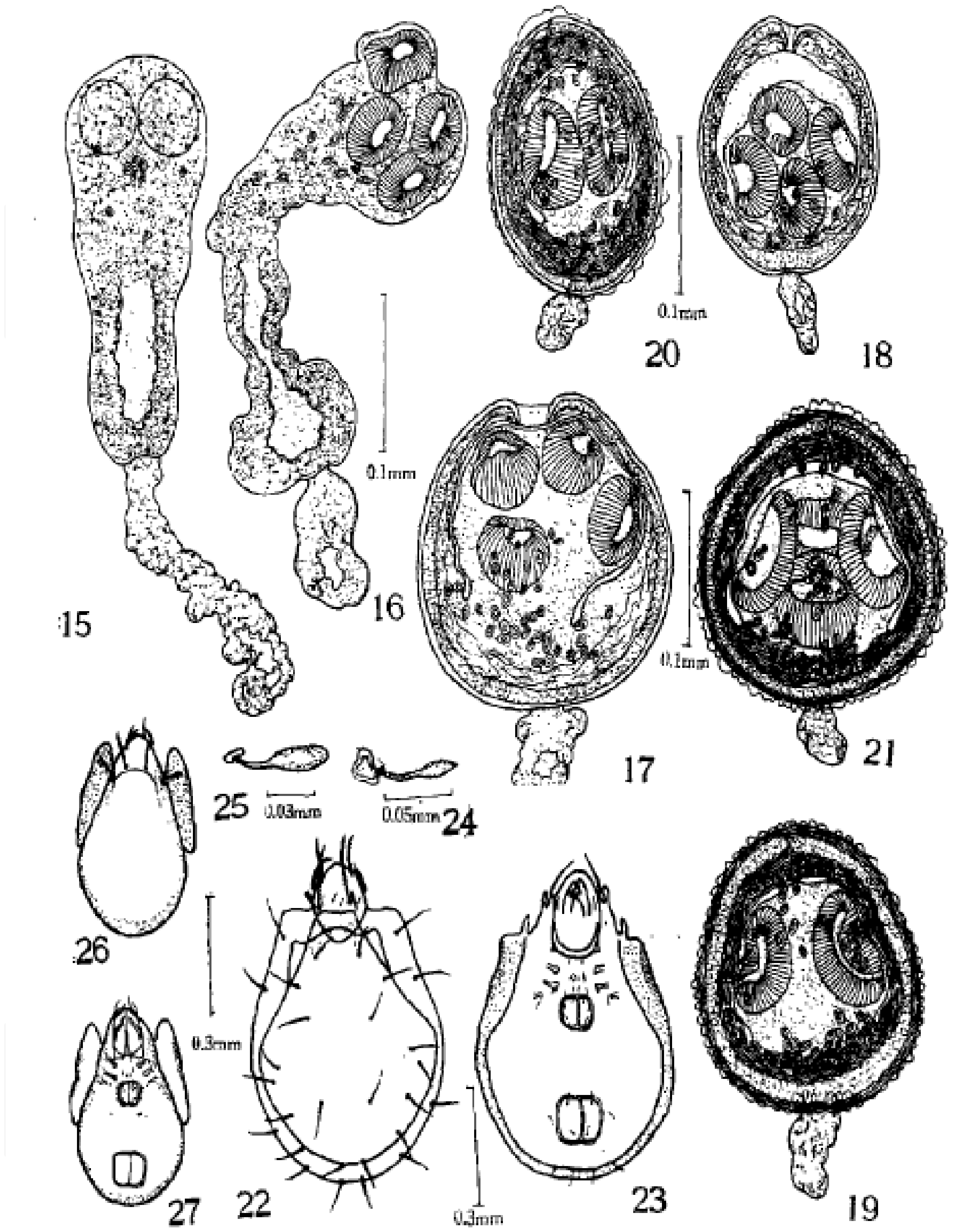
19-13 Oct. (26 days after incubator culture): early stage of cysticercoid, the scolex retracted to the blastula cavity. The blastula cavity, 205.2×216.0. There is a cuticular around it, a big hole at the front can be seen, Scolex,162.0×172.8. The suckers are much active, 64.8×46.8. 42 calcium carbonate granules are at the base, and they are in different sizes. Blastula wall is constructed by 2-3 column epithelial cells. The tail is connected with the base of blastula cavity and there is distinct boundary. The tail is stripped with a width of 54.0, the hooks are there. (Plate 5: 17).

14-15 Oct. (28 days after incubator culture): cysticercoid developed almost the same. Blastula body is quite sturdy, 140.4×160.5. Scolex are separated with blastula wall, 104.4×11.6. Blastula wall are divided two layers, out layer are one line cells. Inner wall are soft cells, and with fibrosis. The calcium carbonate granules are distributed at the base of the scolex and around the inner layer of the blastula wall. The tail is apparently decreased to as a stick, 54.0×28.8. (Plate 5: 18)

16-19 Oct. (32 days after incubator culture): cysticercoids are almost mature. The blastula is spherical, 133.2×187.2. Scolex oval, 108.0×126.0, suckers, 79.2×39.6. Cuticular layer with deep colour, become thick, the edge of the blastula sac it is corrugation. The wall is with two layers, out layer is with epithelial cells arranged very tidy, thickness is 7.2, inner layer is fibrosis, 18.0-21.6. More calcium carbonate granules are appeared, most of them are distributed late part of the scolex and front part of the blastula sac. Tail like a small sac, 43.2×28.8. (Plate 5: 19)

20-26 Oct. (39 days after incubator culture), whole mauture cysticercoids are found, oval body, 198.0×172.8. The cuticule is black, with compactness fiber lines,out side with irregular undulance protuberance, with a thickness of 3.6-10.8. The bastula wall is two layer, out part with 1-2 lines of epithelial cells, transparent, thickness, 10.8-18.0. Number of calcium carbonate granules is 63-70, maily distributed at base of scolex and fiber layer. Tail degenarated to a small sac, transparent, 50.4×36, hooks are still there. After then all the cysticercoids are almost the same, changed quite few (Plate 5: Fig 20,21;Plate 4:Fig 1-5)

2 rabbits were used as host to infect the cysticercoids, adult worms were not found after 58 days of infection. 2 Guinea pigs were also used to infect with 4 and 6 mature cysticercoids, after 28 days adult worms were still not found. Maybe they are not suitable normal hosts.



Explanation to Plate 5: 15. Scolex formation stage larva of 20 days after incubator culture 16. formation stage larva of 21 days after incubator culture Scolex 17. Early stage of cysticercoid, 26 days after incubator culture 18. cysticercoid, 28 days after incubator culture 19 cysticercoid, 32 days after incubator culture (near to mature). 20. and 21. cysticercoid, 39 and 70 days after incubator culture. 22. Dorsal view of *Scheloribates* sp. I. 23. Ventral view of *Scheloribates* sp. I. 24. Pseudostomatal apparatus of *Parakalumma lydia* 25. Pseudostomatal apparatus of *Scheloribates* sp. I. 26. Dorsal view of *Parakalumma lydia* 27. Ventral view of *Parakalumma lydia*.

3. Afterwords

These are the maily representative works, but there are still very good jobs done by many other scientists in China: The life-cycle,ecology and prevention of *Bothriocephalus gowkongensi*(Liao et Shi, 1956); Sudies on the development and intermediate hosts of *Moniezia expansa* (Rudolphi, 1810)(Lin, 1962a); Comparative studies on the procercoid development in their intermediate hosts for *Hymenolepis diminuta* and *H. nana* (Lin, 1962b); Studies on the lifecycle of *Moniezia benedeni* (Cai et Jin, 1984); Studies on the life cycle of *Ctenotaenia citelli* (Kirshenblat) and *Mosgovoyia pectinata* (Goeze) (Lin et Hong,1986), etc. But it is limited pages to put everything here so the author can just take those papers mainly introduced as above.

4. Appendix

A Catalogue of Cestodes in China

A. Proteocephalidea Mola,1928
I.Proteocephalidae La Rue,1911

1 *Proteocephalus* Weinland,1853
(1)*P. fima*(Meggitt,1927)
(2)*P. fixus*(Meggitt,1927)
(3)*P. exiguus* La Rue,1911
(4)*P. longicollis*(Zeder,1800)
(5)*P. torulosus*(Butsch,1786)
(6)*P. parasiluri* Yamaguti,1934
2. *Ophiotaenia* La Rue,1911
(7)*O. nankingensis* Hsü,1935
(8)*O. fixa* Meggitt,1927
(9)*O. sinensis* Cheng et Lin,2002
(10)*O. akgistrodontis* Harwood,1933
(11)*O. mönnigi* Fuhrmann,1924
(12) *Ophiotaenia wuyiensis* n. sp.

3. *Gangesia* Woodland,1924
(13)*G. oligorchis* Roylman et Frece,1964
(14)*G. parasiluri* Yamaguti,1934
(15) *G. pseudobagre* Chen,1984

4. *Silurotaenia* Nybelin,1924
(16)*S. spinula* Chen,1984
(17)*S. siluri*(Batsch,1786)

5. *Paraproteocephalus* Chen,1984
(18)*P. parasiluri* Chen,1962

6. *Corallotaenia* Freze,1965
(19)*C. nanfengensis* Cheng,1997

7. *Corallobothrium* Fritsch,1886
(20)*C. parasiluri* Zmeev,1936

B. Cyclophyllidea van Beneden in Braun,1900

II Dilepididae (Railliet et Henry,1909) Lincicome,1939

8. *Ophiovalipora* Hsü,1935
(21)*O. houdemeri* Hsü,1935
(22)*O. lintonis* Yamaguti,1959
9. *Paradilepis* Hsü,1935
(23)*P. duboisi* Hsü,1935

10. *Amoebotaenia* Cohn,1900
(24)*A. cuneata* Linstow,1872
(25)*A. oligorchis* Yamaguti,1935
(26)*A. brevicollis* Fuhrmann,1907
(27)*A. vanelli* Fuhrmann,1907
(28) *A. pekingensis* Tseng,1932
(29)*A. fuhrmanni* Tseng,1932
(30)*A. lingi* Li et. al,1994
(31) *A. scolopax* Li et. al,1994
(32) *A. lumbrici*(Villot,1883)
(33)*Amoebotaenia* sp.
(34)*A. tropica* Xu,1959

11. *Unciunia* Skrjabin,1914
(35)*U. ciliata*(Fuhrmann,1913)
(36)*U. sinensis* Lin,1976
(37)*U. falconis* Lin,1976
(38)*U. hypsipetis* Lin,1976

12. *Anomotaenia* Cohn,1900・
(39) *A. hoepplii* Tseng,1933
(40) *A. microhyncha*(Krabbe,1869)
(41) *A. citrus*(Krabbe,1869)
(42) *A. nymphaea*(Schrank,1790)
(43) *A. stentorea*(Frölich,1802)

(44)*Anomotaenia* sp. Tseng,1932
(45)*A. nycticoracis* Yamaguti,1935
(46)*A. ciliata* Fuhrmann,1913
(47)*A. erolia* Li et.al.,1994
(48) *A. hypoleucus* Li et.al.,1994
(49)*A. passerum* Joyeux et Timon-David,1934
(50) *A. rustica* Neslobinsky,1911

(51) *A. arionis*(Siebold,1850)
(52)*A. garrulax* Li et. al.,1994
(53)*A. amaurornisus* Cheng et Lin,2002

13. *Choanotaenia* Railliet,1896
(54)*C. infundibulum*(Bloch,1779)
(55)*C. quiarti* Tseng,1932
(56)*C. macracantha* (Fuhrmann,1907)
(57)*C. joyeuxi* Tseng,1932
(58)*C. cingulifera*(Krabbe,1869)
(59)*C. porosa*(Rudolphi,1810)
(60)*C. coromandus* Li et. al.,1994
(61)*C. merula* Li et. al.,1994
(62)*C. stenura* Li et. al.,1994
(63)*C. joyexibaeri* López -Neyra,1952
(64)*C. decacantha*(Fuhrmann,1913)
(65)*C. slesvicensis*(Krabbe,1882)
(66)*C. stellifera*(Krabbe,1869)
(67)*C. rotunda*(Clerc,1913)

14. *Anonchotaenia* Cohn,1900
(68)*A. globata*(Linstow,1819)
(69) *A. oriolina* Cholodkovsky,1906
(70)*A. dendrocitta*(Woodland,1929)

15. *Paricterotaenia* Fuhrmann,1932
(71)*P. paradoxa*(Rudolphi,1802)
(72)*P. arquata*(Clerc,1906)

16. *Dilepis* Weinland,1858
(73)*Dilepis* sp.1 Tseng,1932
(74)*Dilepis* sp.2
(75)*D. undula*(Schrank,1788)
(76)*D. unilateralis*(Rudolphi,1819)

17. *Dipylidium* Leuckart,1863
(77)*D. caninum*(Linnaeus,1758)
18. *Diplopylidium* Beddard,1913
(78)*D. nölleri* Skrjabin,1914

19. *Paruterina* Fuhrmann,1906
(79)*Paruterina* sp. 1
(80) *Paruterina* sp.2

20. *Biuterina* Fuhrmann,1902

(81)*B. passerina* Fuhrmann,1908

21. *Cyclorchida* Fuhrmann,1907
(82)*C. omalancristrota* Wedl,1855

22. *Kowalewskiella* Baczynska,1914
(83)*K. buzzardia* Tubangui et Masilungan,1937

23. *Vitta* Burt,1938
(84)*V. wulingensis* Yun et Tang,1993
(85)*V. magniuncinata*(Burt,1938)

24. *Lateriporus* Fuhrmann,1907
(86)*L. exiensis* Yun et Tang,1992

25. *Deltokeras* Meggitt,1927
(87)*D. delachauxi* Hsü,1935

26. *Angularella* Strand,1928
(88)*A. ripariae* Yamaguti,1940

27. *Parvirostrum* Fuhrmann,1908
(89)*P. magisomum* Southwell,1930

III.Nematotaeniidae Lühe,1910

28. *Nematotaenia* Lühe,1910
(90)*N. dispar*(Goeze,1782)

29. *Baerietta* Hsü,1935
(91)*B. baeri* Hsü,1935

IV. Diploposthidae (Poche ,1926) Southwell, 1929

30. *Diploposthe* Jacobi,1896
(92)*D. skrjabini* Mathevossian,1942
(93) *D. laevis*(Bloch,1782)

V. Anoplocephalidae Cholodkovsky,1902

31. *Oochoristica* Lühe,1898
(94)*O. hainanensis* Hsü,1935
(95)*O. crassiceps* Baylis,1920
(96)*Oochoristica* sp.
(97)*O. ratti* Yamaguti et Miyata,1937

32. *Schizorchis* Hanson,1948
(98)*S. tibetana* Wa-cheih,1965
(99)*S. changduensis* Wa-cheih,1965
(100)*S. altaica* Gvozdev,1951
(101)*S. tangi* Guan et. al.,1986

33. *Anoplocephala* Blanchard,1848
(102)*A. magna*(Abildgaard,1789)
(103)*A. perfoliata*(Goeze,1782)

34. *Paranoplocephala* Lühe,1910
(104)*P. mamillana*(Mehlis,1831)
(105)*P. ryjikovi* Spassky,1950
(106)*P. transversaria* Krabbe,1879

35. *Moniezia* Blanchard,1891
(107)*M. benedeni* Moniez,1879
(108)*M. expansa* Rudolphi,1810
(109)*M. denticulata* (Rudolphi,1810)
(110)*M. planissima* Stiles et Hassall,1892
(111)*M. sichuanensis* Wu,1982

36. *Cittotaenia* Riehm,1881
(112)*C. denticulata* Rudolphi,1804
(113)*C. citelli*(Kirschenblat,1939)

37. *Bertiella* Stiles et Hassal,1902
(114)*B. studeri* Blanchard,1891
(115)*Bertiella* sp.

38. *Paronia*.Diamare,1700
(116)*P. pycnonoti*.Yamaguti,1935
(117)*P. corvi* Guan et Lin,1987
(118)*P. calcauterina* Burt,1939

39. *Avitellina* Gough,1911
(119)*A. minuta* Yang et. al.,1977
(120)*A. tatia* Bhalerao,1936
(121)*A. magavesiculata* Yang et. al., 1977
(122) *A. centripunctata* Rivolta,1874

40. *Stilesia* Railliet,1893
(123)*S. globipunctata*(Rivolta,1874)

41. *Pseudanoplocephala* Baylis,1927
(124)*P. crowfordi* Baylis,1927

42. *Aprostatandrya*(Kirschenblat,1938)
(125)*A. macrocephala* Douthitt,1915
(126)*A.*(*S.*)*cricetuli* Lin et. al,1984

43. *Mosgovoyia* Spassky,1951
(127)*M. pectinata*(Goeze,1782)

44. *Killigrewia* Meggitt,1927
(128)*K. orientalis*(Yun et Tang,1992)
(129)*K. delafondi*(Railliet,1892)

45. *Thysaniezia* Skrjabin,1926・
(130)*T. giardi* Moniez,1879
(131)*T. ovilla* (Rivolta,1878)

46. *Diuterinotaenia* Gvosdev,1961
(132)*D. daofuensis* Guan et Lin,1992
(133)*D. polyclada* Yun et Lin,2000
VI.Amabiliidae Fuhrmann,1908

47. *Schistotaenia* Cohn,1900
(134)*S. indica* Johr,1959
(135)*S. macrorhycha*(Rudolphi,1810)

48. *Tatria* Kowalewski,1904
(136)*T. acanthorhyncha*(Wedl,1855)

VII. Dioecocestidae (Southwell, 1930) Burt, 1939

49. *Gyrocoelia* Fuhrmann,1900
(137)*G. fausti* Tseng,1933
(138) *Gyrocoelia* sp.

50. *Dioecocestus* Fuhrmann,1900
(139)*Dioecocestus* sp.

VIII.Taeniidae Ludwig,1866

51. *Echinococcus* Rudolphi,1801
(140)*E. granulosus*(Batsch,1786)
(141) *E. multilocularis*.Leuckart,1863
(142)*Echinococcus russicensis* Tang et al.,2007
52. *Multiceps* Goeze,1782
(143)*M. multiceps*(Leske,1780)
(144)*M. serialis*(Gervais,1847)
(145)*M. skrjabini* Popov,1937

53. *Taeniarhynchus* Weinland,1858
(146) *T. saginata*(Goeze,1782)

54. *Hydatigera* Lamarck,1816
(147)*H. taeniaeformis*(Batsch,1780)

55. *Taenia* Linnaeus,1758
(148)*T. hydatigera* Pallas,1766
(149)*T. solium* Linnaeus,1758
(150) *T. pisiformis* Bloch,1780
(151)*T. tenuicollis* Rudolphi,1819
(152)*T. ovis* Cobbold,1860

56. *Cladotaenia* Cohn,1901
(153)*C. cylindracea*(Bloch,1782)
(154)*Cladotaenia* sp.

(155)*C. circi* Yamaguti,1935

IX.Catenotaeniidae Wardle et McLeod, 1952

57. *Catenotaenia* Janicki,1904
(156)*C. pusilla*(Goeze,1782)
(157)*Catenotaenia* sp.
(158)*C. linsdalei* McIntosh,1941

X.Mesocestoididae Perrier, 1897

58. *Mesocestoides* Vaillant,1863
(159)*M. lineatus* Goeze,1782
(160)*Mesocestoides* sp.

XI. Davaineidae Fuhrmann, 1907

59. *Cotugnia* Diamare,1893
(161)*C. digonopora*(Pasquale,1890)
(162)*C. taiwanensis* Yamaguti,1935
(163)*C. seni* Meggitt,1926

60. *Davainea* Blanchard,1891
(164)*D. proglottina*(Davaine,1860)
(165)*D. himatopodis* Johnston,1911
(166)*Davainea* sp. Hoeppli,1920
(167) *D. anderi* Fuhrmann,1933

61. *Raillietina* Fuhrmann,1920
(168)*R. cesticillus*(Molin,1858)
(169)*R. echinobothrida*(Megnin,1881)
(170)*R. tetragona*(Molin,1858)
(171)*R. taiwanensis* Yamaguti,1935
(172)*R. shantungensis* Winfield et.al.,1936
(173)*R. tetragonoides* Baer,1926
(174)*R. huebscheri* Hsü,1935
(175)*Raillietina* (*Fuhrmannetta*)sp. Tseng,1933
(176)*R. garrisoni* Tubangui,1931
(177)*R. sinensis* Hsü,1935
(178)*Raillietina* sp. Chen,1933
(179)*R. celebensis* (Tanicki,1902)
(180)*R. madagascariensis*(Davaine,1870)
(181)*R. fragilis* Meggitt,1931
(182)*R. compacta* (Clerc,1906)
(183)*R. parviuncinata* Meggitt et Saw,1924
(184)*R. sartica*(Skrjabin,1914)
(185) *R. kantipura*(Sharma,1943)
(186)*R. pycnonoti*(Yamaguti et Mitunaga,1943)
(187) *R. torquata*(Meggitt,1924)
(188)*R. lini* Cheng et Lin,2002

62. *Ophryocotyle* Friis,1870
(189)*O. insignis* Lonnbery,1890

63. *Fernandezia* López-Neyra,1936
(190)*F. indicus*(Singh,1964)Artjuch,1964

XII.Hymenolepididae Railliet et Henry,1907

64. *Aploparaksis* Clerc,1903
(191)*A. sinensis* Tseng,1933
(192)*A. filum*(Goeze,1782)
(193)*A. parafilum* Joyeux et Bear,1939
(194)*A. crassirostris*(Krabbe,1869)
(195)*A. brachyphallos*(Krabbe,1869)
(196)*A. penetrans* Clerc,1902
(197)*A. fukienensis* Lin,1959
(198)*A. bubulcus* Li et. al.,1994
(199)*A. larina* Fuhrmann,1921

65. *Diorchis* Clerc,1903
(200)*D. flavescens*(Krefft,1871)
(201)*D. anatina* Ling,1959・
(202)*D. anomallus* Schmelz,1941

(203)*D. crassicollis* Sugimoto,1934
(204)*D. formosensis* Sugimoto,1934
(205)*D. nigrocae* Yamaguti,1935
(206)*D. wigginsi* Schultz,1940
(207)*Diorchis* sp.
(208)*D. ransomi* Schultz,1940
(209)*D. sobolevi* Spasskaja,1950
(210)*D. inflata* (Rudolphi,1891)
(211)*D. elisae* Skrjabin,1914
(212)*D. bulbodes* Mayhew,1929

66. *Fimbriaria* Froelich,1802
(213)*F. amurensis* Kotellnikov,1960
(214)*F. fasciolaris* (Pallas,1781)

67. *Drepanidotaenia*.Railliet,1892

(215)*D. nyrocae*.(Yamaguti,1935)
(216)*D. lanceolata*.(Bloch,1782)
(217)*D. przewalskii* (Skrjabin,1914) ・

68. *Hsuolepis.*Yang et al,1957
(218)*H. shengi.*Yang et al,1957 ・
(219)*H. shensiensis* (Liang et Cheng,1963)
(220)*H. crowfordi* (Baylis,1927)

69. *Echinocotyle*.Blanchard,1891
(221)*E. anatina* (Krabbe,1869)

(222)*E. echinocotyle* (Fuhrmann,1907)
(223)*E. nitida* (Krabbe,1869)

70. *Echinolepis* Spassky et Spasskaja,1954
(224)*E. carioca* (Magelhas,1898)
71. *Hymenosphenacanthus* López-Neyra,1958
(225)*H. exiguus* (Yoshida,1910)
(226)*H. fasciculata* (Ransom,1909)
(227)*H. giranensis* (Sugimoto,1934)
(228)*H. longicirosa* (Fuhrmann,1906)
(229)*H. oshincai* (Sugimoto,1934)
(230)*H. venusta* (Rosseter,1897)

72. *Anatinella* Spassky et spasskaja,1954
(231)*A. meggitti* (Tseng,1932)

(232)*A. spinulosa*

73. *Cloacotaenia* Wolffhügel,1938
(233)*C. megalops*(Creplin,1829)

74. *Dicranotaenia* Railliet,1892

(234) *D. coronula* (Dujardin,1845)
(235)*D. introversa* (Mayhew,1923)

(236)*D. pingi* (Tseng,1932)
(237)*D. mergi* (Yamaguti,1940)
(238)*D. querquedula* (Fuhrmann,1921)
(239) *D. simplex* (Fuhrmann,1926)
(240)*D. himantopodis* (Krabbe,1869)
(241)*D. aequabilis* (Rudolphi,1819)
(242)*Dicranotaenia* sp. (Li,1994)

75. *Abortilepis* Yamaguti,1959
(243)*A. abostiva* (Linstow,1904)

76. *Sobolevicanthus* Spassky et Spasskaja, 1954
(244)*S. fragilis* (Krabbe,1869)
(245)*S. gracilis* (Zeder,1903)
(246)*S. octacantha* (Krabbe,1869)
(247)*S. rugosas* (Clerc,1906)
(248)*S. krabbeella* (Krabbe,1869)

77. *Dubininolepis* Spassky et Spasskaja,1954
(249)*D. multistriata* (Rudolphi,1810)

78. *Nadejdolepis* Spassky et Spasskaja,1954
(250)*N. solowiowi* (Skrjabin,1914)
(251)*N. compressa* Linton,1892
(252)*N. longicirrosa* Fuhrmann,1906
(253)*N. nitidulans* (Krabbe,1882)

79. *Wardoides* Spassky et Spasskaja,1954
(254)*W. anasae* Yun,1973
(255)*W. nyrocae* Yamaguti,1935

80. *Tschertkovilepis* Spassky et Spasskaja,1954
(256)*T. setigera* (Froelich,1789)
(257)*Tschertkovilepis*.sp.

81. *Stylolepis* Yamaguti, 1959
(258)*S. longistylosa* (Tseng,1932)

82. *Microsomacanthus* López-Neyra,1942
(259)*M. collaris*(Batach,1786)
(260)*M. compressus*(Linton,1892)
(261)*M. microsoma*(Creplin,1829)
(262)*M. fausti*(Tseng,1932)
(263)*M. paramicrosoma*(Gasowska,1931)
(264)*M. tritesticulata* Fuhrmann,1907
(265)*M. mayhewi*(Tseng,1932)
(266)*M. teresoides*(Fuhrmann,1906)
(267) *M. clerci*(Tseng,1933)
(268)*M. styloides*(Fuhrmann,1906)
(269)*Microsomacanthus* sp.
(270)*M. arcuata*(Kowalewski,1904)
(271)*M. floreata*(Meggitt,1930)
(272)*M. paracompressa* Czaplinski,1956
(273)*M. carioca* Magalhaes,1898
(274)*M. parvula* (Kowalewski,1904)

83. *Rodentolepis* Spassky,1954
(275)*R. sinensis* (Oldhan,1929)
(276)*R. ximengsis* Yun et Tang,1999

84. *Hymenolepis* Weinland,1858
(277)*H. diminuta* (Rudolphi,1819)
(278)*H. nana* (Siebold,1852)
(279)*H. peipingensis* Hsü,1935
(280)*H. uralensis* Cleric,1902
(281)*H. parafola* Ling,1959
(282)*H. hipposidera* Ling,1962
(283)*Hymenolepis* sp.1 Tseng,1933
(284)*Hymenolepis* sp.2 Tseng,1933
(285)*Hymenolepis* sp.3 Tseng,1933
(286)*H. cantaniana* Polonio,1860
(287)*H. chibia* Li et. al.,1994
(288)*H. abundus* Li et. al.,1994
(289)*H. punctulata* Li et. al.,1994
(290)*H. fringillarum* Rudolphi,1809
(291)*H. recurvirostroides* Meggitt,1927
(292)*H. stylosa* Rudolphi,1809
(293)*H. amphitricha* Rudolphi,1819
(294)*H. clandestina* Krabbe,1869
(295)*H. brachycephala* Creplin,1829
(296)*H. variabile* Mayhew,1925
(297)*H. interrupta* Rudolphi,1809
(298)*H. fasciculata* Ranson,1909
(299)*H. parvula* Kowalewsky,1905
(300)*H. citelli* McLeod,1933

(301)*H. carioca* (Magalhaes,1898)
(302)*H. exigua* Yoshida,1910
(303)*H. rustica* (Meggitt,1926)

85. *Retinometra* Spassky,1955 •
(304)*R. chinensis* Yun,1982
(305)*R. giranensis* (Sugimoto,1934)
(306)*R. venusta* (Rosseter,1897)

86. *Mayhewia* Yamaguti,1959
(307)*M. acridotheris* Cheng et Lin,1995
(308)*M. serpentulus* (Schrank,1788)

87. *Vampirolepis* Spasskii,1954
(309)*V. taiwanensis* Sawada,1984
(310)*V. copihamata* Sawada,1984
(311)*V. curvihamata* Sawada,1985
(312)*V. versihamata* Sawada,1985
(313)*V. longicollaris* Sawada,1985
(314) *V. chiangmaiensis* Sawada,1985
(315)*V. acollaris* Sawada,1985

XIII. Progynotaeniidae Burt, 1936

88. *rogynotaenia* Fuhrmann,1909
(316)*P. odhnei* Nybelin,1914

89. *Proterogynotaenia* Fuhrmann,1911
(317)*P. variabilis* Belopolskaya,1863

C. Caryophyllidea van Beneden in Carus, 1863

XIV.Lytocestidae Wardle et McLeod,1952
90. *Khawia* Hsü,1935
(318)*K. sinensis* Hsü,1935
(319)*K. tenuicollis* Li,1964
(320)*K. cyprini* Li,1964
(321)*K. japonensis* Yamaguti,1934
(322)*K. rosittensis* (Szidat,1937)

91. *Caryophyllaeides* Nybelin,1922
(*Tsengia* Li,1964)
(323)*C. neimongkuensis* (Li,1964)
(324)*C. tangi* Cheng et Lin,2002

(325)*C. xiamenensis*(Liu et.al.,1995)

92. *Lytocestus* Cohn,1908
(326)*L. adhaerens* Cohn,1908

XV. Caryophyllaeidae Leuckart, 1878
93. *Caryophyllaeus* Müeller,1787
(327)*C. parvus* Zmeev,1936
(328)*C. brachycollis* Janiszewska,1953
(329)*C. laticeps*(Pallas,1781)
(330)*C. minutus* Chen,1964

94. *Paracaryophyllaeus* Kulakovskaya,1961
(331)*P. dubininae* Kulakovskaya,1962

95. *Breviscolex* Kulakovskaya,1962
(332) *B. orientalis* Kulakovskaya,1962

D. Pseudophyllidea Carus,1863

XVI. Amphicotylidae Ariola,1899

96. *Eubothrium* Nybelin,1922
(333)*Eubothrium* sp.

XVII. Triaenophoridae (Loennberg,1889)

97. *Triaenophorus* Rudolphi,1793
(334)*T. nodulosus* (Pallas,1781)
(335)*T. crassus* Forel,1868

98. *Anchistrocephalus* Monticelli,1890
(336) *Anchistrocephalus* sp. Cheng et Liu, 2008
XVIII. Dibothriocephalidae Lühe,1902

99. *Digramma* Cholodkovsky,1915
(337)*D. interrupta*(Rudolphi,1809)
(338)*D. nemachili* Dubinina,1957

100. *Ligula*. Bloch,1782
(339) *L. intestinalis*(Goeze,1782)

101. *Bothridium* Blainville,1824
(340)*B. pythonis* Blainville,1824

102. *Diphyllobothrium* Cobbold,1858
(341)*D. fuhrmanni* Hsü,1935

103. *Spirometra* Mueller,1937
(342) *S. mansoni*(Cobbold,1883)
(343)*S. decipiens*(Diesing,1850)
(344)*S. erinacei* (Rudolphi,1819)

104. *Duthiersia* Perrier,1873
(345) *D. fimbriata* (Diesing,1850)

105. *Dibothriocephalus* Lühe,1899・
(346)*D. latus* (Linnaeus,1758)

XIX.Ptychobothriidae Lühe, 1902

106. *Senga* Dollfus,1934
(347)*Senga* sp.
(348)*S. ophiocephalina* (Tseng,1933)

107. *Polyonchobothrium* Diesing,1854
(349)*P. magnum* (Zmeev,1936)
(350)*P. ophiocephalina* (Tseng,1933) Dubinina,1962

XX.Bothriocephalidae (Rudolphi,1808) Lühe,1899

108. *Bothriocephalus* (Rudolphi,1808)Lühe,1899
(351) *B. scorpii* (Müeller,1776)
(352) *B. brachysoma* Wang,1977
(353)*B. gowkongensis* Yeh,1955
(354)*B. japonicus* Yamaguti,1934
(355)*B. opsariichthydis* Yammaguti,1934
(356)*B. sinensis* Chen,1964
(357)*Bothriocephalus* sp.

109. *Taphrobothrium* Lühe,1899
(358)*T. japonensis* Lühe,1899

110. *Oncodiscus* Yamaguti,1934
(359)*O. sauridae* Yamaguti,1934

XXI. Parabothriocephalidae Yamaguti, 1959

101. *Parabothriocephaloides* Yamaguti,1934
(360)*Parabothriocephaloides* sp. Wang et. al.,2001

112. *Parabothriocephalus* Yamaguti,1934
(361)*P. gracilis* Yamaguti,1934

XXII.Echinophallidae Schumacher, 1914

113. *Echinophallus* Schmacher,1914
(362)*E. japonicus*(Yamaguti,1934)

E. Tetraphyllidea Carus,1863

XXIII. Phyllobothridae Braun, 1900

114. *Phyllobothrium* Beneden,1849
(363)*P. lactuca* Beneden,1850
(364)*P. laciniatum*(Linton,1889)
(365)*P. loculatum* Yamaguti,1952
(366)*P. tumidum* Linton,1922
(367)*P. ptychocephalum* Wang,1984

115. *Dinobothrium* Beneden,1889
(368)*D. septaria* Beneden,1889

116. *Echeneibothrium* Benoden,1850
(369)*E. hui* Tseng,1933
(370)*E. variabile* Beneden,1850

117. *Anthobothrium* Beneden,1850
(371)*A. bifidum* Yamaguti,1952
(372)*A. parvum* Stossich,1895
(373)*A. pteroplateae* Yamaguti,1952

118. *Rhodobothrium* Linyon,1889
(374)*R. palvinatum* Linton,1889

119. *Rhinebothrium* Euzet,1953
(375)*R. xiamenensis* Wang et al.,2001

120. *Pithophorus* Southwell,1925
(376)*P. musculosus* Subhaparadha,1957

XXIV.Onchobothridae Braun, 1900

121. *Acanthobothrium* Beneden,1850
(377)*A. coronatum* (Rudolphi,1819)Beneden,1849
(378)*A. benedeni* Loennberg,1889
(379)*A. grandiceps* Yamaguti,1952

(380)*A. ijimai* Yoshida,1917
(381)*A. microcantha* Yamaguti,1952
(382)*A. tsingtaoensis* Tseng,1933
(383)*A. pingtanensis* Wang,1984
(384)*A. xiamenensis* Yang,1994
(385)*A. zugeimensis* Yang,1994
(386)*A. polytesticularis* Wang et al.,2001

F. Trypanorhyncha Diesing,1863

XXV. Otobothriidae Dollfus, 1942

122. *Otobothrium* Linton,1890
(387)*O. linstowi* Southwell,1912
(388)*Otobothrium* sp.

123. *Tetrarhynchus* Shipley et Hornell,1906
(389)*T. equidentata* Shipley et Hornell,1906

XXVI. Hornelliellidae Yamaguti,1954

124. *Hornelliella* Yamaguti,1954
(390)*H. musteli* Wang et al.,2001

XXVII. Gymnorhynchidae Dollfus,1935

125. *Gymnorhychus* Rudolphi,1819
(391)*Gymnorhychus* sp. Wang et al.,2001

XXVIII. Eutetrarhynchidae (Guiart,1927)

126. *Eutetrarhynchus* Pintner,1913
(392)*Eutetrarhynchus* sp. Wang et al.,2001

XXIX. Tentaculariidae Poch, 1926

127. *Nybelinia* Poch,1926
(393)*N. rhyncobatus* Yang et al,1995

XXX. Grillotiidae Dollfus, 1969

128. *Grillotia* Guiart,1927
(394)*G. dollfusi* Carvajal,1976

G. Lecanicephalidea Baylis,1920

XXXI. Lecanicephalidae Braun,1900

129. *Lecanicephalum* Linton,1890
(395)*L. xiamenensis* Liu et.al.,1995
(396)*L. peltatum* Linton,1890

130. *Cephalobothrium* Shipley et Hornell,1906
(397)*C. longisegmentum* Wang,1984

XXX. Tetragonocephalidae Yamaguti,1952

131. *Tetragonocephalum* Shipley et Hornell,1905
(398)*T. akajeienesis* Yang et. al.,1995

H. Spathebothriidea Wardle et McLeod, 1952

XXXII. Cyathocephalidae Nybelin, 1922

132. *Cyathocephalus* Kessler,1868
(399)*C.truncatus* (Pallas,1781)

133. *Schyzocotyle* Achmerov,1960
(400) *S. fluviatilies* Achmerov,1960

I. Nippotaeniidea Yamaguti,1939

XXXIII. Nippotaeniidae Yamaguti, 1939

134. *Amurotaenia* Achmerov,1941
(401)*N. percotti* Achmerov,1941

135. *Nippotaenia* Yamaguti,1939
(402) *N. mogurndae* Yamaguti et Miyata,1940

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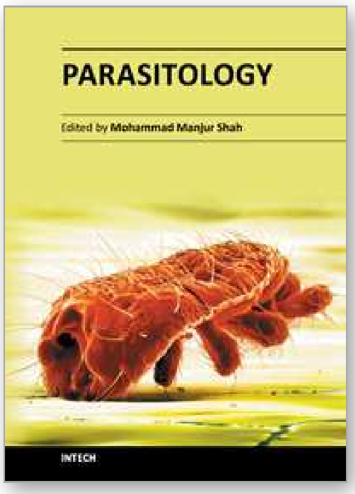

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Parasitology is an established discipline that covers a wide area of subjects, ranging from the basics (study of life cycle, ecology, epidemiology, taxonomy, biodiversity, etc) to the advanced and applied aspects (human and animal related, although control aspect remains the most important task). There is a great scarcity in the amount of available literature that is freely accessible to anyone interested in the subject. This book was conceptualized with this in mind. The entire book is based on the findings of various studies performed by different authors, comprising reviews and original scientific papers. I hope this book will be helpful to diverse audiences like biologists, zoologists, nematologists, parasitologists, microbiologists, medical doctors, pathologists as well as the molecular biologists, by providing them with a better understanding of the subject.