excretion measurements (example in Figure). For the estimation of the values q_r or q_g, the differential coefficient dM/dt was replaced by the difference ratio $\Delta M/\Delta t$ in the left hand equation [2]. Then the rate constants q_r or q_g could be calculated from the means of dry matter uptake per unit time $\Delta M/\Delta t$ as obtained during the experiment, divided by the amounts of ruminal or gastrointestinal dry matter M_r or M_g as determined at the end of the marker excretion after slaughtering the bulls without prior interruption of the feeding. The mean values of k_f and q_r were almost the same (Means $\pm$ SD: 0.054 $\pm$ 0.010 h^{-1} and 0.051 $\pm$ 0.007 h^{-1}). This was also the case for the means of the ratio $k_f/(1 + \tau k_f)$, where τ is the delay time between administration and first appearance of the marker in feces, and of the value q_g (Means $\pm$ SD: 0.039 $\pm$ 0.005 h^{-1} and 0.038 $\pm$ 0.006 h^{-1}).

As a consequence of these findings, the amount of dry matter in the rumen M_r or the total GI tract M_g could be estimated from the amount of dry matter uptake per unit time $\Delta M/\Delta t$, and k_f and τ of ^{152}Eu measurements with

$$[3] \quad M_r = \frac{1}{k_f} \cdot \frac{\Delta M}{\Delta t} \quad \text{or} \quad M_g = \frac{1 + \tau k_f}{k_f} \cdot \frac{\Delta M}{\Delta t}.$$

Values obtained by this procedure in vivo demonstrated good agreement with gravimetric measurements after slaughter (Table). Furthermore, the amount of dry matter in the intestine corresponded fairly well to the values $1/C_o$ from radiometric measurements on healthy bulls. This indicated that ^{152}Eu dilution analysis might be of use for the estimation of the amount of solid contents in the intestine (Table).

The application of the method does not require complete fecal sampling. Healthy animals must be used although transient reduction of feed intake or short lasting diarrhea did not seem to affect the turnover rate constants k_f whereas erroneous results might be produced in case of C_o or $1/C_o$ (Table, first animal). Altered marker administration (time, application route) had no observable effect on the value of k_f, and changing rations did not influence single exponential pattern of ^{152}Eu fecal excretion.

However, without further measurements or assumptions, wet content of the rumen or GI tract cannot be obtained. Of help might be the mean figure of GI tract water contents of 85.7 $\pm$ 0.7% of wet material or, as tested in this study, the relation

$$[4] \quad M_r/M_g = W_r/W_g,$$

when the amount of ruminal water W_r can be determined by dilution techniques (e.g. ^{14}C-PEG), and known values M_r and M_g from ^{152}Eu fecal excretion measurements allow the estimation of GI tract water contents W_g.

Zusammenfassung. Durch Messung der pro Zeiteinheit aufgenommenen Trockensubstanzmenge, der Überführungskonstante des inerten Markers ^{152}Eu in den Kot und dessen Verzögerungszeit bis zur erstmaligen Exkretion liess sich bei zwölf 78 Wochen alten Bullen die Trockensubstanzmenge im Pansen sowie im Gastrointestinaltrakt ermitteln.

A. PFAU and F. A. ABADIR

Institut für Tierzucht und Tierverhalten FAL[6], *D–3051 Mariensee (Federal Republic of Germany, BRD),*
17 July 1974.

[6] Former: Max-Planck-Institut für Tierzucht und Tierernährung.

Morphological Changes in *Thermobia domestica* under the Influence of *Acorus calamus* Oil Vapours

The essential oil of *Acorus calamus* L. has been reported to show insecticidal activity[1–4] and the vapours to control the hatching and moulting of the first instar nymphs in *Dysdercus koenigii* F.[5]. It was observed that the oil also prevented the oviposition in stored grain pests like *Callasobruchus chinensis* L., *Corcyra cephalonica* Stainton and *Trogoderma granarium* Everts[5].

The present paper reports the effect of *Acorus calamus* oil vapours on the development of the ovaries of the firebrat *Thermobia domestica* (Pack.).

Laboratory reared[6] females were used as in earlier studies[7], freshly ecdysed and immediatedly before oviposition. 5 females and 5 males were kept with small Petri dish (6 cm diameter), loosely lidded and containing filter paper impregnated with oil[5]. Those were placed in another Petri dish (14 cm diameter) tightly sealed and were kept in incubator. Controls were kept separately using acetone impregnated filter paper. The first observations were made after 1 week and then the Petri dishes remained unsealed. Subsequent observations were made twice a week. Insects were dissected in insect Ringer solution, the ovaries were fixed in Carnoy's fluid, stained in Mayers' haematoxyline and borax carmine and mounted as whole mounts.

Different abnormalities were observed in more than 200 affected females, after having used doses 3, 5, 7, 9 and 11 and 13 ml of 100 ppm oil in acetone[5]. Only the results of 3, 9, and 13 ml doses are considered here, as shown in the Table.

The action of *Acorus calamus* oil vapours is the same as with classical chemosterilants[8] and JH[9] or its analogues[7], when the external appearance of affected firebrat ovarioles is considered. Differentiation of oögonia and prefollicular cells continues in the adult[10] to be fully impeded by the action of various substances. Classical chemosterilants inhibit the division of the prefollicular cells, thus causing a

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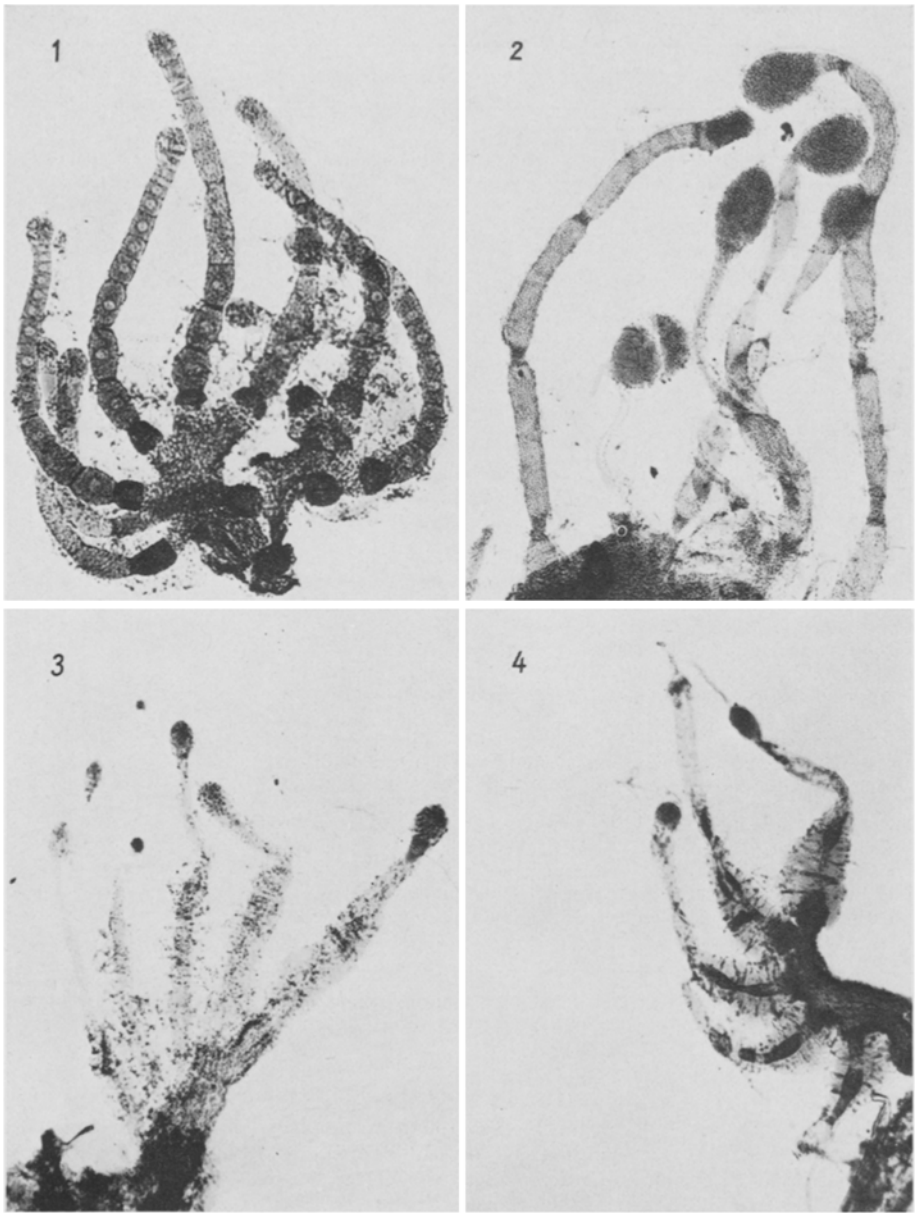

Figs. 1–4. The general view of ovarioles of females *Thermobia domestica* exposed to the different concentrations of aceton solutions of *Acorus calamus* oil. Mayer's haematoxylin (Figures 1, 3 and 4), borax carmine (Figure 2). 1. 3 ml of 100 ppm, after 16 days. Note the cap-like structures at the basic part of vitellaria. 2. 9 ml of 100 ppm, after 6 days, note the hypertrophied germaria and the absence of previtellaria. 3. The same, after 22 days, note the unstainable outer epithelial sheath with few stained pycnotic follicular nuclei. 4. 13 ml of 100 ppm, after 27 days. Note the same events as at the Figure 3. For explanation see the Table.

reduction in the number of young oöcytes and the follicular epithelium formation; at the same time the yolk synthesis ceases[8]. *Acorus* oil shows a selective action upon the germ cells. Similarly to juvenile hormone analogues[11], the *Acorus* oil inhibits or alters the morphogenesis of the follicular cells; where the follicular epithelium is not formed, the cells do not mediate the yolk and chorion formation; they absorb the oöcyte, instead of forming the corpus luteum, though the spermatheca is full of sperm[12]. Moreover, one striking difference was observed for the first time with our treatment: the destruction of the tunica propria and the absence of the vitelline membrane[13]. These findings have not been observed before with any other agent[14].

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Condition of the firebrat ovarioles affected by vapours of *Acorus calamus*

Dose	Ovarioles[a]	Condition of the ovarioles after days of exposition to the vapours		Remarks
		16 days[c]	25 days[d]	
0 (pure acetone)	Germarium	Finger like. 20 oögonia, numerous prefollicular cells, with 8 to 10 young oöcytes.	The same picture, new oöcytes ripening	Females moulted twice. Egg laying 3 times, about 30 eggs from each female
	Previtellarium	More than 10 oöcytes. Start of follicular epithelium formation in proximal part.		
	Vitellarium	In the state of formation.		
		16 days[c] (Figure 1)	25 days[d]	
3 ml/1000 ppm	Germarium	Rounded shape, undifferentiated oögonia no young oöcytes	In 2 ov. completely destroyed, in others oögonia and prefol. cells with pycnotic nuclei.	Egg laying once only, 18 eggs were layed in average from each female, of which about 10% could not hatch
	Previtellarium	Present only in 5 of 10 ovarioles	Malformations found in 4 ovarioles. Granulation in all oöcytes, some are completely destroyed.	
	Vitellarium	Not developed, cap-like at the proximal part of the ovariole	Not developed.	
		6 days[b] (Figure 2)	22 days[d] (Figure 3)	
9 ml/1000 ppm	Germarium	Oval or rounded in shape, highly hypertrophied, filled with oögonia; part of pref. nuclei pycnotized; no young oöcytes	Not developed, empty tubes with chromatin granules	No eggs. Distal part of 1 ovariole after detaching formed rounded body with 8 previtellar oöcytes and rests of germarium
	Previtellarium	Thread-like, numerous prefollicular cells no more than 2 oöcytes in 1 ovariole.	Very thin with 1 or 2 oöcyte nuclei in the state of resorption.	
	Vitellarium	Reduced, being formed in 4 of 10 ovarioles with remnants of resorbed chorionized eggs, no vitellogenesis.	Even the tunica propria after interrupted, disconnecting thus 2 ends of 10 ovarioles.	
		27 days[d] (Figure 4)		
13 ml/1000 ppm	Germarium	Reduced entirely in 3 ovarioles where it is empty, in others pycnotic nuclei and chromatine granules.		
	Previtellarium	Without follicular cells. 1 oöcyte present in only 1 of the ovarioles.		
	Vitellarium	Does not exist the whole length of ovarioles; not more than twice the length of spermetheca.		

[a] Ovary of panoistic type, with 10 ovarioles, 5 in 1 bunch. [b] 1st, [c] 2nd, [d] 3rd inter moulting period. ppm = Part per million solution in acetone.

Zusammenfassung. Eine Behandlung der Weibchen von *Thermobia domestica* mit den Dämpfen eines Extrakts der Wasserpflanze *Acorus calamus* L. bewirkte dauernde Sterilität, da die Oogonien und präfollikulären Zellen in den Germarien und die follikulären Zellen und Oozyten in den Pävitellarien zerstört wurden. In manchen Fällen wurde die Tunica propria zerstört, was zur Unterbrechung der Ovariolen führte.

B. P. SAXENA[15] and EUGENIA B. ROHDENDORF

Entomological Institute of Czechoslovak Academy of Sciences, Department of Insect Physiology, Na Folimance 5, 12000–Praha 2 (ČSSR), 26 April 1974.

[15] Permanent adress: Regional Research Laboratory (Council of Scientific & Industrial Research), Jammu - Tawi 180001, India.

The Effects of Methyl Mercury on Morphological and Histochemical Properties of Human and Rat Spinal Cord and Cerebellum in Tissue Culture

It has been shown by several laboratories that alkyl mercury compounds, in particular methyl mercury, are by several orders of magnitude more toxic than other mercury compounds, and that methyl mercury primarily affects the central nervous system (CNS)[1–3]. Furthermore, observations of mercury poisoning in human subjects have revealed that the fetal CNS is more sensitive to methyl mercury than the adult brain[4]. The neurotoxic effects of this compound have been investigated extensively in clinical cases[5–7] and in experimental studies on animal CNS in vivo and in vitro[3,8–12]. It was observed that methyl mercury produces extensive damage to neurones, neuroglia and nerve fibres. Granule cells of the cerebellum and dorsal root ganglion cells appear to be more sensitive to the toxic effect than neurones of other regions of the CNS[7,8,9,13]. Since the method of tissue culture is a useful tool to study the effects of toxins on the mammalian CNS and especially on the human CNS, we have