

The discovery of rich benthonic microfauna from the Spiti Shales will throw new light on the distribution of microfaunal assemblage within the Tethyan Geosyncline and will help in inter-regional correlation.

The detail work is in progress and the systematics will be published shortly.

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**SOME HISTOCHEMICAL STUDIES ON
CALICOPHORON CALICOPHORUM AND
PARAMPHISTOMUM EPICLITUM
(PARAMPHISTOMATIDAE :
DIGENEA: TREMATODA)**

PARAMPHISTOMES form a major group of helminths which parasitize many ruminants and other livestock and the immature forms of which are the causative agents of the serious disease, paramphistomiasis. With a view to having a better understanding of the host-parasite relationships, some physiological studies applying histochemical techniques were made on *Paramphistomum epiclitum*¹ Fiscoeder, 1904 and *Cotylophoron cotylophorum*² (Fiscoeder, 1901) Stiles and Goldberger, 1910. The present work is a comparative study on *Calicophoron calicophorum* (Fiscoeder, 1901) Näsmark, 1937 and *P. epiclitum*, both of which are the common parasites in the rumen of sheep and goats in Simla region.

The adult worms of *C. calicophorum* and *P. epiclitum* were collected from the rumen of sheep and goats slaughtered at the local abattoir and were fixed in Carnoy, Rossman, Formol calcium and Bouin³ Paraffin sections, cut at a thickness of 5-7 μ were subjected to histochemical tests as summarised in Table I.

The distribution of carbohydrates, proteins and lipids was found to be almost the same in both the species studied (Table I). In view of the fact that both occupy the same habitat in the same host, this similarity indicates the relationship between the habitat and the type of the metabolism occurring in the parasite.

The tegument, both in *C. calicophorum* and *P. epiclitum*, was found positive for carbohydrates of 1:2 glycol group, glycogen, proteins and lipids. The carbohydrates of 1:2 glycol group have also been reported in the tegument of *Fasciola hepatica*⁴ and in *P. epiclitum*¹. Being in conformity with these, the present observations are contrary to some earlier reports⁵⁻⁷. The tegument is suggested to be the region of maximum carbohydrate uptake from the host³. Proteins have also been revealed in the outermost covering of other digenetic trematodes⁸. Besides having been demonstrated in the tegument of many digenea⁶, the lipids have also been detected in the tegument in *Cotylophoron cotylophorum* which also parasitizes the same host and habitat as the worms under present studies. It seems likely that the transport of lipophilic substances takes place at this site².

Presence of glycogen, proteins and sudanophilic substances in the subtegument has also been reported earlier⁹. Singh and Gupta¹ found no proteins and lipids in this layer of *P. epiclitum* and glycogen was found to be missing by Axmann⁵. In view of the variations with regard to the occurrence of glycogen in this layer⁶, the subtegument may be regarded as a temporary site for glycogen storage.

The parenchymal cells have also been found to be containing abundant glucogen^{1,5,7,10} along with the carbohydrates of 1:2 glycol group and also a little amount of lipid and protein material. The parenchymal cells in the suckers, too, appear to be the important storage places^{10,11}.

The gut wall contains some carbohydrates⁷ and lipids¹². Lipids occurring in the lumen of gut may either be from the host diet or may represent the excreted metabolic products².

In both the species studied, the gametogonia and gametocytes were observed to be lacking in glycogen which was present in the mature sperm and uterine eggs only^{5,7}. In the Mehlis' gland and vitellaria carbohydrates, proteins and some sudanophilic substances could be localized. Earlier, lipoproteins and phospholipids have been reported in the secretion of Mehlis' gland and proteins, in the vitellaria of *F. hepatica*¹³ and *P. epiclitum*¹.

In accordance with many earlier observations^{1,14-16} lipids were localized in abundance in the excretory system, indicating that such metabolic by-products are expelled from the body.

The presence of some sudanophilic material in the lymph vessels of these flukes may possibly be related with some excretory function performed by this system, as is suggested² in view of its presumed origin from the primary excretory tubules.

TABLE I
Summary of histoc' emical tests applied in Paramphistomum epiclitum (A) and Calicophoron calicophorum (B)

Metabolite to be demonstrated	Technique	Fixation	Tegument		S. tegument		Parenchyma		Suckers		Oesophagus and Intestine	
			A	B	A	B	A	B	A	B	A	B
1. Carbohydrates	PAS (for 1:2 glycol group)	Carnoy, Rossman	+	++	0	0	+++	+++	+++	+++	+	+
	Best's carmine (for glycogen)		+	+	+	+	+++	+++	+++	+++	+	+
	Mercury-Bromophenol blue	Bouin, Carnoy	++	++	++	++	++	++	+	+	+	+
3. Lipids	Sudan Black-B	Formol calcium (with post-chromation)	+	+	+	0	0	0	+	+	++	+
Metabolite to be demonstrated	Technique	Fixation	Testis/Sperm		Ovary/Ova		Vitellaria		Excretory vesicle		Lymph vessels	
			A	B	A	B	A	B	A	B	A	B
1. Carbohydrates	PAS (for 1:2 glycol group)	Carnoy, Rossman	+	+	+	+	++	++	+	+	+	+
	Best's carmine (for glycogen)		+	+	+	+	++	++	+	+	++	+
	Mercury-Bromophenol blue	Bouin, Carnoy	++	++	++	++	++	+	+	+	+	+
3. Lipids	Sudan Black-B	Formol calcium (with post-chromation)	+	+	+	+	+	+	+++	+++	+	+

+ = slight reaction; ++ = moderate reaction; +++ = intense reaction; 0 = negative reaction.

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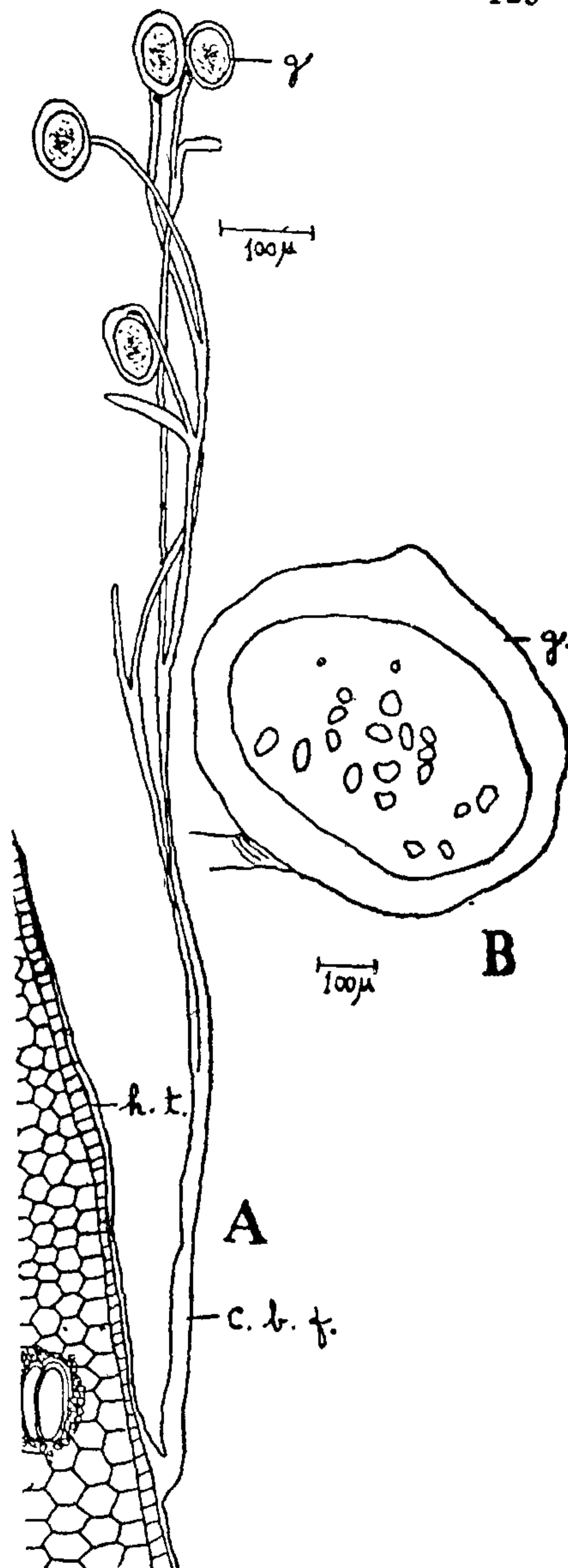
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A NEW RECORD OF *PHYLLOBIUM SPHAGNICOLUM* KLEBS FROM INDIA

It appears from the literature^{1,3-5,7} that only three species of the rare endophytic genus *Phyllobium* have been recorded from West Germany and Great Britain. Klebs² has established this genus and described its two species, viz., *P. dimorphum* and *P. incertum*. West⁶ has reported the third species, viz., *P. sphagnicolum* on the leaves of *Sphagnum* from Great Britain.

While making a taxonomic algal survey of Bihar, during November 1976, the authors have come across *P. sphagnicolum* growing inside and outside of petioles of *Eichhornia crassipes* Solms. from the perennial Ranchi lake, Ranchi, Bihar.

The present alga shown in the figure is made up of sparsely branched filaments which grow inside the tissues of the host. The coenocytic cells of vegetative filaments range from 8.5 μ to 10.25 μ in dimension.



FIGS. A and B. *Phyllobium sphagnicolum* Klebs. Fig. A, a single coenocytic branched filament (c.b.f.) coming out from the host tissue (h.t.) bearing terminal gametangia (g); Fig. B, an ellipsoidal gametangium (g).