Effect of dietary sterols and sterol esters on the maintenance of feeding of first stage larvae of the southwestern corn borer

Choice Available	Larval Establishment (%)	Choice Available	Larval Establishment (%)
Control (sterol-free)	55	Control	69
Cholesterol	45	Cholesterol oleate	31 [a]
Control	50	Control	38
7-Dehydrocholerol	50	Stigmasterol	62 [b]
Control	55	Control	40
Ergosterol	45	β-Sitosterol	60 [b]
Control	65	Control	53
Cholesterol acetate	35[a]	β-Sitosterol acetate	57
Control	65		
Cholesterol myristate	35[a]		

[a] Difference significant at the 0.01 probability level. [b] Difference significant at the 0.05 probability level.

The two plant sterols proved to be feeding stimulants since significantly more larvae established on diets containing stigmasterol or β-sitosterol than on the sterol-free controls. These data indicate that these plant sterols permitted higher larval growth rates than cholesterol in earlier nutritional experiments because they stimulated larval feeding[5]. Although *D. grandiosella* must have the capacity to metabolize both of these sterols to cholesterol[2], β-sitosterol may be converted at a higher rate than stigmasterol since larvae grew better on diets containing the former than the latter. Beta-sitosterol and stigmasterol no doubt stimulate the southwestern corn borer to feed on its host plants and may be necessary feeding stimulants for many plant feeding insects[11]. These sterols, however, probably do not function in host plant selection because they are widely distributed among green plants[12,13].

Zusammenfassung. Eine Beziehung zwischen chemischer Struktur und biologischer Aktivität wurde im Einfluss diätetischer Sterole auf das Fütterungsverhalten frisch geschlüpfter Larven von *Diatraea grandiosella* gefunden. Die experimentellen Resultate zeigen, dass die C_{29}-Pflanzensterole, β-Sitosterol und Stigmasterol, die Futteraufnahme anregen, Cholesterol, 7-Dehydrocholesterol, Ergosterol und β-Sitosterolazetat sich in dieser Hinsicht neutral verhalten und Cholesterol-Ester die Futteraufnahme hemmen.

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Size of *Trichinella spiralis* (Nematoda) Muscle Cysts in the Rat, Mouse and Guinea-Pig

The life cycle of *Trichinella spiralis* and its many parameters in laboratory animals has been known for many years and comprehensively reviewed[1,2]. There, however, have been only a few reports[1,3–10] on the size of the cysts in skeletal muscle; indicating an incompleteness of life cycle information. Nevertheless, this cyst size, along with the size of other stages in the life cycle, are often and importantly used as a criterion in the efficacy of *T. spiralis* anthelminthics[11]. The aim, therefore, of this paper is to investigate, describe, and establish definite parameters concerning the in vivo size of the cysts in rat, mouse, and guinea-pig skeletal muscle.

Materials and methods. 10 Sprague-Drawley male albino rats, 10 CFW strain male mice, and 10 random-bred male guinea-pigs were used. They were maintained individually in polycarbonate cages. Purina Laboratory Chow and fresh water were provided *ad libitum*. At the age of 42 days, all animals were inoculated with 1000 ± 50 infective larvae by stomach tube. At the end of 60 days postinoculation, animals were killed with ether fumes and their diaphragms excised. The cysts were teased out of the muscle fibers onto microscope slides. Measurements, in mm, were made at $\times 450$ using a micromanipulator and ocular micrometer. 500 measurements were made/animal host (50/individual). A 2-factor analysis of vari-

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Table I. Size of *Trichinella spiralis* muscle cysts as reported by various authors

	Authors and hosts								
	Gould[1] (rat)	Böhm[3] (pig)	Böhm[4] (mouse)	Dammann[5] (pig)	Dengler[6] (pig)	Johne[7] (pig)	Opalka[8] (bear)	Stäubli[9] (man)	Arakawa[10] (mouse)
Length (mm) (mean range)	1.000	–[a]	0.23	0.495	0.35	0.40	–	–	–
	0.9–1.28	0.26–0.66	–	–	–	–	0.216–0.576	0.4–0.6	–
Width (mm) (mean range)	0.035	–	0.13	0.415	0.25	0.26	–	0.2	–
	0.035–0.040	0.21–0.31	–	–	–	–	0.086–0.316	–	0.105–0.037

[a] No data given.

Table II. Size of *Trichinella spiralis* muscle cysts in the rat, mouse, and guinea pig

Host	Range	Mean±S.E.	*N*	*P* value[a]
Rat				
Length (1)	0.20–1.30	0.56±0.60	500	>0.05
Width (2)	0.02–0.08	0.06±0.04	500	>0.05
Mouse				
Length (3)	0.18–0.95	0.47±0.51	500	>0.05
Width (4)	0.02–0.06	0.04±0.04	500	>0.05
Guinea-pig				
Length (5)	0.15–0.80	0.39±0.37	500	>0.05
Width (6)	0.01–0.05	0.03±0.03	500	>0.05
Analysis of variance of the means between different hosts				
Comparison of lengths (*p*)				Comparison of widths (*p*)
1 vs. 3<0.05				2 vs. 4<0.05
1 vs. 5<0.01				2 vs. 6<0.01
3 vs. 5<0.05				4 vs. 6<0.05

[a] Analysis of variance on interactions among individual animals within given host species.

ance[12] via Snedecor's *F*-test (to test the interactions among individual host animals and the effects between animal hosts) was used to determine any significance of the observed differences in cyst size. A probability value of 0.05 or less was considered significant.

Results and discussion. From a comparative point of view, it is apparent that size differences of *T. spiralis* cysts have been reported from different animals in the literature (Table I). Since the authors[1,3–10] have not stated their sample size, standard error or standard deviation, statistical comparisons cannot be made with this present study.

From data obtained in the present study (Table II), it is evident that a uniform cyst size is present for *T. spiralis* within a given host (viz., rats, mice, and guinea-pigs) since interactions among individual animals within given host species were not significant ($P > 0.05$). However, there were significant ($P < 0.05$) differences between the mean cyst size in rats vs. mice vs. guinea-pigs. The mean size of the cyst, therefore, is dependent upon the species of host animal and varies from one species of host to another. This suggests that cyst size is more dependent upon the host's physiology than the parasite's. Based on this cyst size, the rat may be considered as a better host than the mouse and the mouse a better host than the guinea-pig since, respectively, the largest cysts are found in the rat, then the mouse, and the smallest ones in the guinea-pig.

As a result, in anthelminthic studies where cyst size is a factor, identical control animals of the same species and strain must be used concurrently under identical conditions. Workers cannot depend on the literature for comparisons of cyst size.

Zusammenfassung. Bei Ratte, Maus und Meerschweinchen ist die Grösse der Muskelzysten von *Trichinella spiralis* 60 Tage nach standardisierter experimenteller Infektion bestimmt worden. Die Grösse der Muskelzysten variierte bei jeder der 3 untersuchten Tierarten erheblich. Bei der Ratte wurden durchschnittlich grössere Muskelzysten von *T. spiralis* gefunden als bei der Maus, bei der die Muskelzysten wiederum durchschschnittlich grösser waren als beim Meerschweinchen. Die Zystengrösse von *T. spiralis* scheint demnach vom Stoffwechsel der jeweils als Wirt dienenden Tierart abhängig zu sein.

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