



Title	STUDIES ON ECHINOCOCCOSIS IX. : DIFFERENCES IN DEVELOPMENT OF THE TAPEWORM STAGE BETWEEN ECHINOCOCCUS GRANULOSUS (BATSCH, 1786) AND E. MULTILOCULARIS LEUCKART, 1863
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STUDIES ON ECHINOCOCCOSIS IX.
DIFFERENCES IN DEVELOPMENT OF THE TAPEWORM STAGE
BETWEEN *ECHINOCOCCUS GRANULOSUS* (BATSCH, 1786)
AND *E. MULTIOCCULARIS* LEUCKART, 1863

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The authors, in their third and seventh reports, described respectively the morphological changes in the development of *E. granulosus* and *E. multilocularis* during the period from the 15th to the 375th day after infection within dogs. Here they wish to point out the differences between the two species on the basis of the herein described results of experiments.

RESULTS

Difference in the Body

Strobila Every young strobilae of both species consist each of 3 segments including a scolex and 2 proglottids. However, in a few specimens of *E. granulosus* which were very young the borderline between the 1st and 2nd proglottid was not clear. With their development the number of proglottids increase, and in the gravid stage the most of *E. granulosus* consist of a scolex and 3 proglottids while the most of *E. multilocularis* have a scolex and 4 proglottids.

TABLE 1. *Growth of Strobila*

DAY AFTER INFECTION	<i>E. GRANULOSUS</i>		<i>E. MULTIOCCULARIS</i>	
	Length (mm)	Proportion of Growth	Length (mm)	Proportion of Growth
15th			0.50~1.10 (0.95)	1
16th	0.72~1.12 (0.98)	1		
35th	2.00~3.35 (2.76)	2.8		
117th			1.80~2.80 (2.20)	2.3
135th	3.20~4.00 (3.69)	3.8		
290th			2.20~3.12 (2.53)	2.7
375th	6.40~9.20 (7.76)	7.9		

Remarks: In parenthesis average.

The length of strobilae of both species, in the early stage of development, is almost the same. The subsequent growth of *E. multilocularis* is slower than that of *E. granulosus*. The size of *E. multilocularis* on the 290th day after infection approaches barely the size of *E. granulosus* on the 35th day, and it is only almost one-third of size of *E. granulosus* on the 375th day after infection (Table 1).

Rostellum The rostellum of *E. multilocularis* is smaller than that of *E. granulosus*, while the proportion of its growth is not so different from that of *E. granulosus*.

TABLE 2. Growth of Rostellum

DAY AFTER INFECTION	<i>E. GRANULOSUS</i>		<i>E. MULTILOCULARIS</i>	
	Diameter (μ)	Proportion of Growth	Diameter (μ)	Proportion of Growth
15th			59.2~74.0 (66.8)	1
16th	68~88 (76.8)	1		
35th	96~116 (108.4)	1.4		
117th			81.4~103.6 (94.8)	1.4
135th	100~120 (112.0)	1.5		
290th			96.2~111.0 (105.1)	1.6
375th	152~180 (168.4)	2		

Difference in the Holdfast

Rostellar Hook The rostellar hooks, in number, are 32 to 40 in *E. granulosus* while 26 to 36 in *E. multilocularis*. There is little difference between the two species in the shape of hook, but it is, if anything, felt to be a little stronger in *E. granulosus* than in *E. multilocularis*. In young stage, such as the 15th or 16th day after infection, the size of the rostellar hook of the latter species is rather larger than that of the former one, but the subsequent growth is faster in the former species than in the latter. Then in the gravid stage, the rostellar hook of the former species becomes larger than that of the latter one. This difference is conspicuous in the growth of the larger hook.

TABLE 3. Growth of Large Hook

DAY AFTER INFECTION	<i>E. GRANULOSUS</i>		<i>E. MULTILOCULARIS</i>	
	Size (μ)	Proportion of Growth	Size (μ)	Proportion of Growth
15th			25.0~28.0 (26.0)	1
16th	21.3~27.5 (24.9)	1		
35th	32.5~33.8 (33.0)	1.3		
117th			28.8~31.3 (29.3)	1.13
135th	35.0~40.0 (36.9)	1.5		
290th			28.8~32.5 (31.1)	1.2
375th	37.5~42.5 (39.9)	1.6		

TABLE 4. *Growth of Small Hook*

DAY AFTER INFECTION	<i>E. GRANULOSUS</i>		<i>E. MULTILOCULARIS</i>	
	Size (μ)	Proportion of Growth	Size (μ)	Proportion of Growth
15th			22.0~25.0 (23.0)	1
16th	17.5~22.5 (20.8)	1		
35th	20.0~23.8 (22.4)	1.1		
117th			23.8~27.0 (24.7)	1.1
135th	23.8~27.5 (25.7)	1.2		
290th			24.5~28.0 (26.3)	1.14
375th	25.0~32.5 (27.9)	1.3		

For reference, the sizes of hooks of scolices within various cysts which were collected by the authors are shown in Table 5. As a side remark please note that the hook of scolex from man was larger and that one from swine was smaller than those described by VOGEL (1957).

TABLE 5. *Size of Rostellar Hook of Scolex within the Cyst*

HOST	LARGE HOOK (μ)	SMALL HOOK (μ)
* Man	25.0~27.0 (25.5)	22.0~23.0 (22.7)
* Vole	25.0~27.0 (25.5)	22.0~23.0 (22.9)
Swine	25.0~26.0 (25.7)	18.8~21.0 (20.0)
Sheep	21.0~25.0 (24.0)	15.0~21.0 (20.0)
Sheep	23.5~25.0 (24.7)	20.0~21.3 (20.8)

Remarks: * *E. multilocularis*; Others *E. granulosus*.

Sucker The proportion of growth of the sucker is larger in *E. multilocularis* than

TABLE 6. *Growth of Sucker*

DAY AFTER INFECTION	<i>E. GRANULOSUS</i>		<i>E. MULTILOCULARIS</i>	
	Diameter (μ)	Proportion of Growth	Diameter (μ)	Proportion of Growth
15th			44.4~ 59.2 (50.4)	1
16th	88~100 (92.0)	1		
35th	96~104 (101.2)	1.1		
117th			74.0~ 88.8 (78.9)	1.6
135th	112~124 (118.8)	1.3		
290th			81.4~100.7 (87.3)	1.7
375th	128~160 (140.6)	1.5		

in *E. granulosus*. However, in the gravid stage the sucker of the former species is far smaller than that of the latter, because in the young stage it is only about one half the size of the sucker of the latter one.

Difference in the Genital Organ

The genital organ develops faster in *E. multilocularis* than in *E. granulosus*. The development of the sexual organ of *E. granulosus* on the 16th or 17th day after infection is not distinct but traceable. However, in the 2nd and the last proglottids of *E. multilocularis* even on the 15th day after infection it is pretty well developed and in some specimen it is very distinct in the last proglottid.

There is a differences between the two species in the position of the genital pore. The genital pore is situated behind the center of the margin of proglottid in *E. granulosus*, while in front of the center or the anterior third of the margin of proglottid in *E. multilocularis*.

Some specimens of *E. multilocularis* consisting of 5 segments, in the 3rd proglottid have a bladder-like uterus just like that of the 4th proglottid or last one, excepting for the incompleated eggs within it. The gravid uterus of *E. granulosus* shows sacciform having lateral sacculations or lateral branches which gradually increase as the tapeworm grows older, but in *E. multilocularis* it shows sacciform almost without lateral sacculation.

The first discovery of eggs by fecal examination was on the 48th or 61st day in *E. granulosus* while on the 30th or 35th day after infection in *E. multilocularis*. Size of the embryophore is from 29.6 to 44.0 μ by 27 to 42.5 μ in *E. granulosus* while from 29.5 to 40.5 μ by 27.5 to 39.5 μ in *E. multilocularis* which were stained with DELAFIELD'S hematoxylin after fixing with 70% alcohol or reserved in 10% formalin.

The testes are about as many anterior to the level of the genital pore as posterior to it in *E. granulosus*, while the most of them are located behind the level of the genital pore in *E. multilocularis*. The number of testes ranges from 45 to 65 in *E. granulosus* while from 15 to 30 in *E. multilocularis*.

CONCLUSIONS

There are found, morphologically and developmentally, distinct differences between *E. granulosus* and *E. multilocularis* in the strobila, rostellum, rostellar hook, sucker and genital organ. This agrees quite well with VOGEL's observations.

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CORRIGENDUM

Page 91, line 3 from bottom of page: for 1950 read 1954