

Researches Concerning the Correlation Between the Characteristics of Raw and Dry Cocoon at some Mulberry Silkworm Breeds (*Bombyx mori L.*)

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Abstract. Our researches had as main purpose the making of a comparative study concerning the correlation between the raw and dry cocoons at some mulberry silkworm breeds. Analyzing the obtained results concerning the characteristics of the raw and dry cocoon as well as the correlation between them, we revealed that the lowest and the highest values alternate from a trait to another and from a breed to other ones, a positive correlation couldn't be established for the traits studied.

Keywords: cocoon, incartment, silky layer, stoving, fibroin , sericin , silk, denyeri

INTRODUCTION

In the amelioration process, the improvement of raw cocoon traits (raw cocoon mass, the incartment mass, the percent of silk layer) and dry cocoon traits (the dry cocoon mass, the fiber mass, the percent of fiber forming silk, the fibroine percent) is wanted, as well as the linear correlation of these traits (the raw cocoon characteristics – dry cocoon characteristics). (Robertson A., 1960)

In this respect many authors have conducted researches in this area of study such as Naceva I. 1990, Won-Bon Jeong 1990, Braslavsky M.Y. 1992, Sengupta K. et al. 1975, Matei Alexandra 2003, Mano V. 1984, obtaining results similar with what we found.

Analyzing the results obtained it can be revealed that the breed which presented the highest raw and dry cocoon value, is situated last in what concerns the fiber mass, and the breed that had the lowest raw cocoon and silk layer value was the first at the silk percent and fiber mass score. That is why we believe that the selection and amelioration must be reoriented and improved for these traits.

MATERIALS AND METHODS

The researches were conducted on a number of 4 mulberry silk worm breeds (AC₂₉ – Chinese white, AC –Cisl u white, AB – B neasa white, B₁ – B neasa 1) raised in the same climate and feeding conditions.

The measures regarding the raw cocoon mass (with crisalida) were done by weighing 60 cocoons (30 females and 30 males) with the help of an electronic balance, and in order to determine the incartment mass the crisalida was removed.

So as to evaluate the dry cocoon mass the cocoons were stoved using a warm air stoving method (drying cabinet) at a temperature of 75-80°C, after 10 days from the mass ingogosare.

The silk mill mass was established by weighing, while for the study of its length an electric „vartelnita” was used which registers the rotation number, each rotation being equivalent to a linear meter.

The fibroin content which represents the insoluble compound of the silk mill consisted in the sericin sanitation by immersing the cocoon wall in an alkaline solution (soap + Na₂CO₃+Na₂SO₃) followed by boiling and after which the resulted material was washed in distilled water, rinsed in acetic acid and dried at 105°C. By reducing from the initial cocoon wall mass the fiber material mass, resulted from the treatments mentioned, the sericine content was established.

RESULTS AND DISCUSSIONS

In table 1 and graphics 1, 2 and 3 the way cocoon mass is revealed along with the incartment mass and the silky layer.

The raw cocoon mass ranged between 1,830 g at AC₂₉ breed and 2,2176 g at AC breed while the B₁ and AB breeds reveal close values 2,0481 g respectively 2,0802 g.

Three breeds show values above their average, 2,0441 g, the exception making the AC₂₉ breed which had the trait’s value under this medium.

For the incartment mass trait, the lowest value was registered also at AC₂₉ breed (0,403 g) while the maximum value was revealed at B₁ breed with 0,437 g, and the breed’s average for this trait was of 0,421 g.

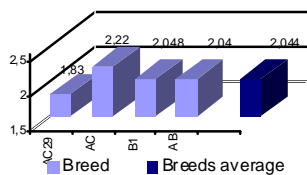
The silky layer varied between 19,903% at AB breed and 21,852% at AC₂₉ breed, compared to the breed’s average which had the value of 20,831%.

It is noticed that the AC breed had the highest values for the raw cocoon mass trait and the incartment mass had the penult value of 19,967 % for the silky layer trait, and the AC₂₉ which had the lowest values for the traits mentioned above but the highest score of 21,852% for the silky layer trait.

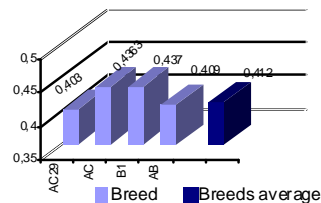
The raw cocoon’s mass at the females varied between 2,113 g at AC₂₉ breed and 2,462 g AC breed, while at males ranged between 1,635 g at AC₂₉ breed and 1,97 g at AC breed.

The silky layer percent at the female cocoon ranged between 18,022 g at AB breed and 19,633 g at B₁ breed. The male cocoons had values for the silky layer trait in between 21,710 g at AC breed and 24,281 g at AC₂₉ breed.

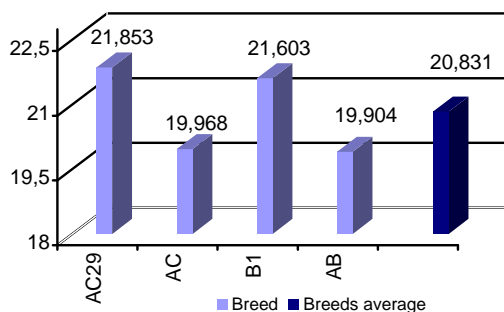
Analyzing the numbers above concerning the raw cocoon's mass, the incartment mass and the silky layer according to sexes, results that the AC₂₉ breed, which presents the lowest values at both sexes for the first two characteristics, has the highest value of silk layer at males and the highest average according to breed. The AC breed which has the highest raw cocoon mass at both sexes and the highest incartment mass at males, presents the lowest value for the silk layer in males while the females have an intermediary value for this trait. Also it can be seen that the female sex has the raw cocoon's mass higher than the one shown at males, but these last ones have a higher percent in the silky layer than the one found at females.



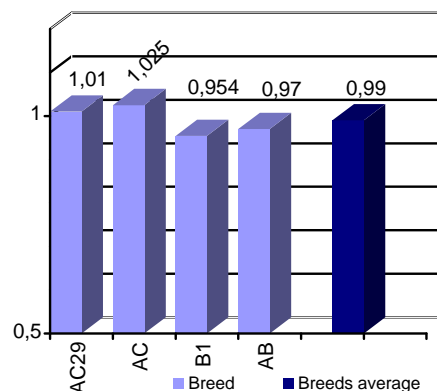
Graphic1 Raw cocoon's mass (g)



Graphic 2 Incartment mass (g)



Graphic 3 Silky layer's percent (%)



Graphic 4 Dry cocoon's mass (g)

Tab. 1

Raw cocoon's biological indices

Breed	N	Raw cocoon mass (g) $\bar{X} \pm S\bar{X}$			Incantment mass(g) $\bar{X} \pm S\bar{X}$			Silky layer (%) $\bar{X} \pm S\bar{X}$		
				\bar{X}			\bar{X}			\bar{X}
AC ₂₉	60	2,056 ± 0,170	1,604 ± 0,145	1,830 ± 0,160	0,396 ± 0,048	0,388 ± 0,042	0,392 ± 0,002	19,331 ± 2,341	24,215 ± 1,482	21,773 ± 1,732
		2,169 ± 0,146	1,666 ± 0,140	1,918 ± 0,178	0,423 ± 0,051	0,404 ± 0,051	0,413 ± 0,006	19,516 ± 2,088	24,348 ± 1,924	21,932 ± 1,713
\bar{X}		2,113 ± 0,040	1,635 ± 0,021	1,830 ± 0,035	0,409 ± 0,281	0,396 ± 0,281	0,403 ± 0,285	19,423 ± 0,065	24,281 ± 0,047	21,852 ± 0,056
AC	60	2,371 ± 0,167	1,845 ± 0,206	2,108 ± 0,186	0,453 ± 0,026	0,405 ± 0,039	0,429 ± 0,017	19,158 ± 0,877	22,043 ± 1,227	20,600 ± 1,023
		2,552 ± 0,251	2,100 ± 0,206	2,326 ± 0,160	0,440 ± 0,047	0,445 ± 0,030	0,443 ± 0,001	17,292 ± 1,453	21,377 ± 2,289	19,334 ± 1,448
\bar{X}		2,462 ± 0,020	1,973 ± 0,028	2,217 ± 0,024	0,447 ± 0,004	0,425 ± 0,014	0,436 ± 0,004	18,225 ± 0,661	21,710 ± 0,236	19,967 ± 0,449
B ₁	60	2,234 ± 0,121	1,785 ± 0,104	2,010 ± 0,159	0,435 ± 0,034	0,418 ± 0,029	0,427 ± 0,005	19,484 ± 1,259	23,462 ± 1,214	21,473 ± 1,410
		2,390 ± 0,205	1,780 ± 0,073	2,086 ± 0,216	0,472 ± 0,044	0,422 ± 0,026	0,447 ± 0,018	19,782 ± 1,041	23,682 ± 0,973	21,732 ± 1,382
\bar{X}		2,312 ± 0,055	1,783 ± 0,001	2,048 ± 0,027	0,454 ± 0,013	0,420 ± 0,001	0,437 ± 0,011	19,633 ± 0,105	23,572 ± 0,078	21,602 ± 0,019
AB	60	2,363 ± 0,189	1,858 ± 0,130	2,111 ± 0,178	0,428 ± 0,031	0,412 ± 0,025	0,420 ± 0,005	18,184 ± 1,581	22,275 ± 1,697	20,230 ± 1,450
		2,256 ± 0,192	1,842 ± 0,194	2,049 ± 0,146	0,403 ± 0,052	0,391 ± 0,041	0,397 ± 0,041	17,860 ± 1,679	21,293 ± 1,493	21,784 ± 1,217
\bar{X}		2,309 ± 0,038	1,850 ± 0,005	2,080 ± 0,021	0,415 ± 0,008	0,402 ± 0,007	0,408 ± 0,008	18,022 ± 0,114	21,784 ± 0,348	19,903 ± 0,165
\bar{X}		2,044 ± 0,069			0,421 ± 0,007			20,831 ± 0,450		

The dry cocoon mass at parental breeds ranged between 0,954 g at B₁ breed and 1,025 g at AC breed with a breed's average of 0,990. (Table 2 graphic 4)

The variability of this trait is very low which demonstrates the genotype value close to that of the breeds, their purity, a better conditioning in the 2nd year of study and also better carrying and micro climate conditions.

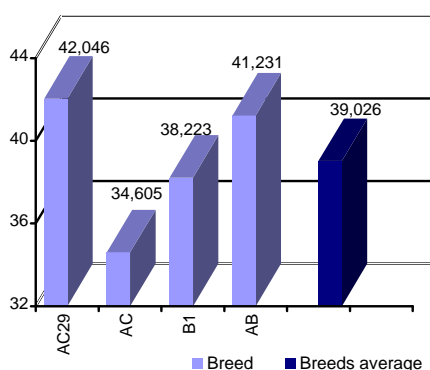
Dry cocoon's mass (g)

Breed	Cocoon mass (g)		
	\bar{X}	Sd	$S \bar{X}$
AC ₂₉	1.010	0.071	0.019
AC	1.025	0.104	0.026
B ₁	0.954	0.081	0.020
AB	0.970	0.079	0.021
\bar{X} breeds	0.990	0,083	0,021

For the dry cocoon mass from the data presented in table 2, a slight variability is registered in what concerns this trait at the parental breeds and also at hybrids. The AC breed, which showed a higher raw cocoon mass, 2,217 g, has the average mass of dry cocoon also higher (1,025 g).

Even if the difference between the average values of the raw cocoon mass and the incartment, are higher at dry cocoons, they have close values (0,954 g and 1,025 g compared to the breed's average 0,990 g). The fiber-forming silk is given by the rapport between the fiber mass and dry cocoon mass.

The percent of fiber – forming silk ranged between 34% at AC breed and 42% at AC₂₉ breed with a medium of 39,026%. (Table 3, graphic 5) At AB and B₁ breeds the values were intermediate, situated around the average value.



Graphic 5 The fiber-forming silk percent(%)

The fiber's delicacy is pretty uniform varying between 3,166 denyeri at AB breed and 3,433 denyeri B₁ breed, with a breed's average of 3,259 denyeri.

In respect to the fiber – forming silk percent the variability for this trait was higher, ranging between 38,223% at B₁ breed and 42,046% at AC₂₉ breed.

The delicacy is expressed in conventional units "denyeri" (one denyer = 0,05 g). The fiber's thickness can be determined rapidly through it, by control measurements of 500 m fiber from one torsion balance, the silk string reaching a delicacy of 2 and 4 denyeri.

The delicacy of the silk fiber ranged between 3,166 at AB breed and 3,433 denyeri at B₁ breed, with a breed average of 3,259 denyeri. (Table 3)

If we take a look at the results presented in tale 4 we notice that the average fiber length was of 918,66 m at AC₂₉ breed and of 1051 m AB breed. It can be revealed close values among the AC₂₉ breed and AC breed (918 – 919 m) and among the B₁ and AB breeds with (1050 – 1051 cm).

The fiber's mass had values in between 0,314 g at AC breed and 0,360 g at AB breed with a breed average of 0,339 g. The medium of the fiber mass at AC₂₉ breed over steps the breed's average while B₁ breed has values very similar to it, respectively 0,332 g .

Tab. 3

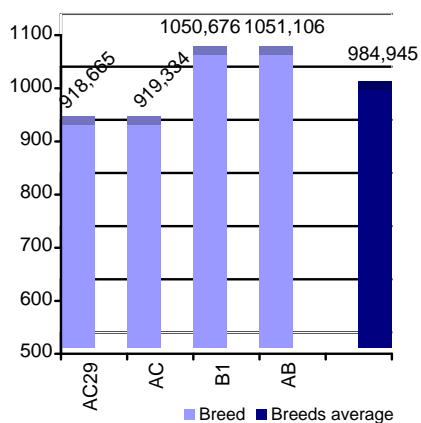
The fiber – forming silk percent and fiber's delicacy (%)

Breed	Fiber – forming silk %			Fiber's delicacy (denyeri)		
	\bar{X}	Sd	$S \bar{X}$	\bar{X}	Sd	$S \bar{X}$
AC ₂₉	42,046	5,337	1,520	3,238	0,518	0,132
AC	34,605	5,745	2,831	3,200	0,429	0,117
B ₁	38,223	4,350	1,532	3,433	0,365	0,086
AB	41,231	7,454	2,050	3,166	0,435	0,123
\bar{X}	39,026	5,72	1,98	3,259	0,436	0,114

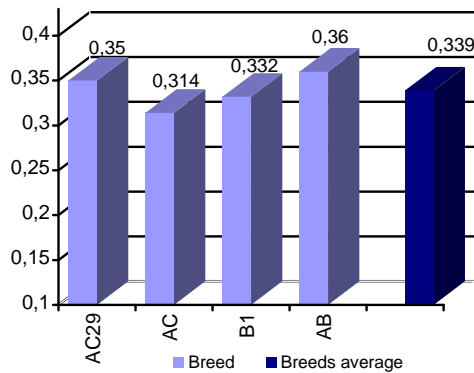
Tab. 4

Fiber's length (m) and fiber's mass (g)

Breed	Fiber's length(m)			fiber's mass (g)		
	\bar{X}	Sd	$S \bar{X}$	\bar{X}	Sd	$S \bar{X}$
AC ₂₉	918,665	103,112	31,232	0,350	0,054	0,12
AC	919,334	92,948	22,705	0,314	0,253	0,13
B ₁	1050,676	115,587	23,51	0,332	0,063	0,015
AB	1051,106	97,104	34,21	0,360	0,059	0,012
\bar{X}	984,945	102,187	27,914	0,339	0,107	0,013



Graphic 6 fiber's length (m)



Graphic 7 Fiber's mass (g)

The fibroine content had values ranging between 73,56% AC breed and 75,86% at AB breed. The fibroine content value is very close, the AC₂₉ and AB breeds showing 75,61%, respectively 75,86%. (Table 5, graphic 8)

Tab. 5

The fibroine content (%)

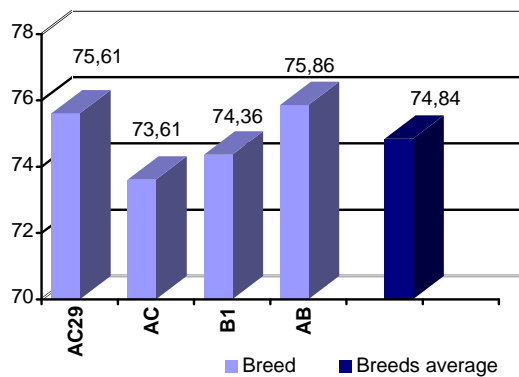
No. crt.	Breed	\bar{X}	S \bar{X}	Sd	Difference compared to the witness
1.	AC ₂₉	75,61	0,13	0,24	+ 0,77
2.	AC	73,56	-	-	- 1,28
3.	B ₁	74,36	0,46	0,71	- 0,48
4.	AB	75,86	0,33	0,57	+ 1,02
\bar{X} breeds		74,84	0,47	0,72	-

The sericine content showed numbers in between 24,14% and 26,43% at AB and AC breeds. The AC and B₁ overstepped the breed's average with 1,28% and 0,49%. (Table 6)
The breeds had a higher fibroine percent and a lower sericine percent and vice verse.

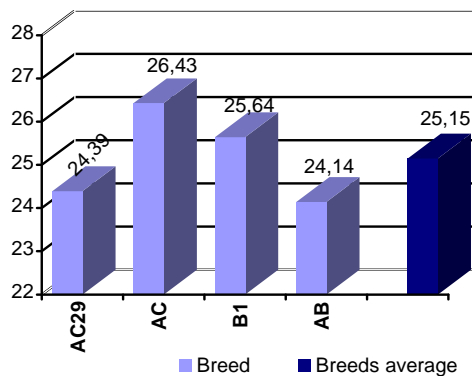
Tab. 6

Sericine content at parental breeds (%)

No. crt.	Breed	\bar{X}	S \bar{X}	Sd	Difference compared to the witness
1.	AC ₂₉	24,39	0,16	0,23	- 0,76
2.	AC	26,43	1,41	2,49	+ 1,28
3.	B ₁	25,64	0,65	0,81	+ 0,49
4.	AB	24,14	0,66	1,14	- 1,01
\bar{X} breeds		25,15	0,668	0,79	



Graphic 8 Fibroine percent (%)



Graphic 9 Sericine percent (%)

CONCLUSIONS

- In general the minimal and maximal values of the traits studied alternate from a trait to another, and also the intermediary values are changing from one trait to another and from one breed to the other.
- There is no positive correlation between the raw cocoon mass, incertment mass and the silky layer, meaning that the breed that showed the highest value in the raw cocoon mass did not have the same result in the incartment mass and silky layer.
- ThecAC₂₉ breed that had the lowest raw cocoon mass and incartment mass, has the highest percent in the silky layer.
- The AC breed that presented the highest raw and dry cocoon mass is situated in the last place regarding the fiber mass.

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