REDUCING POWER OF THE BLOOD OF CASTOR SILKWORM, *Philosamia cynthia ricini* BOISDUVAL†

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In the studies of the composition of the blood of castor silkworm, the author found that the reducing power of the blood shows striking rises before molting and pupation. This phenomenon was reported first by Demjanowski and Prokoffjewa (1935) for ***Bombyx mori***, and verified by Kuwana (1937) in a much more extensive study on the same insect. Kuwana, however, reported a much lower reducing power of the blood throughout the pupal stage than that shown by Demjanowski and Prokoffjewa. It seemed worthwhile to repeat these studies.

In addition to the study of the changes in total reducing power, the present investigation offers a partial analysis of the nature of the reducing substances. Measurements are reported from the beginning of the fourth instar till the emergence of the adult.

Materials and Methods

The castor silkworm, ***Philosamia cynthia ricini***, race H_1, was used throughout these experiments.

The methods used for the collection of blood were the same as those employed by Kuwana. Blood was obtained from a larva by cutting a leg out with sharp scissors, and allowing the blood to drip into a 5 ml. test tube kept in an ice bath; and from the pupa by dissecting the pupa with scissors along the dorsal line, pressing the body moderately with fingers, and allowing the blood to flow from the anterior cut. Since histolysis proceeds very actively within the pupal body, special care must be taken not to let other tissues flow out together with the blood, and if any, centrifuging is necessary. From the moth, blood was obtained by pricking the intersegmental part with a dissecting needle.

Total reducing values were obtained by the method of Hagedorn and Jensen (see Hawk, Oser, and Summerson, 1947, p.528).

The cold reducing values were obtained by the same method modified only by omitting the 15-minute period of heating the blood filtrate-ferricyanide mixture. The entire procedure for the cold method (Gulland and Peters, 1930) was carried out at room temperature.

† The author is indebted to Mr. Chu Yung-kong, Taiwan Sericultural Improvement Station, for his continuous supply of materials for the study.

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Observation

The results of the measurements of total reducing power are shown in Table 1 and Fig 1. At the beginning of the fourth instar the reducing value is about 120 mg./dl. expressed as equivalent glucose; it decreases to 115 m.g/dl. in the following two days, and then rises to some 140 mg./dl. in the fourth sleep. Just before molting the reducing value rises sharply to. 195 mg./dl. After molting, however, the value rapidly falls to about 130 mg./dl., and then gradually decreases to 110 mg./dl. at the mid-feeding period of the fifth instar. From this lowest level, the reducing valus gradually increases until a temporary fall is noted which accompanies the known pre-ripening period of excretion (Koizumi et al., 1940). Then it rises more rapidly to about 160 mg./dl. during the ripening period and suddenly shoot up to a peak of more than 230 mg./dl. just before pupation. After pupation the reducing value falls rapidly from the peak to 170 mg./dl., and gradually decreases

Table 1

Date	Stage	Total Value ♀	Total Value ♂	Cold Value ♀	Cold Value ♂	Hot Value ♀	Hot Value ♂
II-20	Fourth instar	119		74		45	
21		117		70		47	
22		113		59		54	
23		121		70		51	
24	Fourth sleep	141		95		46	
25	Before molting	195		148		47	
25	After molting	132	126	75	71	57	55
26	Fifth instar	127	123	67	66	60	57
27		125	120	65	61	60	50
28		119	116	56	61	63	55
III-1		117	112	53	53	64	59
2		113	110	56	54	57	56
3		129	124	70	69	59	55
4		131	128	79	77	52	51
5		141	132	92	88	49	44
6	Excreting	125	120	77	75	48	45
7	Ripening	159	146	115	108	44	38

Date	Stage	Total Value ♀	Total Value ♂	Cold Value ♀	Cold Value ♂	Hot Value ♀	Hot Value ♂
III-8		161	157	117	115	44	42
9		170	163	122	120	48	43
10	Before pupation	232	221	177	168	55	53
10	After pupation	168	164	108	106	60	58
12		150	147	101	101	49	46
14		145	141	98	94	47	47
15		157	148	109	105	48	43
16		177	166	122	119	54	47
17		175	168	118	117	57	51
19		193	179	137	123	56	56
21		191	181	132	129	59	52
24		202	190	145	136	57	54
26		199	188	145	135	54	53
28		192	184	136	125	56	59
30		197	188	146	131	51	57
IV-2	Before eclosion	221	209	159	143	62	66
3	Adult	173	168	115	107	58	61

Reducing powers as measured with the zinc hydroxide filtrate.
Amounts expressed as equivalent glucose mg./dl.=100ml.

to 140 mg./dl. within four days. Then it it increases again up to about 190 mg./dl. and maintains this rather high level until emergence.

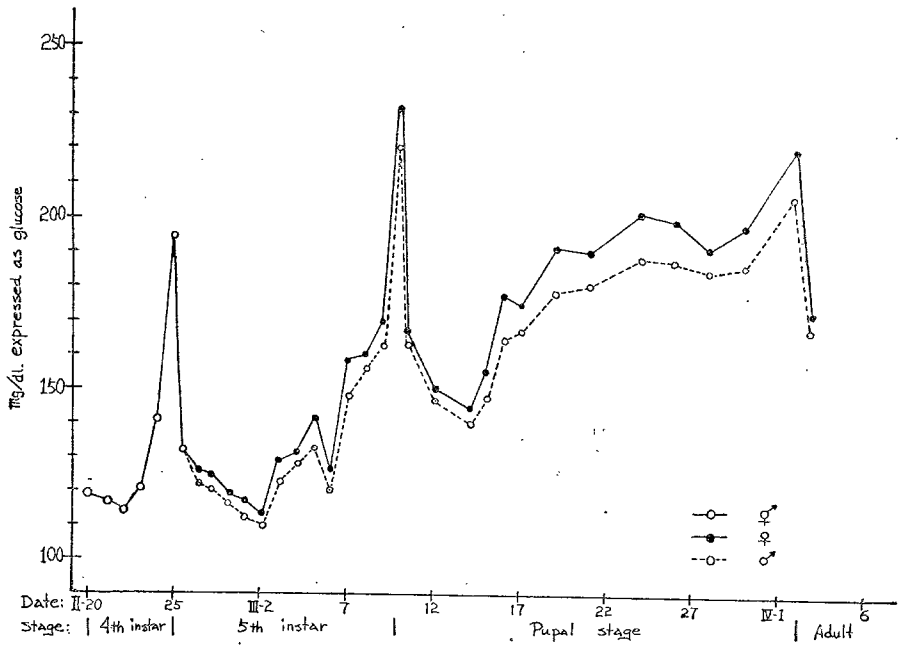

Fig. 1 Course of the total reducing power, (dl.=100ml.)

The total reducing values were measured separately for males and females after the fourth sleep, and those of females are a little higher than those of males.

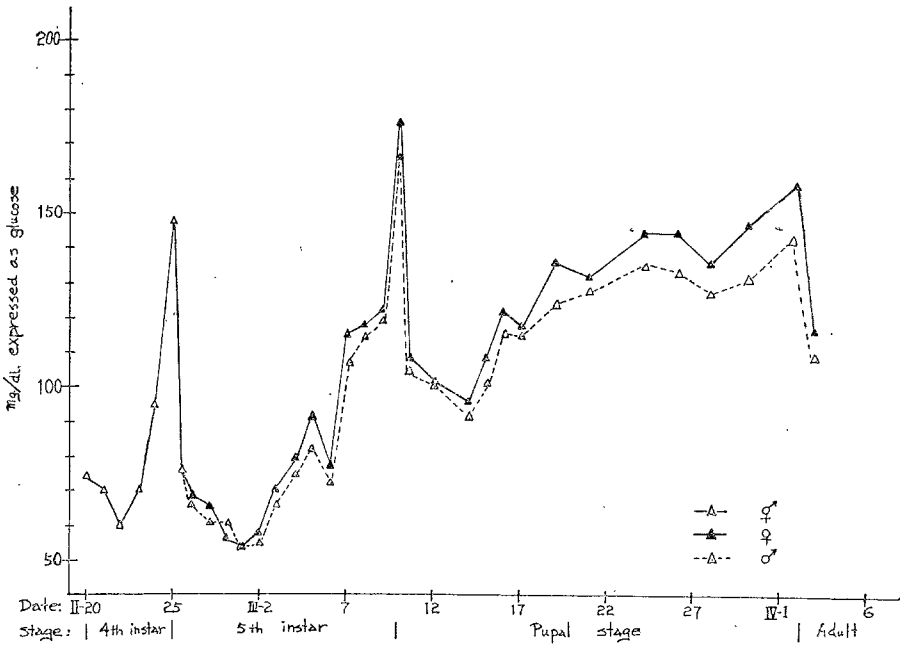

Fig. 2 Course of the cold value fraction of reducing power (dl.=100 ml.)

The measurements and the changed course of the cold value, shown in Table 1 and Fig. 2 are generally parallel to those of the total value, and the cold value shows lower than the total value by about 40-60 mg./dl.

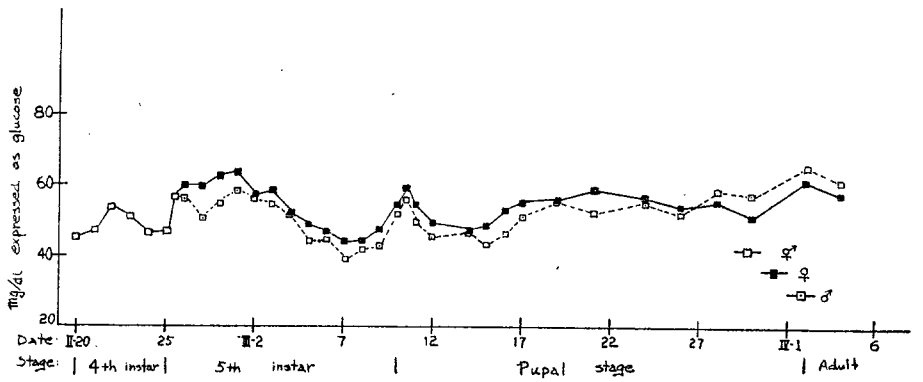

Fig. 3. Course of the hot value fraction of reducing power (dl.=100ml.)

The difference between the total value obtained by the standard hot method and the cold value obtained by the modified cold method is designated as the hot value. Measurements are shown in Table 1 and Fig. 3.

Discussion

The results presented in this study show that the changes in total reducing power of castor silkworm generally agree with those obtained by Demjanowski and Prokoffjowa for ***Bombyx mori*** with the exception of special excretory period. However, a higher reducing power is shown throughout the late pupal stage than that reported by Kuwana. On the other hand, results similar to those of the present have observed in pupal extracts of ***Galleria*** (Crescitslli and Taylor, 1935) and ***Popillia*** (Ludwig and Rothstein, 1949.)

By the modified cold method, the total reducing power can be divided into two fractions, the hot value and the cold value. The hot value represents those reducing substances only oxidizible by potassium ferricyanide at higher temperature. Since this value is quite stable throughout the course of development, it might be safe to say that changes in these reducing substances are not responsible for the major variation in total reducing power. Therefore the rise in the total value is referable to the cold value fraction that represents those substances which reduce potassium ferricyanide at room temperature. The cold value would also include those substances containing sulphydryl group, such as glutathione, which are stable to potassium ferricyanide but are able to react with iodine (Gulland and Peters, 1930). This analysis comfirmed that of Kuwana (1937).

Certain phenolic substances derived from tyrosine which are responsible for the hardening and darkening of the cuticle after molting, pupation, and eclosion may be

蓖蔴蠶血液還原力之研究

胡秉權

蓖蔴蠶之血液還原力較家蠶爲高，在發育過程中有變動現象。幼蟲每次蛻皮，蛹化之前，其血液還原力均呈陡升；蛻皮及蛹化之後即行下降，並在蛹之後期迄成蛾爲止維持相當高之還原力。蓖蔴蠶幼蟲在成熟吐絲之前有一特殊之排泄期，在此排泄期中，徐增中之還原力呈暫時之下降，此一現象不見於家蠶。

對血液還原力之初步分析，其變動之主因可能由於血液中若干能爲 Hagedorn-Jensen 法在室溫時氧化之物質之增減所致。至於須在沸水浴中始能爲 H-J 法氧化之物質，在整個發育過程中甚爲穩定，諒與還原力之變動無直接關係。