Journal of Medicinal Chemistry and Drug Discovery

Available online at http://www.jmcdd.com
October - November, 2014, Vol. 4, pp 26-34
ISSN: 2347-9027

Research Article

PHYSICAL AND BIOCHEMICAL PROPERTIES OF OIL EXTRACTED FROM ERI SILKWORM PHILOSAMIA RICINI PUPAE

PRIYADARSHINI .P.A

Department of Genetics, Vijay a College, Bangalore
E Mail: priyadarshinichintu@gmail.com

ABSTRACT

The physical and biochemical properties was analysed in pupae of eri silkworm *Philosamia ricini* at different stages of pupal development. The moisture content in both male and female at 0 hours was found to be high and drastically there was loss of moisture at 216 hours of development, further the oil weight and percentage in female is more when compared to that of male. The oil colour revealed light brown with unpleasant odour and complete solubility in organic solvent. The refractive index ranged from 1.4770-1.4773, saponification value was between 74.99-85.91, iodine value ranged from 24.99-29.94 and acid value 14.99-19.94.

Key words: Eri silkworm, refractive index, iodine valu , saponification value, acid value

INTRODUC TION

Eri silkworm, *Philosamia ricini* belongs to the order Lepidoptera and family Saturniidae is domesticated non-mulberry silkworm. Among the five commercially exploited silk, four varieties are produced in the North- East region including silk. The Brahmaputra valley of Assam and the adjoining foot hills is believed to be the original home eri silkworm (Sarmah *et al.,* 2012).It is a polyphagous and multivoltine insect, feeds primarily on castor (*Ricinus communis* L.) (Suryanaryana *et al.,* 2002). Eri silkworm produces brick red and creamy white coloured cocoons. This can be reared indoors like mulberry silkworm.

The eri silkworm is economically important insect, which produces large quantity of silk . In addition to the a large quantity silk, a large by- products is also produced after reeling process which could be utilized in a better way by value added products with improved adoption technology (Sahay *et al.,* 1997*).* It is found that pupae obtained after reeling of silkworm cocoons are generally away which is rich in protein, oil, carbohydrates and minerals. The oil extracted from the pupa is used in paints, varnishes, soaps, candles, pharmaceuticals, bio-diesel and plastic

industries (Basavanna *et al*., 1967, Datta *et al*., 1993, Chavan *et al.,* 1999*, C*hauaderdhury, 2003). Sarker and Quader (1990) have studied extractability and properties of pupal oil. In this paper the comparative study of physical and chemical properties of male and female oil was considered for the study.

MATERIALS AND METHOD

Second instar larvae of eri silkworm *Philosamia ricini* was harvested from a local farmer of Shankarapuram, Hosur Taluk, Tamilnadu. It was maintained in the room temperature until they started spinning into cocoon. The spinning of the cocoon was recorded from 0 hours (1st day) -216 hours(9th day). At every 72 hours of interval (3rd day), the cocoon was cut open and the pupae was used for the investigation . The male and female were sorted out on the basis of the genital marking and approximately 100 gm of pupae was used for the study of moisture content, oil percentage, colour, odour, solubility, refractive index , iodine value, saponification value, acid value and protein percentage.

The pupae was first dried at 65^{0}c for 3 days and the moisture content was calculated using the Indian standard method [**IS: 7874 (part I) – 1975]**. The pupae oil was extracted using chloroform from dried male and female pupae powder at different hours during development using Soxhlet extractor **(IS: 10640 – 1983**). The extracted oil percentage was recorded using Indian Standard method [**IS: 7874 (Part I) – 1975**]. The physical and chemical properties was calculated following Indian Standard methods [**IS: 548 (Part I) -1994]**

RESULT

The moisture loss in the male and female pupae of eri silkworm, have shown significant variations as depicted in the Table.1. The analysis of the results revealed that the moisture loss required to extract maximum amount of oil from the 216 hrs pupae at constant temperature 65ºC with 5 hrs of drying duration was found to be 16.54% in male and 15.27% in female pupae of eri silkworm, respectively. The analysis of the results showed that the optimum moisture loss required to extract maximum amount of oil from the male and female pupae at 216 hrs was found to be 61.66% in male and 62.93% in female at constant temperature of 65ºC with 5 hrs of drying duration (Table.1).

In the present study, the oil extracted from male and female pupae powder of eri silkworm, ***P. ricini*** have revealed great variation in the quantity and per cent of oil extracted. The analysis of the results show that the oil weight ranged from 3.52- 9.50 g and oil percentage ranged from 9.18 - 24.77% in male, whereas in female the oil weight ranged from 4.60 - 11.80 g and oil percentage ranged from 12.40 - 31.83% at 0 to 216 hrs of pupae development (Table.2).

Data on table.3 showed that the extracted male and female pupae oil at different hours of development (0 to 216hrs) showed light brown with unpleasant odour. The solubility of pupae oil extracted noticed to be soluble in organic solvents such as Absolute alcohol, Petroleum ether, Chloroform, Hexane and Cyclo-hexane, but was insoluble in water , it was estimated that the moisture percentage of eri silkworm pupae oil was found to be 0.2% at 0 hr, 0.3% at 72 hrs, 0.2% in 144 hrs and 0.3% at 216 hrs of male and female respectively. It was observed that the weight of the oil does not decrease even if stored for long duration.

It was observed that the refractive index value (expressed in number) of oil ranged between 1.4773 – 1.4770 in both male and female eri silkworm at different hours of development, the saponification value (expressed in number) of male and female pupae oil at 0 hr found to be 75.88 and 77.41 respectively. Where as in 72 hrs it was found to be 79.94 in male and 85.53 in female, at 144 hrs 78.80 in male and 85.91 in female, and at 216 hrs it was noticed 74.99 in male and 75.50 in female.

The iodine value (expressed in number) of eri silkworm pupae oil at 0 hr of development was noticed to be 25.88 in male and 27.41 in female; at 72 hrs 29.94 in male and 35.53 in female, at 144 hrs 28.80 in male and 35.91 in female, whereas at 216 hrs of male and female it was observed to be 24.99 and 25.50 respectively, the acid value (expressed in number) of male and female pupae oil at 0 hr was 17.88 in male and female 18.88, at 72 hrs 15.94 in male and 19.94 in female, at 144 hrs it was observed with 15.91 in male and 18.80 in female, whereas at 216 hrs male and female it was noticed with 15.50 and 14.99 respectively. The protein per cent was estimated in the pupae oil was in the range between 1.15% - 2.89% in both male and female.

It was observed in the present study that the protein per cent in female oil was higher at 216 hrs when compared to that of male.

DISCUSSION

It was found in the present study that the oil yield decreases when the water content is either more or less than the optimum in the male and female pupae of eri silkworm.

The physical and chemical properties such as colour , odour, solubility, moisture content, refractive index, iodine value, saponification value, acid value and protein per cent were analysed in male and female pupae oil and have revealed not much remarkable variation.

The colour of the oil is light brown in male and female pupae during 0-216 hrs of development. It is found that the refractive index, iodine number and acid values varies among both sexes. The present findings agree with the findings of Bose and Majumder (1990).

The refractive index of eri pupae oil is comparable to other common lipids of both vegetable and animal origin. This indicates the presence of long chain unsaturated fatty acids as described by Choudhury (2003).

The iodine value of eri pupae oil is quite high when compared to common animal lipids. The acid value indicates the presence of high amount of free fatty acids in eri pupae oil. Thus, eri pupae oil contains higher amount of unsaturated fatty acids than the common animal lipids.

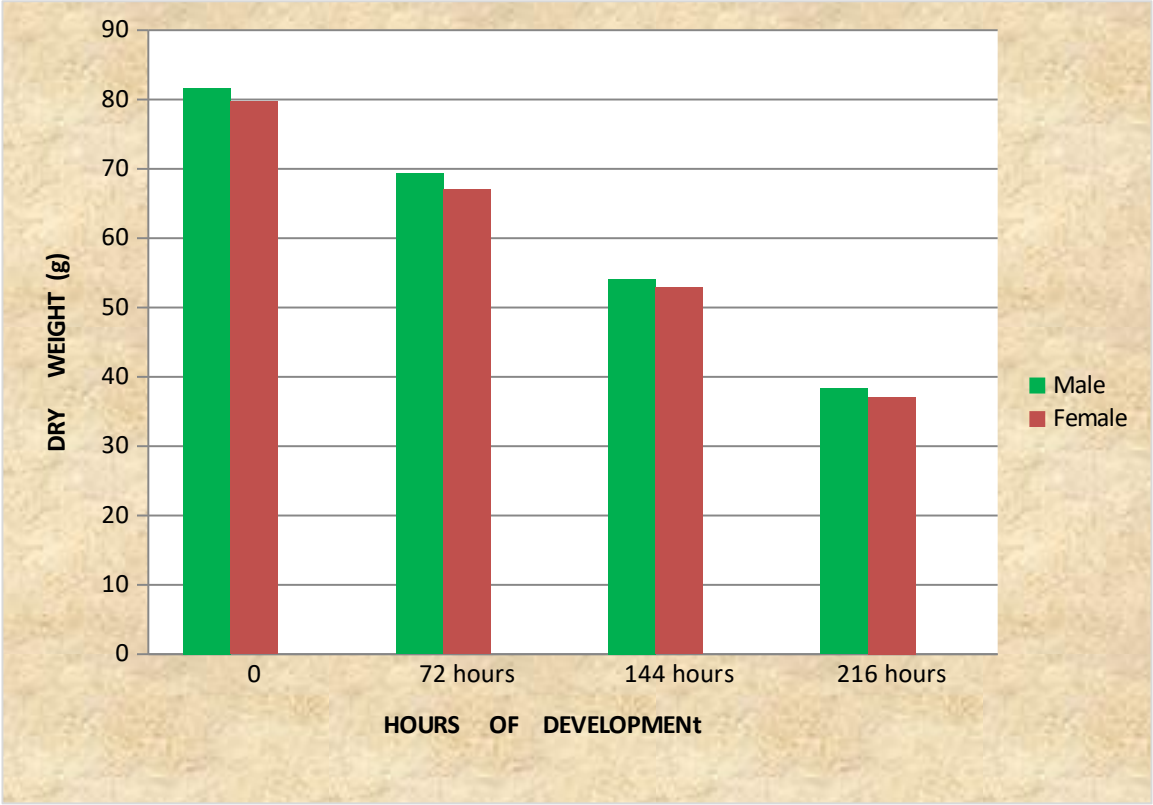
The saponification value signifies that its ransidification values is lower than that of common animal fats. The analysis of the results such as that of eri pupae oil has great prospect for its utility in food industry as well as the source material for oleo-chemical industries. This observation coincides with that of Choudhury (2003).

The present study revealed that the eri pupae oil is safe, nutritionally equivalent and commonly used as vegetable oil. Eri silkworm pupae can be harvested to provide a cost effective alternate edible oil that can be used as nutritional advantages in the food and feed industry. Therefore, eri silkworm and its host plants offer an excellent example of multiple product crops and of sustainable agricultural practice with excellent opportunity for economical and nutritional benefits (Thingnganing Longvah ***et al***., 2012).

Table-1 Moisture loss in the male and female pupae of eri silkworm, *Philosamia ricini* During 0 to 216 hrs of development

	Male pupae (wet weight 100g) Moisture content (78.20%) Drying duration (5 hrs at 60ºC)			**Female Pupae (wet weight 100g)** Moisture content (78.20%) Drying duration (5 hrs at 60ºC)		
Development (hrs)	Dry weight of pupae (**g**)	Moisture loss (**%**)	Moisture per cent required to extract oil	Dry weight of pupae (**g**)	Moisture loss (**%**)	Moisture per cent required to extract oil
0 hr	81.67	**18.33**	**59.87**	79.70	**20.83**	**57.37**
72 hrs	69.37	**30.63**	**47.57**	67.04	**32.69**	**45.51**
144 hrs	54.09	**45.91**	**32.29**	52.91	**47.09**	**31.11**
216 hrs	38.34	**61.66**	**16.54**	37.07	**62.93**	**15.27**

Dry weight of male and female pupae of eri silkworm during 0 – 216 hrs of development



Moisture loss per cent in male and female pupae of eri silkworm during 0 -216 hrs of develpoment

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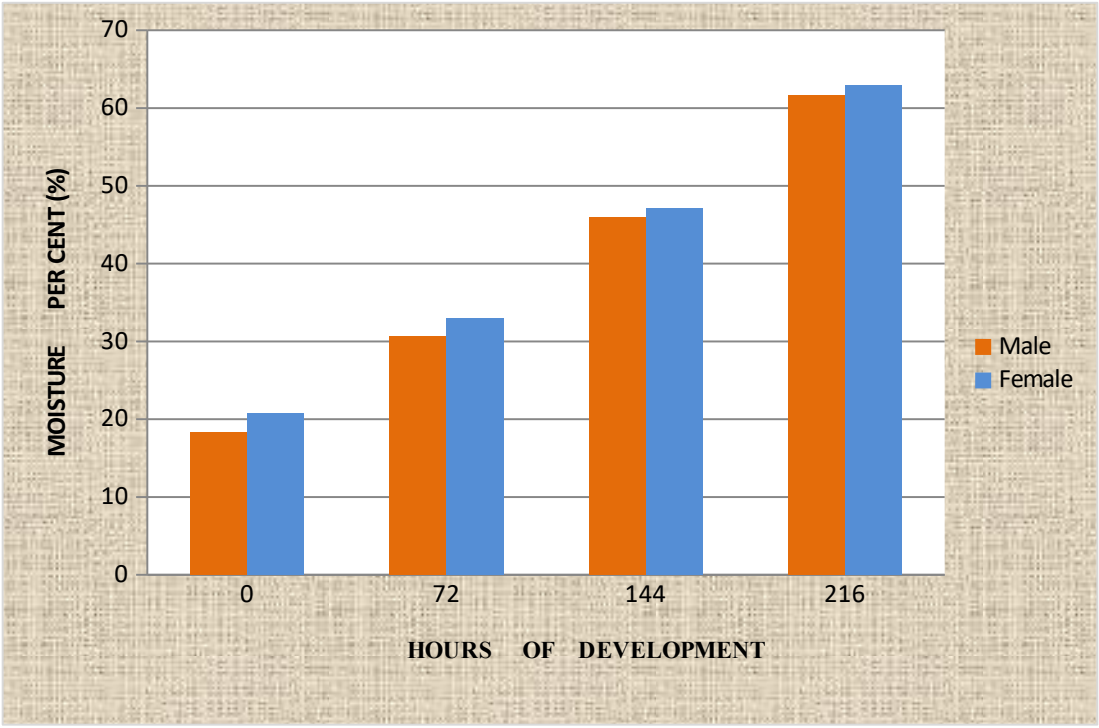
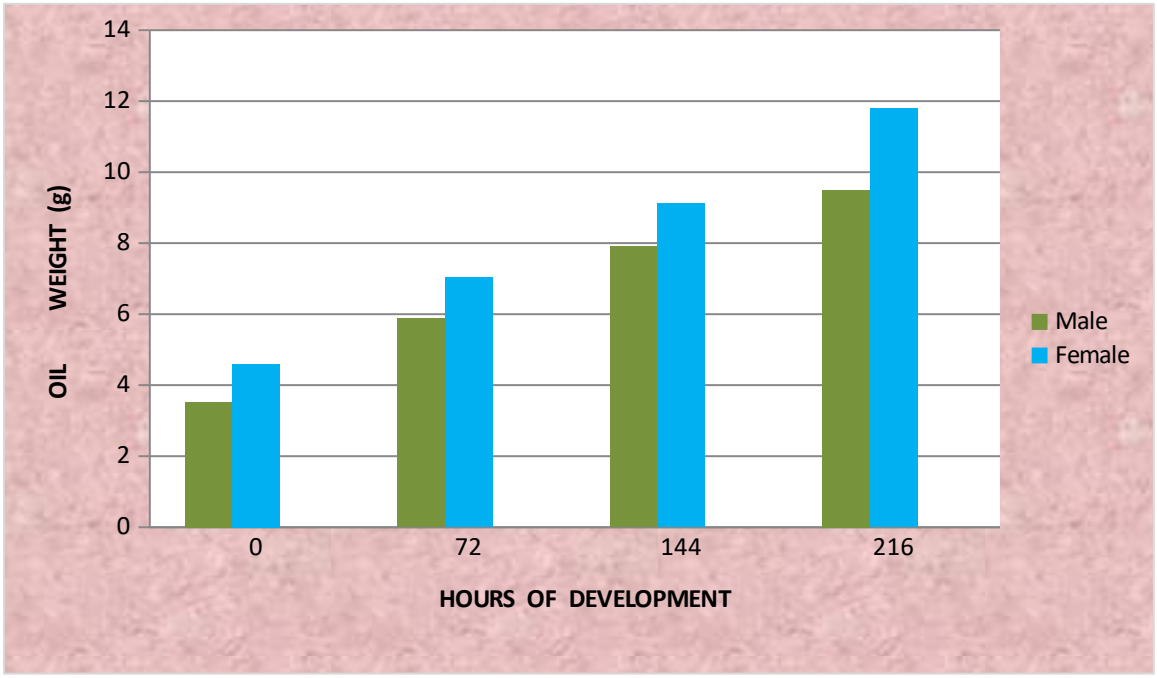


Table-2 Oil weight and oil per cent in the male and female pupae of eri silkworm, *Philosamia ricini* during 0 to 216 hrs of development

	Male pupae (Dry weight 38.34 g) (Moisture content required to extract oil 16.54%)			**Female Pupae (Dry weight 37.07 g)** (Moisture content required to extract oil 15.27%)		
Development (hrs)	Dry weight **(g)**	Oil weight **(g)**	Oil **(%)**	Dry weight **(g)**	Oil weight **(g)**	Oil **(%)**
0 hr	81.67	3.52	**9.18**	79.70	4.60	**12.40**
72 hrs	69.37	5.88	**15.33**	67.04	7.03	**18.96**
144 hrs	54.09	7.91	**20.63**	52.91	9.12	**24.60**
216 hrs	38.34	9.50	**24.77**	37.07	11.80	**31.83**

Oil weight(g) in male and female pupae of eri silkworm during 0 -216 hrs of development



Oil per cent in male and female pupae of eri silkworm during 0 -216 hrs of development

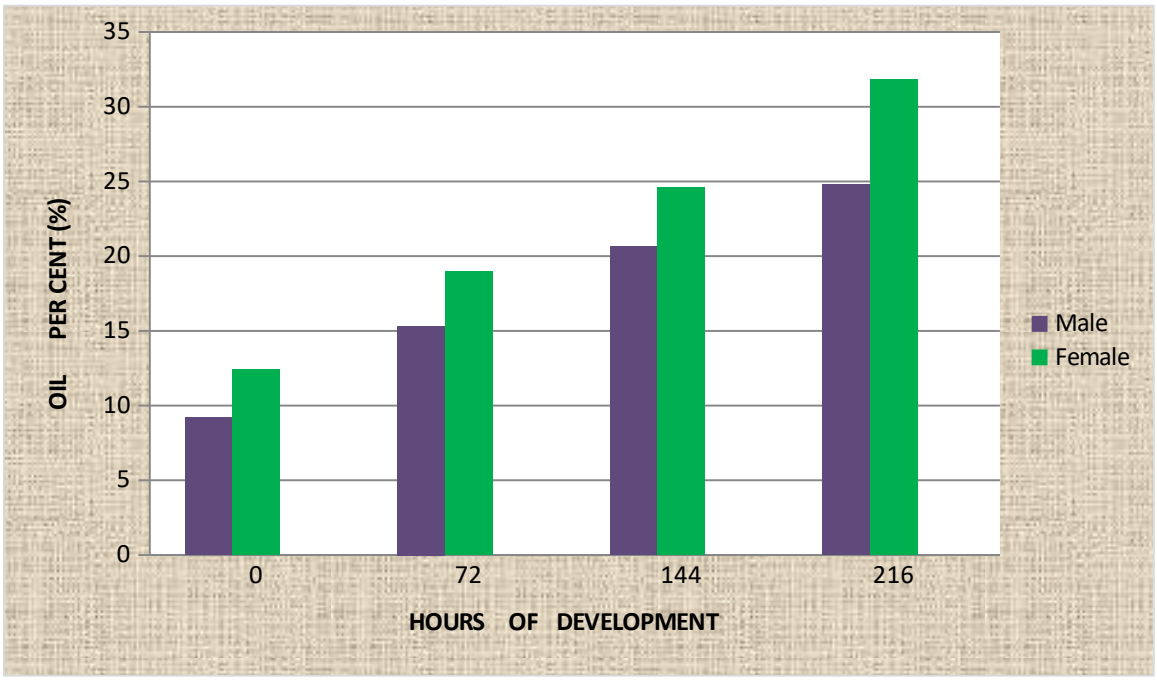


Table-3 Physical and chemical properties of oil extracted from pupae of eri silkworm, *Philosamia ricini* at different hours of development

Sl No	Characteristics	0 hrs		72 hrs		144 hrs		216 hrs	
		Male	Female	Male	Female	Male	Female	Male	Female
1	Colour	Light brown	Light brown	Light brown	Light brown	Light brown	Light brown	Light brown	Light brown
2	Odour	Unpleasant	Unpleasant	Unpleasant	Unpleasant	Unpleasant	Unpleasant	Unpleasant	Unpleasant
3	Solubility Test								
a	Absolute alcohol	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble
b	Petroleum ether	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble
c	Chloroform	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble
d	Hexane	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble
e	Cyco-hexane	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble	Soluble
f	Water	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble	Insoluble
4	Moisture	0.2%	0.2%	0.3%	o.3%	0.2%	0.2%	0.3%	0.3%
5	Refractive Index At 40^0	1.4773	1.4773	1.4772	1.4772	1.4772	1.4772	1.4771	1.4770
6	Saponification Value (Number)	75.88	77.41	79.94	85.53	78.8	85.91	74.99	75.5
7	Iodine value (Number)	25.88	27.41	29.94	35.53	28.80	35.91	24.99	25.50
8	Acid Value (Number)	17.88	18.88	15.94	19.94	15.91	18.80	15.50	14.99
9	Protein percent	1.15%	1.22%	1.36%	1.96%	2.01%	2.67%	2.05%	2.89%

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