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PROTEIN AND LIPID ESTIMATION OF TWO INSECT PARASITIC NEMATODES OF WESTERN U.P.

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Abstract

For the estimation of various biochemical parameters two insect parasitic nematodes H. diesingi and S. orientalis were studied. Both these parasites inhabit same host and found in the gut of Periplanetaamericana. Both these parasites exhibit difference in the amount of protein and lipid. Both the species of nematode parasites utilize protein and lipidto a different degree for the production of energy. But the difference in biological parameters of both the species may be due to the difference in their micro ecological niche. As H.diesingiinhabits the rectum freely, on the other hand, S.orientalis is found in intestine. Protein represents a large group of complex nitrogenous compounds. Total protein in H. diesingi is more in comparison to S.orientalis. Lipids are major constituents of helminth parasites. During the course of study it was observed that total lipid content in H. diesingi is quite high as compared to S. orientalis.

***Key words**: Hammerschmiditielladiesingi, Schwenkiella orientalis, lipid, Protein*

Introduction

As reported by various workers, insect parasitic nematodes can be employed as an agent of biological control to reduce the pest population without disturbing the ecology (Barron, 1981; Swarup and Gokte, 1986). During the course of study of insect parasitic nematodes of western U.P., the author came across two nematode species *viz.,Hammerschmiditielladiesingi*(Chitwood, 1932) and *Schwenkiella orientalis* (Singh and Agarwal, 1997), inhabiting the gut of *Periplanetaamericana*. Present communication deals with the biochemical composition of *H. diesingi* (Chitwood, 1932) and *S. orientalis* (Singh and Agarwal, 1997).

Materials and Methods

Total protein content of the fresh homogenate was estimated by the Dye Binding Method of Spector (1978). The total lipid contents were extracted by the method of Folch*et. al.* (1957) as modified by Misra (1968). Total phospholipids were determined by the method of Bartlett (1959) as modified by Marinetti (1962). The phospholipid values were obtained

after multiplying the phospholipid phosphorous by a factor of 25 as suggested by Subrahmanyam and Venkatesan (1968).

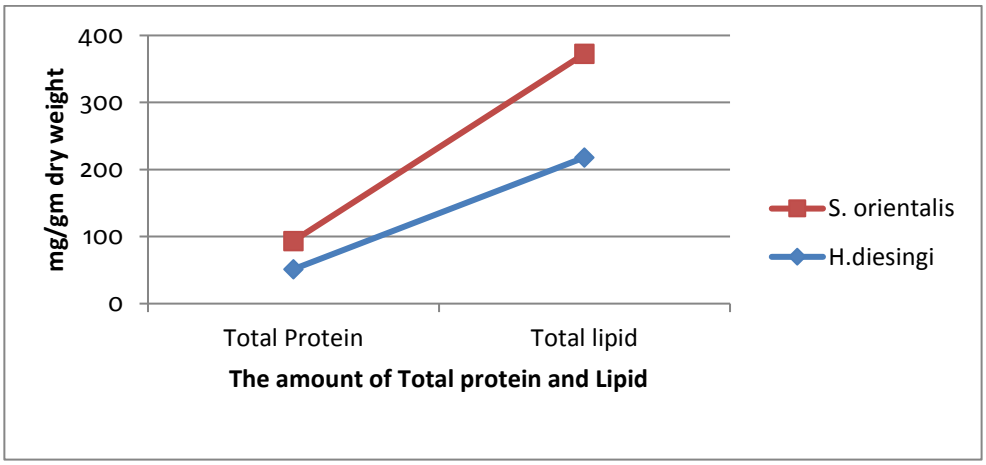
Observation

Result of the quantitative estimation of various biochemical constituents of female specimens of *Hammerschmidtiella diesingi* Chitwood, 1932 and *Schwenkiella orientalis*Singh and Agarwal, 1997 are appended in the following Tables (1-2)

Table 1: The total amount of Protein (mg/gm) in female of *Hammerschmidtielladiesingi*Chitwood, 1932 and *Schwenkiella orientalis*Singh and Agarwal, 1997

	H.diesingi	***S. orientalis***
1	51.16	41.31
2	51.78	42.81
3	50.96	41.96
4	51.14	42.34
5	51.38	42.51
6	51.88	41.80
7	50.99	42.53
8	52.01	42.38
9	50.90	41.93
10	51.53	42.48
Total	513.73	422.05
Mean	51.373	42.205
S.D.	± 0.407	± 0.445
S.E.	± 0.091	± 0.099

Protein: During the course of observation it was noticed that female specimens of *H. diesingi* have more protein in comparison to *S.orientalis* (Table-1). In *H. diesingi* it amounts to be 51.373mg/gmand in *S. orientalis* it amounts to be 42.205 mg/gm.



Lipids

Total lipids (Table-2) are quite high in both the nematodes. *H. diesingi*possess higher amount of lipids as compared to *S.orientalis*. The amount of total lipid was estimated to be 218.04 mg/gm dry weight in *H.diesingi* and 154.57 mg/gm dry weight in *S.orientalis*.The amount of phospholipid (Table-2) appears to be quite high in comparison to other lipid fractions, observed in both the worms.

The amount of phospholipid appears to be 61.26% of the total lipid fraction in *H.diesingi*whereas the amount of phospholipid reached to 41.88% of the total lipid in *S. orientalis*.

However, cholesterol content (table-3) of the *H. diesingi* appears to be high in comparison to *S. orientalis*. Cholesterol constitutes 8.97% of the total lipid in case of *H. diesingi* whereas it is responsible for 7.9% of the total lipid content in case of *S.orientalis*.Moreover, as regard the free fatty acids of the two nematodes under observation are concerned (Table-3) surprisingly, the values are higher in *S.orientalis* rather than *H.diesingi*. The free fatty acid constitute 6.12% of the total lipid fraction of *H.diesingi* whereas it is responsible for 21.06% of the total content of *S.orientalis*.

Table2 :The amount of total lipids (mg/gm dry weight) in female *Hammerschmidtielladiesingi*Chitwood, 1932 and *Schwenkiella orientalis* Singh and Agarwal, 1997

	H. diesingi	**S. orientalis**
1	218.7	154.90
2	217.5	154.20
3	218.6	154.23
4	217.2	154.46
5	217.8	154.56
6	217.3	154.92
7	218.4	154.92
8	218.6	154.89
9	218.4	154.33
10	217.9	154.69
Total	2180.4	1545.7
Mean	218.04	154.57
S.D.	± .5649	± .2734
S.E.	± .126	± .061

Discussion

Protein

The term protein is derived from Greek word meaning, the primary or a substance holding first place. The protein represents a large group of complex nitrogenous compound, member of which are reported from the protoplasm of all animals and plants. They are of special interest in the biology of nematodes as in adults most of the nitrogen metabolism is concerned with formation of eggs (Chappell, 1980). Various species of nematode parasite utilize protein to a different degree for the production of energy. Thus, the amount of protein varies from species to species (Von Brand, 1973).

The total protein of *H. diesingi* is estimated to be 51.37 mg/gm and in *S. orientalis* it amounts to be 42.205 mg/gm of the body weight. The first report of protein content among the parasite was abstracted by Weinland (1901) in case of *Ascaris lumbricoides.* Subsequently, total protein have been worked out by different workers in various nematode from time to time like Naumycheva and Suschenko (1969) in *Ascarislumbricoides*; Wilson (1965) in *Nippostrongylusbrasilensis*; Eckert, (1967) in the larva of *Haemonchuscontortus;* Eckert (1967) in *Cooperiapunctata*; Richard and Dodin in *Ascarislumbricoides*; Jin et. al. (1980) in *Ascaris*suum; Rathaur et. al. (1980) in *Setariacervi*;Naidu, (1980) in *Bunostomumtrigonocephalum*and Prusse et.al (1982) in *Diptalonemaviteae.*

Both these parasites inhabit same host but they possess difference in the amount of the protein content of their body. This difference in the protein content may be due to the difference in their micro ecological niche. As one of them *H. diesingi* harbour the rectum freely and depend upon the dietary supply of protein which is very mearge in the compartment of alimentary canal because most of the digestion and absorption takes place in earlier section of intestine. On the other hand, *S. orientalis* is present in the intestine, which also derives its nutrient from dietary supply of protein in which this section of host alimentary canal is rich. It is difficult for the author, unfortunately, to correlate her findings but Chopra and Premvati (1978) have also derived similar conclusion in case of *Bunostomumtrigonocephalum* and *Trichurisovis.*

Lipid

Lipids are the major constituents of helminth parasites. Lipids of various part of body vary as they are highly diverse and heterogenousgroup of compounds which can be classified as phospholipids, sterols, fatty acids, glycerides and waxes. The present investigation deals

with the phospholipids, cholesterol and free fatty acid fractions of *H. diesingi* and *S. orientalis*.

Some histochemical evidences suggest that phospholipids are the major lipid content of the cell membrane of nematodes (Chappell, 1980). Cholesterol constitutes the major sterols present in the body of nematodes. However, fatty acids besides being constituent of phospholipid or glycolipids occur as esters with different sterols in the form of mono, di and tri glycerides.

Total lipids

In *H. diesingi*and *S. orientalis* the values of total lipids are quite high. In *H. diesingi* the amount to be 218.04 mg/gm and in it is 154.57 mg/gm. This value falls within the range recorded by earlier workers in different nematodes like Roberts and Fairbairn (1965); Barrett, (1968); Castro and Fairbairn (1969); Clark (1969); Naidu, (1980); Rathauret. al. (1980); Kapoor and Sood (1985); and Kumar and Lal (1985).

During the course of investigation, it was observed that the total lipid content in *H. diesingi* is quite high as compared to *S. orientalis*. Both these nematodes predominantly depend upon the dietary supply of lipids. *H. diesingi* is found inhabiting rectum and *S.orientalis*is found inhabiting intestine. It is difficult for the author to correlate her findings about the quantitative difference of total lipid contents per unit volume of the two nematodes under investigation. However, in my opinion this could be-

1. It acts as one of the primary source of energy as *H. diesingi* has less total carbohydrate content and reserve polysaccharides init as observed by me, during the course of this study. Role of total lipid as primary source of energy has also been documented by Rogers (1962); Croll (1972); Lee and Atkinson (1976) and Kumar (1987) in nematodes parasitic in vertebrates.
2. However, this could also be due to the fact that possibly most of the carbohydrate and protein have already been digested in upper part of alimentary canal by the host, thus the digested lipid is the only option of the parasites to browse upon.
3. Moreover, this was also observed by the author that *H. diesingi* is more prolific breeder as compared to *S. orientalis* (This inference is based on the volume of eggs present on the body of parasites and rate of oviposition). Therefore, the parasite *H.diesingi* has more lipid content in comparison to *S. orientalis*. This reason has already been documented by Naidu (1980) in case of *T. ovis*, Kapoor and Sood, (1985) in case of *H. contortus* and *Ascarislumbricoides*.

Besides this, a few workers like Von Brand (1973) and Lee and Atkinson (1976) explained the difference in lipid component on the basis of aerobic and anaerobic existence with which I disagree because both the nematodes under the present investigation are found parasitic in the alimentary canal of the host which has poor oxygen content. Thus, the reason for the quantitative difference is not the habitat in which the parasites thrive but it is something else which is explained earlier.

Phospholipld

Out of the total lipids, the highest fraction obtained is of phospholipids in *H. diesingi* and *S. orientalis* in percent of total lipid. In case of several parasites the fractionation of lipid has shown that phospholipid matter often accounts for relatively high percentage of total lipid Von Brand, (1966).

The present observations are in agreement with the views of other workers who have also reported the highest concentration of phospholipids in some other nematodes like *Ascarislumbricoides* (Subrahmanyam and Venkatesan, 1968); *Trichinellaspiralis* (Castro and Fairbairn, 1969); *Setariacervi* (Ansari et.al., 1973); *Setariacervi* (Rathaur et.al., 1980); and *Bunostomumtrigonocephalum*(Kumar and Lal, 1985). According to these workers, this higher amount of phospholipids is on account of the fact that it is one of the important component of cell membrane and helps in maintaining the continuity between the internal and external environment of each and every cell with which I also agree.

Higher amount of phospholipids of *H.diesingi* in comparison to *S.orientalis* has been observed during the course of investigation but it is difficult for the author to explain the reason for this. However, Fulk and Shorb, (1971) observed age related changes in phospholipid content of *Ascaridiagalli.* They pointed out that phospholipid content gradually declines in the female with the increasing with their age. Moreover,Von Brand, (1973) and Chappell, (1980) while working on *Ascaridiagalli* and *Trichurisovis* reported the presence of higher amount of phospholipid in Ascaradiagalli in comparison to Trichurisovis. According to these workers Ascaridiagalli is an active parasite and has elaborately developed muscle cell, whereas specimen of Trichurisovis are found in the mucosal line of alimentary canal of the host. Thus it does not require well developed muscle cells. Due to this reason there occurs higher percentage of phospholipids in *Ascaridiagalli*.

But I do not agree with this hypothesis forwarded by Von Brand (1973) and Chappell (1980). As the parasites under the present investigation exhibit opposite trend. Therefore, I agree with the age dependent changes in the phospholipid content in the parasite. At this

moment it is not possible for the author to draw any conclusion of her observation as she has no idea about the age of parasite used for the quantitative estimation of phospholipids

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