

REVUE DU VER A SOIE

(*BOMBYX MORI* L.)

JOURNAL OF SILKWORM

A V I S

*Toutes les demandes
de renseignements doivent
être adressées :*

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ALES - (Gard)

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(A suivre)

(To be followed)

11ème CONFERENCE TECHNIQUE SERICICOLE INTERNATIONALE
MURCIE (Espagne) - Avril 1960.

Première Partie

S E C T I O N A L I M E N T A T I O N

(suite et fin)

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11ème CONFERENCE TECHNIQUE SERICICOLE INTERNATIONALE
MURCIE (Espagne) - Avril 1960.

L'INFLUENZA DI ALCUNI ELEMENTI OLIGODINAMICI
SULLO SVILUPPO LARVALE E CRISALIDALE
E SULLA ATTIVITA' RESPIRATORIA DEGLI EMOCITI
IN *BOMBYX MORI*.

Da Carmina MANUNTA (Italia) (*)

INTRODUZIONE.

M. COMENGE e M. GUELLENZU (1949) nei loro studi sul metabolismo degli elementi oligodinamici in larve di *Bombyx mori*, nutrite a regime esclusivo con *Morus alba*, *Maclura aurantiaca* *Brousonetia papyrifera* o *Ficus carica* su 18 elementi riscontrati nei tessuti mettevano in rilievo che Ag, Cu, e Ti possono essere considerati come oligo-elementi. Gli autori infatti misero in rilievo che due larve solamente sulle 100 nutrite con *Maclura aurantiaca*, arrivarono fino allo stato di insetto perfetto, mentre quelle nutrite su *Ficus* e su *Brousonetia* morirono dopo due o tre giorni. Essendo stata eseguita l'analisi spettrografica delle ceneri delle foglie la composizione di queste risulta analoga a quella delle foglie di gelso, la differenza, dipendendo unicamente dalla presenza o assenza dell'elemento argento. Gli autori concludono che soltanto le foglie che contengono argento (*Morus* e *Maclura*) sono capaci di portare la larva allo stato di insetto perfetto, mentre le foglie in cui la presenza di argento è incerta sono incapaci di alimentare i bachi.

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Questo risultato secondo gli autori é confermato dall'analisi spettrografica nelle varie fasi dello sviluppo del baco da seta.

Cioè, oltre agli elementi plastici (Ca, K, Mg, Na e P) in tutte le ceneri analizzate sia dei tessuti della foglia che dei bachi come di quelle dei bozzoli e degli escrementi sono rinvenuti gli elementi oligo-dinamici Al, Cu, Fe, Li, Mn, Ni, Pb, e Si, il Ba riscontrandosi al limite della sensibilità del metodo usato dagli autori, mentre il Co è ritenuto trovarsi in proporzione inferiore al limite di sensibilità. Ma KIKKAWA (1955) riscontro assieme al Fe ed al Cu, tracce di Co nelle uova di bachi normali, ma non in quelle di mutanti a uova rosse ed a uova bianche. In tutte le ceneri esaminate Mn e Co si riscontrarono in quantità inferiori a quelle del Fe, mentre Ni, Mo e V sono inferiori a quelle dei metalli prima citati. Le quantità di Ti risultarono analoghe o superiori a quelle del Cu.

Fe, Mn, Ni, Pb e Ti si riscontrano in minor quantità nei bachi mutati e Mo e V non compaiono affatto durante le mute.

In quanto all'Ag si osserva una maggior quantità nelle tre prime età a partire dalla schiusura, esso comincia ad eliminarsi a partire dalla quarta età, spiegandosi così la sua diminuzione negli stadi successivi. La quantità d'argento contenuta negli escrementi, sarebbe secondo l'opinione di COMENGE e GUELLENZU la dimostrazione di un eccesso nella foglia, l'eccesso eliminandosi esclusivamente attraverso le vie digerenti, poichè non è stato riscontrato nè nella seta nè nella pelle.

Poichè secondo i predetti autori la mancanza di Ag nelle foglie di varie speci di *Ficus* sarebbe la causa della inibizione dello sviluppo del baco da seta su questo regime alimentare si potrebbe tentare l'allevamento correggendo la carenza di Ag mediante irrorazione delle foglie con sali di argento. In attesa di poter condurre un allevamenti di bachi da seta su foglie di *Ficus* spruzzate con soluzioni di sali d'argento, durante l'allevamento di quest'hanno ho ritenuto opportuno seguire lo sviluppo del baco da seta su foglie di *Morus alba* spruzzate con soluzioni diluite di sali di Ag.

Allo stesso tempo per vedere se certi elementi oligo-dinamici abbiano o no una influenza sugli emociti della emolinfa, ritenendo che l'abbassamento o l'elevamento del numero di questi possano influire sul consumo di O_2 della emolinfa stessa, onde mettere in rilievo una loro eventuale attività respiratoria, ho creduto opportuno analizzare il QO_2 durante le V^a età larvale.

Secondo i dati della letteratura gli oligo-elementi agirebbero sulla nutrizione sia in quanto, presenti nelle molecole di enzimi, di vitamine, di ormoni esplicano funzioni di biocatalizzatori nei processi del metabolismo cellulare o si comportano come attivatori di enzimi, influenzando i processi metabolici o appaiono essi stessi come catalizzatori diretti del trasporto di O_2 nell'ossidazione di sostanze facilmente ossidabili.

Gli emociti, secondo i dati della letteratura, oltre alle funzioni di fagocitosi, di trasporto delle riserve, di sintesi delle proteine libere, sono implicati anche del metabolismo del fenolo e nella catena delle secrezioni di ormoni stimolanti la crescita.

Secondo il referto di CHAUVIN (1956), se la ghiandola protoracica e il cervello intervengono nella muta essi non sembrano le sole maglie della catena endocrina che governa il fenomeno, gli emociti, in realtà hanno una ben determinata funzione, poichè il loro blocco mediante inchiostro di china in larve di *Rhodnius* in IV stadio un giorno dopo il pasto, provoca un ritardo considerevole nella muta.

Inoltre, gli emociti, manifestano al momento della muta segni evidenti di attività secretoria. In tal caso potrebbe riscontrarsi una modificazione del consumo di O_2 per eventuale influenza di oligo-elementi sull'attività secretoria degli emociti.

Oltre agli elementi Fe, Al, Mn e Ti presenti nella foglia del gelso nei tessuti del baco ho voluto saggiare anche il comportamento durante lo sviluppo in trattamenti con Zn e con U, saggiando anche il Cd. Fatta eccezione per l'Ag e per l'U di cui si sono usati rispettivamente il nitrato ($AgNO_3$) e l'acetato ($UO_2(CH_3 - COO)_2$) sono state preparate soluzioni N/100 dei rispettivi cloruri.

Questi saggi furono eseguiti su una sola razza la Orgoscolo a sangue bianco ed a bozzolo bianco. Furono prelevati circa 1500 bachi appena usciti dalla seconda muta e suddivisi in lotti di 200 ciascuno.

La foglia tagliata veniva spruzzata accuratamente con uno spruzzatore a getto finissimo con le rispettive soluzioni saline W/100 e con H_2O quella per i controlli. La foglia veniva conservata in frigorifero a $3-4^\circ$ in scatole di carta dopo averla lasciata asciugare in ambiente a temperature di stanza.

Fu seguito l'accrescimento durante tutto lo sviluppo fino all'incrisalidamento.

Il consumo di O_2 dell'emolinfa fu eseguito solo per la V^a età (negli stadi di terzo e quinto giorno, massimo accrescimento e maturi).

Ho scelto questi stadi di sviluppo per due motivi : 1° perchè per ogni lotto in esperimento avevo solo 200 individui , 2° perchè proprio per la V^a età dai primi giorni all'inizio della maturazione secondo le ricerche di NITTONO (1955) il N° degli emociti non subisce grandi variazioni. Infatti i punti massimi sono stati riscontrati in corrispondenza dell'avvicinarsi delle singole mute. Tuttavia anche nel corso della V^a età lievi modificazioni del N° degli emociti sono state riscontrate da SPILLER GRI-SI (1957).

Le determinazioni del consumo di O_2 dell'emolinfa sono state eseguite al Warburg in ambiente di aria e su tre cc. di emolinfa addizionata di cc. 3 di cloruro di sodio al 0.7 %. E' necessario far gocciolare l'emolinfa su 3.5 cc. di $NaCl_3$ in provetta calibrata fino a cc. 7 e prelevare cc. 6 della sospensione mediante pipetta, versando nella vaschetta manometrica.

Le determinazioni sono state eseguite a temperatura di 25° entro il limite di tempo da 1 a 2 ore dal prelevamento : in quanto saggi preliminari hanno messo in rilievo una respirazione regolare per le prime tre ore. Infatti in queste condizioni sperimentali per la emolinfa di Orgosolo in 3° giorno V^a età ottenni per la prima ora un QO_2 uguale a - 6.5, per la seconda - 6.6, per la terza - 6.3, per la quarta - 3.9, per la quinta - 1.4.

E' stato eseguito parallelamente per i singoli stadi in esami anche il conteggio del numero degli emociti (media di 5 individui). Esprimo il mio più vivo ringraziamento alla Dr. Maria Antonietta RABA - GLIO per il conteggio degli emociti secondo il metodo da lei applicato in una sua precedente ricerca - M. A. RABAGLIO e S. SPILLER-GRISI (1958).

Sempre per i predetti stadi di sviluppo fu eseguito anche il dosaggio dell'azoto totale mediante semimicrokjedal.

Per tutti i trattamenti, fatta eccezione per il Cd., lo sviluppo è normale e la mortalità pressochè identica a quella dei controlli. Non comparve in tutto il corso dell'esperimento nessun gialloso, fatta eccezione del periodo della filatura, ma sempre nelle stesse proporzioni dei controlli come si può dedurre dai risultati allo stoscamento (*).

(*) Nella valutazione dei risultati ottenuti allo stoscamento per i singoli trattamenti (è da notare che ad eccezione dei trattati con Ag NO_3 , per i prelevamenti dell'emolinfa sono stati utilizzati lo stesso numero di bachi - 20-15-10-10 rispettivamente per i quattro stadi in esame.

Zn Cl_2 : 7 marci, 9 bozzoli incompleti con bachi morti, 4 doppiioni con 2 crisalidi N. 80 bozzoli con 80 crisalidi.

Mn Cl_2 : 3 bachi marci, un bozzoli macchiato con baco marcio. Un bozzolo incompleto con baco marcio, uno incompleto con baco morto, 3 doppiioni con due crisalidi un bozzolo con crisalide imperfetta, n. 74 bozzoli con 74 crisalidi normali.

Fe Cl_3 : 4 giallosi, 2 marci, 3 bozzoli incompleti macchiati con bachi morti, 1 bozzolo incompleto macchiato interamente con baco morto, numero 67 bozzoli con 67 crisalidi normali.

Al Cl_3 : 3 bozzoli incompleti con bachi morti, 4 giallosi, 4 bachi marci, n. 68 bozzoli con crisalidi normali.

Controlli : 3 bachi marci, 4 giallosi, 3 doppiioni di cui 1 con una crisalide e un baco e due con crisalidi normali, n. 84 bozzoli normali con 84 crisalidi normali.

Ti Cl_3 : 2 giallosi, 4 marci, 4 bozzoli incompleti con bachi morti e 4 completi pure con bachi morti, 1 doppiione con un baco morto ed una crisalide, un doppiione con due crisalidi, 1 bozzolo con crisalide giallosa, n. 76 con 76 crisalidi normali.

Acetato di uranio : 3 bachi giallosi, 4 bachi marci, 3 bozzoli macchiati, 4 bozzoli incompleti con bachi morti, 76 bozzoli con 76 bachi normali.

Ag NO_3 : 1 baco gialloso, 2 marci, 3 bozzoli incompleti, 60 bozzoli completi, ma assai più piccoli dei controlli e di quelli, per tutti gli altri trattamenti (anche le crisalidi molto più piccole che nei controlli benchè perfette), 5 bachi incrisalidarono senza aver filato.

Dei trattati con Cd 106 morirono prima della terza muta e il resto dopo la muta. Prelevai allora altri 200 bachi in terza muta e diminui la concentrazione della soluzione di cloruro di Cd da N/100 a N/200. Con questo trattamento dei 200 trattati soltanto 17 bachi riuscirono ad arrivare al sonno, sonno che si protrasse più a lungo dei controlli (questi erano mutati già il 25/7, mentre al 28/7 i trattati con Cd erano ancora in sonno). Al 29/7 solo 8 bachi superarono la muta e mangiarono i primi giorni e poi morirono. Evidentemente il Cd appare tossico per i bachi. E' probabile che esso agisca bloccando il gruppo solfidrilico di sostanze attivanti lo sviluppo.

Nella tabella seguente (Tab. 1) sono riportati i pesi di 100 individui a partire dalla terza muta, per i singoli trattamenti. Fatta eccezione dei trattati con il nitrato di argento i dati concordemente per tutti gli stadi di sviluppo, mostrano andamento pressochè simile a quello dei controlli; anzi in alcuni casi come per i trattamenti con Fe, Cl_3 , con uranio acetato con Al Cl_3 , con Zn Cl_2 i valori per la terza e la quarta muta sono lievemente più elevati che per i controlli. Lo stesso si può dire per il peso delle crisalidi e delle cortecce seriche e per il rapporto serico.

Si scosta nettamente invece il comportamento per i trattati con Ag NO_3 . Questo oligo-elemento evidentemente se ingerito in eccedenza al fabbisogno determina un accrescimento meno inteso del normale, tanto che il peso delle crisalidi è assai ridotto, da 144 % nei controlli a 87.5 %. Anche la corteccia serica ha un valore assai più basso (da 22 % per i controlli a 13.5 % per i trattati) (Vedi fig.1). Ciò nonostante il rapporto serico risulta più elevato di tutti gli altri trattamenti e dei controlli stessi (13.25 per i controlli, 14.83 per i trattati con Ag NO_3). Evidentemente nonostante l'abbassamento metabolico l'utilizzazione delle proteine per la sintesi della seta è maggiore che per la costruzione degli altri tessuti. Questo risultato è confermato anche dai dati sull'azoto totale come si può osservare dalla tabella seguente (Vedi Tab. 2).

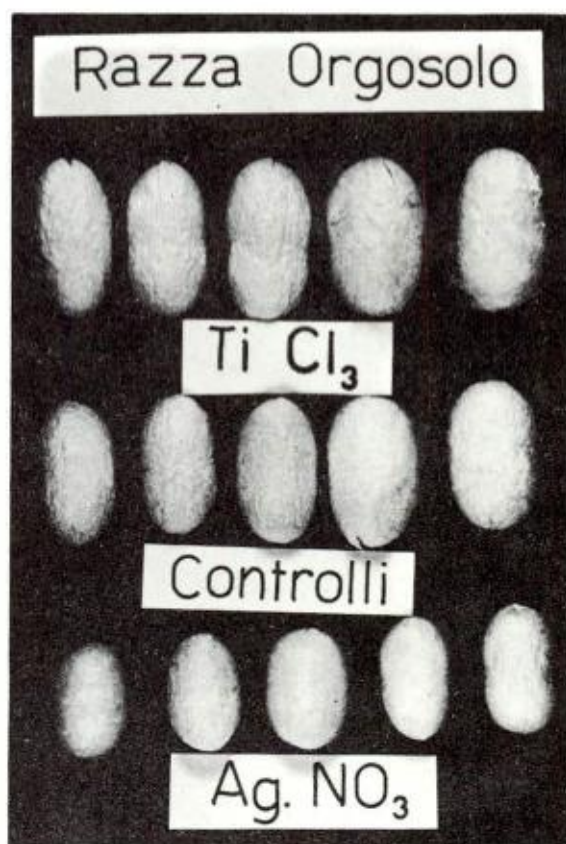


Fig. 1

Per tutti i trattamenti in esame se si considera il contenuto in azoto totale misurato in mg. per 1 cc. di emolinfa si osserva un incremento del terzo giorno 5^a età a maturi ed i valori, se si fa eccezione per i trattati con Ag NO_3 , si aggirano tutti attorno a quelli dei controlli (le variazioni essendo nei limiti dell'errore sperimentale). Viceversa se si osservano i dati in mg. per un g. di peso secco si riscontra un incremento dal 3 al 5° giorno di V^a età ed in tutti una lieve diminuzione durante il massimo accrescimento. Ciò probabilmente è la conseguenza di una maggior idratazione dell'emolinfa, caratteristica di questo stadio, ma a maturità si osserva un incremento anche rispetto ai dati del V° giorno 5^a età.

Sia che si considerino i valori medi dell'azoto totale per 1 cc. di emolinfa o per 1 g. di peso secco, soltanto per i trattati con Ag NO_3 si osserva un netto scostamento dai valori dei controlli (rispettivamente da 9,29; 106,13 a 6,50; 87,65), mentre per tutti gli altri trattamenti i valori sono pressochè uguali a quelle dei controlli, anzi in qualche caso lievemente superiori come nei trattati sia con Al Cl_3 che con acetato di uranio.

La tabella 3 mette in confronto le relazioni fra numero di emociti e consumo di ossigeno. E' evidente che non vi è alcuna relazione fra numero di emociti e consumo di ossigeno, infatti sia prendendo in esame i valori per gli emociti nei quattro stadi in esame che i valori medi per tutti gli stadi non si osserva una correlazione fra numero, di emociti e consumo di ossigeno. Così pur osservandosi, specialmente, per il trattamento con Zn Cl_2 un aumento del numero degli emociti rispetto ai controlli (valore medio per i controlli 2.000 e per i trattati 3.650), il valore medio per il consumo di O_2 resta pressochè invariato (per i controlli 6,6 e per i trattati con Zn Cl_2 6,1).

Soltanto per il trattamento con Zn Cl_2 si osserva un notevole incremento nei quattro stadi in esame del numero degli emociti rispetto ai controlli. Secondo il reperto di FRIEND (1958) AKAO avrebbe riscontrato un alto contenuto in Zn negli organi riproduttivi dell'emolinfa di *Bombyx mori* dimostrando che tale elemento è probabilmente importante per la

riproduzione. Deboli incrementi si riscontrano anche per i trattati con Ag NO_3 , con Mn Cl_2 e con Ti Cl_3 con Fe Cl_3 .

Ma per i trattati con Ti Cl_3 soltanto, si osserva un incremento del consumo di O_2 dell'emolinfa benchè il numero degli emociti si assai inferiore a quello dei trattati con Zn Cl_2 e solo lievemente superiore a quello dei controlli.

Evidentemente queste aumento nei trattati con Ti Cl_3 ed anche, benchè un po' meno, nei trattati con uranio acetato deve ricercarsi forse in una maggior produzione di ossidasi in un esaltamento delle attività enzimatiche.

Questo risultato è così in perfetto accordo con i dati della letteratura.

Secondo CHAUVIN (1956) l'emolinfa del baco da seta assorbe una certa quantità di ossigeno, ma questo gas deve entrare immediatamente in combinazione perchè il tenore in O_2 libero dell'emolinfa non è che del 0,5 al 0,7 %. Quest'assorbimento è massimo a metà di ogni stadio minimo alla fine, accentuandosi prima della ninfosi. Per aggiunta di tirosina la curva di assorbimento dell' O_2 dell'emolinfa tende a risalire sicchè evidentemente la tirosina costituisce un componente possibile del sistema catalizzatore d'ossidazione. Tuttavia il tenore in rapporto con il consumo di ossigeno del sangue.

La melanosi nei bachi da seta ad opera dei fermenti ossidanti varia a seconda degli stadi e a seconda delle razze; così il sangue di razze a bozzoli bianchi annerisce più celermente che quello delle razze a bozzolo colorato.

La tirosinasi nel baco da seta ha il suo optimum a pH 6,6 a 37° e l'appare più intensa nei maschi che nelle femmine, il massimo osservandosi in V^a età.

La conversione della fenilalanina in tirosina è molto attiva nel corpo del baco da seta ed appare una delle tappe per la biosintesi della tirosina.

Secondo THOMSON (1949) anche i *corpora allata* influenzerebbero il consumo di O_2 , ma questo autore attenne un aumento del consumo di O_2 solo nelle femmine in cui si sono impiantate 3 paia di *corpora al-*

lata, mentre si nota una diminuzione per allatectomia in entrambi i sessi.

CONCLUSIONI.

1) Il Cloruro di Cadmio risulta tossico per i bachi da seta almeno nella razza in esame, la Orgo-solo, quando viene somministrato su foglia di gelso spruzzata con rispettiva soluzione N/100 ed è poco tollerato anche a diluizione 1 : 2. Questo è anche spiegabile, se si pensa che tale elemento non è stato riscontrato neanche in tracce nè nei tessuti fogliari nè in quelli del baco.

2) Fra gli altri sali minerali in esame ($Zn Cl_2$, $Mn Cl_2$, $Fe Cl_3$, $Al Cl_3$, $Ti Cl_3$, Uranio acetato $Ag NO_3$ somministrati ugualmente con la foglia (spruzzata con le rispettive soluzioni N/100) a partire dalla terza età fino alla filatura, soltanto per il trattamento con $Ag NO_3$ si è messo in rilievo una curva di accrescimento più bassa rispetto ai controlli e a trattati con gli altri sali.

3) Analogamente, i valori in azoto totale (sia in mg. per cc. di emolinfa che in mg. per g. di peso secco) si mantengono nel corso della V^a età nettamente più bassi solo per i trattati con $Ag NO_3$.

4) Un comportamento inverso invece si ottiene nei riguardi del rapporto serico; il cui dato più elevato si osserva solo per i trattati con $Ag NO_3$. Questo risultato parrebbe dimostrare un'azione dell' Ag favorevole alla secrezione della seta (*) per lo meno nel senso che rimane meno ostacolata la incorporazione dell'azoto nel secreto serico che nell'accrescimento dei tessuti.

5) Poichè secondo COMENCE e GUEL BENZU nella foglia del gelso l' Ag sarebbe già in eccesso, è probabile che la diminuzione del metabolismo, oltre essere dovuta a minor ingestione di foglia, resa meno appetibile dal trattamento, sia determinata, almeno in parte, anche dal maggior lavoro richieste alle vie digerenti per l'eliminazione di un così forte

(*) Questa azione dell' Ag parrebbe analoga a quella del Co rilevata da BOSTICCO e ARNAUDO (1956). Questi AA. ritengono infatti che il Co quale elemento micronutritivo esplichi un'azione eccitante sulla secrezione della ghiandola serigena, tramite un indispensabile previo arricchimento da parte dei seritteri di acido ribonucleico.

eccesso, rispetto alla quantità richiesta per il normale sviluppo ed accrescimento.

6) Dato che i bachi hanno dimostrato di poter svilupparsi su foglia di gelso spruzzata di sali di Ag è probabile che si renda possibile con discreto esito l'allevamento su foglie di varie specie di *Ficus*, spruzzate di soluzioni diluite di sali di Ag (ad es. Ag NO₃ N/200 e N/300), per correggerne la carenza in Ag di tale alimento. I precitati AA. infatti ritengono che in carenza di Ag non sia possibile lo sviluppo del baco da seta.

7) Il numero degli emociti durante la V^a età larvale risulta aumentato pressochè del doppio rispetto ai controlli solo per i trattati con Zn Cl₂, ma discreto aumento si nota anche per i trattati con Ag NO₃ ed incrementi rispettivamente sempre più deboli per quelli trattati con Mn Cl₂, Ti Cl₃ e con Fe Cl₃; nei trattamenti con Uranio acetato (*) e con Al Cl₃ il numero medio degli emociti è pressochè simile a quello dei controlli.

8) Nessuna correlazione si osserva fra aumento del numero degli emociti ed intensità respiratoria dell'emolinfa; questa pressochè per tutti i trattamenti va aumentando dai primi giorni della V^a età fino all'avvicinarsi della salita al bosco, mentre il numero degli emociti va diminuendo.

9) L'esame dei valori medi del consumo di O₂ dell'emolinfa durante la V^a età larvale per i vari trattamenti non mette in rilievo alcun scostamento significativo da quello dei controlli se si fa eccezione per i trattati con Ti Cl₃ per cui si ottiene un valore più elevato, la cui cause è evidentemente da attribuirsi o ad una maggior produzione di enzimi ossidasi o ad un esaltamento della attività di questi.

(*) CHAUVIN riporta come lo studio degli elementi radioattivi in *Bombyx* ha messo in rilievo nel corpo della pupa priva di cuticole tracce di uranio e come nella seta si debbano riscontrare tracce più rilevanti.

TAB. I : PESO DI N°. 100 INDIVIDUI DURANTE L'ALLEVAMENTO CON I RISPETTIVI TRATTAMENTI.

SOSTANZE USATE	MUTATI III ^a	MUTATI IV ^a	3° g. V ^a età	5° g. V ^a età	MASS. ACCR.	MATURI	CRISALIDI ♀ ♂	CORTECCIA SERICA	RAPPORTO SE- RICO MEDIO
Zn Cl ₂	14.02	75.00	182.50	315.00	425.00	342.00	140.00	20.00	12.50
Mn Cl ₂	13.55	72.40	187.50	310.00	428.00	292.00	155.00	23.00	12.92
Fe Cl ₃	14.00	73.10	178.25	312.50	433.60	295.00	138.00	22.00	13.75
Al Cl ₃	14.10	15.64	186.00	325.00	404.00	302.50	133.00	19.01	12.50
Controlli	<u>13.85</u>	<u>70.00</u>	<u>188.50</u>	<u>320.00</u>	<u>420.00</u>	<u>302.00</u>	<u>144.00</u>	<u>22.00</u>	<u>13.25</u>
Ti Cl ₃	12.80	69.20	199.75	305.00	405.00	298.00	147.00	20.00	11.97
URANIO ACETATO	14.20	75.60	200.05	305.25	388.00	287.00	125.00	20.00	13.79
Ag NO ₃	12.60	68.40	148.60	285.00	285.00	245.00	87.50	13.50	14.63

TAB. II : CONTENUTO IN AZOTO TOTALE IN MG. PER A e C. DI EMOLINFA (1) E PER 1 G. DI PESO SECCO (2).

SOSTANZE USATE	3° g. V età		5° g. V età		MASS. ACCR.		MATURI		VALORI MEDI	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Zn Cl ₂	5.25	94.72	7.35	107.30	11.41	100.00	12.25	116.86	9.06	104.72
Mn Cl ₂	5.25	94.70	8.05	110.01	11.20	100.02	12.25	117.00	9.18	105.63
Fe Cl ₃	5.25	94.77	8.20	112.00	9.25	90.00	11.90	113.06	8.70	102.45
Al Cl ₃	5.46	98.00	7.84	114.00	11.06	100.00	12.95	123.33	9.32	108.83
<u>Controlli</u>	<u>5.46</u>	<u>98.56</u>	<u>7.00</u>	<u>102.22</u>	<u>11.55</u>	<u>98.75</u>	<u>13.16</u>	<u>125.00</u>	<u>9.29</u>	<u>106.13</u>
Ti Cl ₃	5.25	94.65	8.05	110.55	11.20	101.07	11.55	115.50	9.01	105.44
URANIO ACETATO	5.25	95.00	8.05	110.50	11.55	100.05	13.30	125.08	9.53	107.65
Ag NO ₃	4.90	89.00	5.85	97.50	6.65	78.00	8.61	86.10	6.50	87.65

TAB. III : N° EMOCITI PER mm³ E CONSUMO DI O₂ (QO₂) PER 1 cc. DI EMOLINFA.

SOSTANZE USATE	E T A'									
	3° g. V ^a età		5° g. V ^a età		MASS. ACCR.		MATURI		VALORI MEDI	
	N° emociti	QO ₂	N° emociti	QO ₂	N° emociti	QO ₂	N° emociti	QO ₂	N° emociti	QO ₂
Zn Cl ₂	4200	-5.3	3800	-5.0	4400	-6.7	2200	-7.4	3650	-6.1
Mn Cl ₂	2200	-5.3	2400	-5.3	3000	-8.5	1800	-9.1	2350	-7.0
Fe Cl ₃	2000	-2.8	2200	-5.9	2800	-7.5	2200	-8.7	2300	-6.2
Al Cl ₃	2000	-6.6	2000	-6.0	2200	-6.7	1800	-5.6	2000	-6.2
<u>Controlli</u>	<u>2200</u>	-7.0	<u>2000</u>	-4.9	<u>2600</u>	-7.3	<u>1200</u>	-7.5	<u>2000</u>	-6.6
Ti Cl ₃	2000	-7.7	2200	-6.5	3600	-9.7	1800	-9.5	2400	-8.3
URANIO ACETATO	2000	-7.2	2000	-5.4	2400	-8.4	1800	-8.4	2050	-7.3
Ag NO ₃	3800	-4.3	2600	-5.6	2800	-7.8	2000	-8.6	2800	-6.6

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RIASSUNTO.

In esperimenti di somministrazione insieme con la foglia del gelso di alcuni oligo-elementi durante lo sviluppo larvale e crisalide in Bombyx mori, si sono raggiunte le seguenti conclusioni : il Cadmio si è manifestato assai tossico per i bachi durante lo sviluppo larvale. Zn, Mn, Fe, Al, Ti, U appaiono ben tollerati se spruzzati sulla foglia in soluzione salina N/100.

Il sali di questi elementi non influiscono sull'azoto totale dell'emolinfa durante la V^a età, e non modificano nè la curva di accrescimento nè il rapporto serico rispetto ai controlli.

Viceversa il trattamento con Ag NO₃ modifica, abbassandole, sia la curva di accrescimento, che quella per l'azoto totale, pur osservandosi un rapporto serico alquanto più elevato rispetto ai controlli e agli altri trattati.

Questo risultato parrebbe dimostrare un'azione dell'Ag favorevole alla secrezione della seta per lo meno nel senso che rimane meno ostacolata l'incorporazione dell'azoto nel secreto serico che nell'accrescimento dei tessuti.

Poichè l'Ag anche addizionato alla foglia del gelso non modifica il decorso dello sviluppo, probabilmente si potrà tentare, forse con risultato migliore di quelli fino ad ora ottenuti, l'allevamento su foglie di varie specie di Ficus correggendo la loro carenza in Ag.

Non è risultata alcuna correlazione fra numero di emociti e consumo di ossigeno della emolinfa : si è però ottenuto un innalzamento del valore medio del consumo di O₂ per la V^a età soprattutto per il trattamento con Ti. Tale aumento è evidentemente dovuto ad una maggior produzione di enzimi ossidativi.

Il numero degli emociti tuttavia per la V^a età larvale si rivela pressochè doppio rispetto ai controlli per il trattamento con Zn - discorso aumento si è notato anche per i trattati con Ag NO₃ ed assai più lieve per i trattati con Mn, Ti e con Fe.

L'INFLUENCE DE CERTAINS ELEMENTS OLIGODYNAMIQUES SUR LE DEVELOPPEMENT DE LA LARVE ET DE LA CHRYSALIDE AINSI QUE SUR L'ACTIVITE RESPIRATOIRE DES HEMOCYTES CHEZ BOMBYX MORI.

Résumé.

Les effets des microéléments introduits dans l'alimentation de Bombyx mori, sur le développement larvaire et pupal de cet animal ont été étudiés au cours d'une série d'expériences dont voici les conclusions :

1. Le chlorure de Cadmium est toxique pour les vers à soie (du moins les races que nous avons testées avec Orgosolo) nourris de feuilles de mûrier "arrosées en aspersion" d'une solution à N/100. De même en réduisant la concentration à la moitié de cette proportion la tolérance est

faible. Ce résultat n'est pas surprenant étant donné que le Cadmium n'existe pas même à l'état de traces dans le corps du ver à soie, non plus qu'il n'existe pas dans la composition des feuilles de mûrier.

2. D'autres sels minéraux ont été administrés, au 5ème âge à la maturité des vers, par aspersion sur les feuilles d'une solution à N/100 de : $Zn Cl_2$, $Mn Cl_2$, $Fe Cl_3$, $Ti Cl_3$, $Ag NO_3$, Acétate d'Uranium. Pour $Ag NO_3$, seulement la courbe de croissance est plus basse comparée aux courbes des témoins.

3. De même les valeurs en N total (à la fois en mg pour 1 cc. de sang et en mg. pour 1 g. de poids sec) deviennent, au cours du 5ème âge, nettement inférieurs seulement après le traitement à $Ag NO_3$.

4. Pour ce traitement seulement le rapport soyeux est plus élevé. Ce résultat signifie peut-être que l'Ag diminue davantage l'incorporation de N dans les tissus larvaires plutôt que dans la sécrétion de la soie.

5. Reste à savoir pour quelle part le métabolisme réduit dépend de l'alimentation déficiente et pour quelle part il dépend de l'action toxique due à un excès d'Ag.

6. Puisqu'il est possible d'élever des vers à soie avec des feuilles aspergées de sels d'argent, nous essaierons de les élever avec des feuilles de figuier (*Ficus*) aspergées d' $Ag NO_3$ pour voir si après correction du manque d'Ag, les vers à soie pourraient être élevés avec cette nourriture.

7. Le nombre d'hémocytes pendant le 5ème âge, est presque doublé, comparaison faite avec les témoins, après traitement avec $Zn Cl_2$; un léger accroissement de leur nombre apparaît après traitement avec $Mn Cl_2$, $Ti Cl_3$ et $Fe Cl_3$. Dans les traitements à l'acétate d'Uranium et $Al Cl_3$ le nombre moyen des hémocytes décroît.

8. Il n'y a aucune corrélation entre l'augmentation du nombre des hémocytes et l'intensité de la respiration sanguine. Pendant tous les traitements, cette activité respiratoire croît depuis les premiers jours du 5ème âge, jusqu'à la maturité des vers à soie, alors que le nombre des hémocytes décroît.

9. Les valeurs moyennes de consommation d' O_2 par le sang pendant le 5ème âge ne sont pas très différentes de celles des témoins; c'est seulement après traitement au $Ti Cl_3$ que l'on constate une valeur nettement plus élevée.

INFLUENCE OF SOME OLIGOELEMENTS ON THE LARVAL AND PUPAL DEVELOPMENT IN *BOMBYX MORI* AND ON THE RESPIRATORY ACTIVITY OF HAEMOCYTES IN THE SAME

Summary.

The following conclusions have been reached in a series of experiments on the effects, during the larval and pupal development of *Bombyx mori* of microelements given by feeding :

1. Cadmium Chloride is toxic for silkworms (at least the breed we experimented with Orgosolo) giving mulberry leaves sparkled with N/100 solu-

tion. Also reducing the concentration to half of this one, the tolerance is scarce. This result is rather to be expected since Cadmium does not exist even in traces in silkworm body nor in mulberry leaves.

2. Other mineral salts have been administered sprinkled on the leaves in solution N/100, since third age till maturity: Zn Cl_2 , Mn Cl_2 , Fe Cl_3 , Ti Cl_3 , Ag NO_3 , Uranium acetate. Only for Ag NO_3 the curve of growth is lower in comparison with the controls.

3. Also values in total N (both in mg. for 1 cc. of blood and in mg. for 1 g. of dry weight) result, in the course of the fifth age, sharply lower only after treatment with Ag NO_3 .

4. Just for this treatment, and only for it, the serie ratio is higher. This result does not mean probably that Ag is lowering more the incorporation of N in larval tissues, than its incorporation in silk secretion.

5. Remains to be seen how much the lowered metabolism depends on a deficient alimentation and how much on toxic action of an excessive amount of Ag.

6. Since it is possible to grow silkworms with leaves sprinkled with Ag salts we shall try to rear with Ficus leaves sprinkled with Ag NO_3 in order to see if, once corrected the deficiency of Ag, silkworms could grow with such food.

7. The number of haemocytes, during the fifth larval age, is almost doubled, in comparison with the controls, after treatment with Zn Cl_2 ; a relative rising of it appears also after treatment with Mn Cl_2 , Ti Cl_3 , and Fe Cl_3 . In treatments with Uranium acetate and Al Cl_3 the mean number of haemocytes is similar to those of controls.

8. There is no correlation between augmentation of the number of haemocytes and intensity of blood respiration. For all treatments, this respiratory activity is increasing from the first days of the age to the maturity of silkworms, while the number of haemocytes is decreasing.

9. The mean values of the O_2 consumption by blood during the fifth larval stage does not show generally significant divergence from the controls, only after treatment with Ti Cl_3 higher value is found.

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VUE D'ENSEMBLE
DES RECHERCHES SUR L'ALIMENTATION PERMANENTE
DU VER A SOIE.

Par M. Michel PASCAL (France) (*).

Depuis longtemps on a pensé que la rentabilité de toute organisation pour la production de cocons était liée à la possibilité de réaliser au cours de l'année une succession ininterrompue d'élevages de Vers à soie. Ce souci n'est d'ailleurs pas spécifiquement séricicole puisqu'on tente actuellement de réaliser pour diverses raisons l'élevage continu de nombreux insectes dont en particulier plusieurs lépidoptères.

- Le premier pas à réaliser dans cette perspective semble être la mise au point d'une alimentation à base de végétal polyvalent proposé à l'état frais.

Nos essais nous ont confirmé que l'aliment de remplacement possible et naturellement le mieux adapté au Ver à soie reste le scorsonère, *Scorzonera hispanica*, mais que certaines précautions sont cependant à prendre dans la préparation des repas. Reste une expérimentation à réaliser pour obtenir des races de scorsonère à feuilles sélectionnées pour les caractères suivants : résistance au froid et à l'oïdium, absence de pilosité, richesse azotée et forte production ; tout étant à faire dans ces divers domaines.

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Il est à noter que le scorsonère permettrait de couvrir dans sa totalité la période hivernale mais qu'il conviendrait de trouver une utilisation industrielle des racines produites et non écoulées pour la consommation humaine.

Nous avons également prospecté la flore naturelle régionale pour y découvrir d'autres plantes de remplacement. C'est dans cet esprit que les essais portant sur *Podospermum laciniatum* (composée) sont actuellement poursuivis. Cette plante très commune est susceptible d'amélioration par sélection et culture. Elle est naturellement bien adaptée au Ver à soie et donne des résultats s'approchant de ceux que donnent le scorsonère. Le *Podospermum* a l'avantage de résister aux plus basses températures enregistrées dans le Midi de la France.

A la suite de cinq générations élevées sur *Podospermum*, nous avons pu observer une plus grande homogénéité du développement et une diminution de la durée d'élevage sans que le poids individuel de soie produite augmente notablement.

- Dans un deuxième stade des études, on a pensé s'orienter vers la recherche de plantes qui par leur composition chimique seraient voisines du Mûrier mais que le Ver à soie n'accepte pas par manque de similitude gustative. On peut dans cette voie extraire des substances attractives du mûrier et les placer sur l'aliment proposé qui est alors ingéré. D'autres ont tenté d'obtenir des lignées de chenilles présentant la mutation "absence de chimiotropisme". Aucun résultat positif n'a pu encore être enregistré ici par ces procédés.

- Enfin, on peut s'orienter vers des recherches qui tendent à rendre l'alimentation de plus en plus indépendante de la saison et même du végétal.

Tout d'abord des essais de conservation de Mûrier. Les tentatives de conservation autres qu'une conservation limitée par le froid laquelle ne constitue en fait qu'une mise en survie des feuilles, ont toujours été vouées à des échecs partiels. Ces diverses tentatives ont porté sur les procédés classiques de conservation ; depuis l'ensilage, la

dessiccation, la congélation, la conservation en milieux chimiques (SO_2 , Cl NA, Orthoxyquinoléine, Nipagine, etc...). Le seul procédé donnant quelques résultats reste la conserve classique par stérilisation humide (méthode Appert), mais des recherches restent à poursuivre pour déterminer les substances détruites ou modifiées par la chaleur et qui entraînent des troubles dans le développement normal de la larve. Les divers essais de supplémentation effectués n'ont pas été concluants.

Pour terminer signalons que des tentatives d'alimentation artificielle ont été poursuivies en tenant compte des formules mises au point chez d'autres insectes et également des connaissances actuelles sur la composition chimique du mûrier. Le problème du support et de sa protection contre la déshydratation est apparu très important; la prise de nourriture par contre ne pose pas de problème à partir d'extraits de feuilles de mûrier. La croissance est possible mais le premier obstacle à résoudre reste la réalisation des mues. Cette difficulté n'est pas le propre d'une alimentation sans végétal frais, nous l'avons rencontrée quoiqu'avec moins d'acuité sur la laitue par exemple, les chenilles dépassant le poids et la taille de la mue sans que celle-ci intervienne.

L'ensemble de ces travaux ont été rapportés plus en détail dans un mémoire paru aux Annales des Epiphyties de l'I.N.R.A. (*).

En conclusion, nous souhaitons qu'un maximum de recherches soient poursuivies dans cette voie. Pour notre part nous nous orientons actuellement vers l'étude biochimique de ces problèmes, orientation qui est rapportée par ailleurs.

(*) LEGAY (J. M.), PASCAL (M.) et BAUD (L.) - Contribution à l'étude de l'alimentation chez le Ver à soie.

Annales des Epiphyties, n°3, pp. 324-359, 1959.

RESUME.

Nos recherches sur l'alimentation permanente du Ver à soie ont comporté plusieurs étapes.

La première a consisté en une étude des aliments les mieux acceptés et permettant une croissance normale ; le Scorsonère et le Podospermum ont répondu à ces expériences ; sur ce dernier après cinq générations , des résultats intéressants ont été observés.

Dans un deuxième stade nous avons proposé des végétaux divers , qui seuls ne sont pas attaqués par les larves. Ils sont ingérés si on leur ajoute les substances attractives contenues dans le Mûrier.

Enfin , nous avons essayé de réaliser une alimentation de plus en plus artificielle, avec les conserves de Mûrier ou les régimes déjà mis au point chez d'autres insectes. Dans ces diverses tentatives la "mue " constitue un obstacle sérieux, empêchant la poursuite des expériences.

SURVEY OF RESEARCHES ON PERMANENT ALIMENTATION OF SILKWORM.

Summary

Our research works on the permanent alimentation of the silkworm required several stages.

The first one was a study on the best accepted foods allowing a normal growth; Scorsonera and Podospermum answered to these requirements; after five generations interesting results were observed on the latter.

In a second stage , we proposed various plants which alone are not eaten by the larvae but are ingested when adjunction is made of the attractive substances contained in the mulberry-tree.

At last , we tried to realize a more and more artificial alimentation with tinned mulberry leaves or with diet already found out for other insects. During those various essays , the molt constitutes a serious handicap which stops prosecuting the experiments.

EFFECT OF CHLOROMYCETIN ON THE METABOLIC RATE
IN THE SILKWORM, *BOMBYX MORI* L.

By Mr B. SHYAMALA (India) (*)

Since chloromycetin in small quantities has a growth promoting influence, it was of interest to investigate whether chloromycetin had any influence in the hormones of the organism. However, since there is no method available for a rapid assay for hormones in insects, it was thought that a study of the metabolic rate in the silkworm (the rate of increase in oxygen uptake with body weight) would indirectly indicate the presence of any hormonal influence.

The experimental groups consisted of (1) untreated control worms, (2) worms administered water at the rate of 0.1 ml/day, and (3) worms administered chloromycetin (250 µg/ml) at the rate of 0.1/ml/day. After 5-6 days of the experiments, the uptake of oxygen by each group was measured at the end of a starvation period of about 10-12 hours.

The results show that total oxygen consumption in water administered group was almost the same as in the untreated group even though there was an increase in the body weight of the former group. In the chloromycetin treated worms there was an increase in the body weight as well as in the total oxygen consumption. When the oxygen uptake was calculated for 100 mg body weight, it was found to be low for water fed group and significantly high for treated worms, as the accompanying results reveal.

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TABLE I : OXYGEN UPTAKE BY SILKWORMS (BODY WT. EXPRESSED IN MG.)
(OXYGEN UPTAKE EXPRESSED IN μ l/5 min. INTERVALS).

	Water	Water dosed	Chloromycetin dosed
Total O ₂ uptake (average)	24.72	24.60	28.90
Body weight (average)	303.1	364.4	390.4
Oxygen uptake / 100 mg. body weight (1 expt.)	8.94 $\pm$ 0.60	6.67 $\pm$ 0.42	7.74 $\pm$ 0.42 *
11 experiment	7.25 $\pm$ 0.496	6.43 $\pm$ 0.262	7.14 $\pm$ 0.339 **

* not significant

** significant at 5 % level.

In the log-log plot of respiration against body weight, the rate of increase of body weights was not found to be appreciably different for the three groups as indicated by the regression lines. Hence it may be concluded that chloromycetin might not exert an hormonal influence in promoting growth.

The increased respiration with chloromycetin might be attributed to increased intestinal absorption, especially of minerals since chloromycetin also produces increased mineral deposition as shown by an increased specific gravity of haemolymph and increased ash content of the larvae as a whole. The thinning of the gut wall in antibiotic fed chickens has been noticed by several workers and has been presumed to contribute to a greater intestinal absorption. The present finding that chloromycetin feeding increases respiration strongly supports the view that the antibiotic is favouring an active uptake and transport of minerals.

EFFET DE LA CHLOROMYCÉTINE SUR LE TAUX MÉTABOLIQUE CHEZ LE VER À SOIE, Bombyx mori L.

Résumé.

L'Auteur recherche l'effet de la chloromycétine sur les hormones en étudiant le taux métabolique chez les vers à soie traités à la chloromycétine et en établissant des comparaisons pondérales avec des vers témoins. En conclusion, la chloromycétine n'exerce pas d'influence sur les hormones de croissance mais elle favorise le transport et le stockage des matières minérales.

MICRO-ELEMENTS IN THE NUTRITION OF
THE SILKWORM, *BOMBYX MORI* L.

By Mr S. SRIDHARA (India) (*).

Eventhough a large amount of work is being carried out on the nutritional and metabolic aspects of insects, very little information is available on their mineral element requirements and on the inter-relationship between different elements. Therefore, a study of the effect of cobalt and manganese on the nutrition and metabolism of the silkworm, *Bombyx mori* L., was undertaken.

Experiments conducted showed that cobalt upto a concentration of 100 γ /ml is beneficent for its growth, whereas at 200 γ /ml it is slightly toxic. Therefore, a reserval of the toxicity produced by cobalt at a concentration of 1000 γ /ml, was tried with different concentrations (200 γ , 400 γ , 600 γ /ml each) of manganese and iron. It was found that in spite of the fact that manganese is toxic at 200 γ /ml level, and cobalt at 1000 γ /ml level, and the growth response of the worms receiving manganese with cobalt at these toxic levels was high. This indicated to a competitive relationship between the two elements. However, relationship between iron and cobalt was not as conspicuous.

Analyses of the excreta of the insects dosed with these elements revealed that there was progressive increase in the manganese excreted from the control to those receiving increasing amounts (200 γ ,

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400 γ and 600 γ /ml) of the element. However, the amount of manganese excreted by those receiving manganese together with cobalt was the same as that excreted by the insects receiving only manganese at the respective concentrations. From this it may be concluded that cobalt does not affect the excretion of manganese or alternatively that it does not affect the intestinal uptake of manganese.

Further experiments carried out with different concentrations of manganese (100 γ and 200 γ /ml) and cobalt (100 γ , 200 γ , and 400 γ /ml) showed that manganese at the 100 γ /ml level increased growth. However, the results expressed in a graph as substrate concentration against rate of growth proved conclusively the existence of a competitive antagonism between the elements. The quantitative data recorded are presented in the following table.

TREATMENT	GROWTH RESPONSE (in gm.)
1. Control	3.0035
2. Control + cobalt	
a) 400 γ /ml	5.0186
b) 200 γ /ml	2.7373
c) 100 γ /ml	2.5203
3. Manganese + cobalt	
a) 100 + 400	5.2466
b) 100 + 200	3.4807
c) 100 + 100	2.9298
4. Manganese + cobalt	
a) 200 + 400	3.4286
b) 200 + 200	2.8602
c) 200 + 100	2.5858

Note : The elements were fed with mulberry feed (smeared) 0.1 ml twice a day during the IV instar and 0.2 ml twice a day during the V instar.

LES OLIGO-ELEMENTS DANS L'ALIMENTATION DU VER A SOIE, Bombyx mori L.

Résumé.

L'Auteur étudie les effets du Cobalt et du Manganèse sur la nutrition et le métabolisme du Ver à soie.

Quant à la croissance des vers, le cobalt et le manganèse ont des effets compétitifs, mais le cobalt n'affecte ni l'excrétion ni le stockage du manganèse.

11ème CONFERENCE TECHNIQUE SERICICOLE INTERNATIONALE
MURCIE (Espagne) - Avril 1960

TISSUE CULTURE
OF THE SILKWORM EMBRYO.

By Mr Takeo TAKAMI (Japan) (*)

Tissue culture in insects is an attractive theme of many entomologists and pathologists in recent years. And many contributions have been made to this field by the studies in the silkworm, that is, most of the successful results reported on this theme, though they are still small in number, are of the silkworm, especially of its ovarian tissue (Trager 1932, Wyatt 1956, Grace 1958, Aizawa et Vago 1959). There has been no report, however, of the positive results on the embryo culture in insects but that of Bucklin (1953) in *Melanoplus*.

In vitro culture of silkworm embryos has been studied in connection with the diapause of eggs (Takami 1957, 1958, 1959, 1960). When cultures are made on the extract from non-diapausing silkworm eggs, explanted embryos of non-diapausing eggs show a remarkable difference in development from those of fully diapausing ones. In the former, segmentation of the ectoderm, formation of appendage and invagination of the stomodaeum and of the proctodaeum, etc., proceed until the stage just before the revolution, bristle formation and mandibular pigmentation being often reached. In the latter, the development is only partial or none. In cultures made on the extract from fully diapausing eggs, even non-diapausing embryos, which can grow actively on the extract from non-diapausing eggs as men-

(*) Mr Takeo TAKAMI, National Sericultural Experiment Station, Ministry of Agriculture and Forestry, Suginami-ku, Tokyo (Japan).

tioned above, show an only restricted development, hardly reaching appendage formation. These are typical cases. And there are intermediate or unexpected cases according to differences in variety, age and preserving condition of eggs used for experiments. Then cultures are made on the extract from non-diapausing eggs, diapausing embryos within two days after deposition develop as well as non-diapausing ones. And the older the explants of diapausing eggs are at the time of explantation, the less active their development is. The extract from diapausing eggs within two days after deposition is as effective as the one from non-diapausing eggs for culturing embryos, becoming less effective with the age (diapause) of the eggs. It is usual that the efficacy of the extract reaches the lowest level at about 30 days after deposition of diapausing eggs, and remains on the level about 100 days at 25° C., then changing to recovery in some measure. And it is fully recovered with termination of diapause. There is an exceptional type of diapausing eggs whose embryos are dormant showing no sign of development in vivo and in vitro, but whose extract is highly effective for culturing non-diapausing embryos. Such a type seems to be a variation in diapause due to environmental conditions.

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CULTURE DE TISSU D'EMBRYON DE VER A SOIE

Résumé.

La culture de tissu d'embryons de vers à soie a été étudiée en fonction de la diapause.

Quand les cultures sont réalisées sur des extraits provenant d'oeufs de vers à soie n'ayant pas subi la diapause, les embryons cultivés sur ces oeufs non-diapausés ont un développement très différent de celui des explants cultivés à partir d'oeufs ayant subi une diapause complète. Chez les premiers, la segmentation de l'ectoderme, l'invagination du stomodaeum, etc., ont lieu jusqu'au stade précédant la révolution, la formation des soies et la pigmentation mandibulaire ayant été atteinte. Dans les cultures faites sur des extraits d'oeufs ayant subi une diapause complète, même des embryons n'ayant pas subi de diapause montrent un développement très restreint.

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MURCIE (Espagne) - Avril 1960.

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11ème CONFERENCE TECHNIQUE SERICICOLE INTERNATIONALE
MURCIE (Espagne) - Avril 1960

ETUDE COMPARATIVE SUR L'ETOUFFAGE DES COCONS
A CONTRE COURANT ET A COURANT DIRECT.

Par M. André FROEHLI (France) (*).

OBJET DE L'ETUDE.

Cette étude a pour objet de déterminer les différences qualitatives dans le séchage des cocons pouvant être mises en évidence entre l'étouffage classique à contre-courant dit *méthodique* et l'étouffage à courant direct dit *non méthodique* adopté au Japon.

La qualité du séchage des cocons se définit par le degré de siccité obtenu dans un temps donné et par les résultats en filature.

II. CONDITIONS D'EXPERIMENTATION DE
CES DEUX METHODES D'ETOUFFAGE

Pour les deux méthodes nous avons utilisé notre étouffoir de laboratoire construit sur le principe de l'étouffoir à tiroir BIANCHI-DUBINI.

Cet étouffoir comprend cinq tiroirs superposés. La température de l'air pulsé est maintenue automatiquement à 80°.

Pour l'étouffage classique à contre-courant, les cocons sont mis dans le tiroir supérieur où la température est la plus basse, soit 63° et l'air le plus humide. Ils sortent après un cycle de 10 heures par le tiroir inférieur où la température est la

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plus élevée, soit 80° C. et l'air le plus sec (fig. 1).

Pour l'étouffage à courant direct les mêmes valeurs de températures et le même cycle ont été conservés.

Dans ce cas, l'inverse de l'étouffage classique, les cocons sont déposés dans le tiroir inférieur où la température est la plus élevée (80°C.) et sortent après le cycle de 10 heures par le tiroir supérieur où la température est la plus basse: 63° C. (fig. 2).

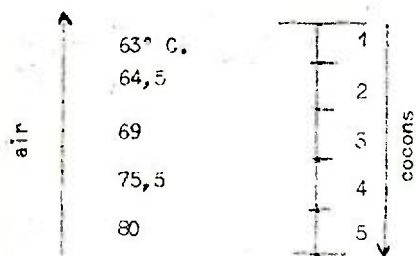


FIG. 1 - ETOUFFAGE CLASSIQUE
à CONTRE COURANT

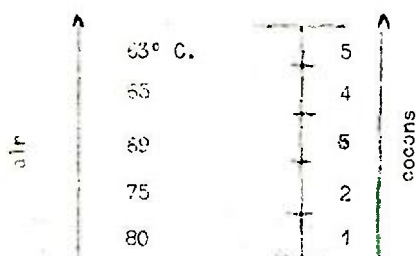


FIG. 2 - ETOUFFAGE à COURANT DIRECT

Pour l'expérimentation de ces deux méthodes nous avons utilisé respectivement 65 kg de cocons frais de croisement bijaune.

III. RESULTATS DES DEUX METHODES D'ETOUFFAGE EN CE QUI CONCERNE LE DEGRE DE SICCITE OBTENU

Nous traduisons ce degré de siccité dans le tableau I par le rapport du poids des cocons secs au poids des cocons frais exprimé en %.

TABEAU N° 1

Mode d'étouffage	Rapport sec / frais en % à l'étouffage	Rapport sec / frais en % après 45 jours
A contre courant	37.6	35.8
A courant direct	37.4	35.8

A l'examen de ces résultats nous pouvons en déduire que :

1) L'on obtient pratiquement le même degré de siccité dans les deux méthodes ; autrement dit , la dessiccation des cocons est aussi rapide dans l'étouffage à contre-courant que dans l'étouffage à courant direct dans les conditions de l'expérience.

2) Le séchage n'a pas été trop poussé , les cocons ont perdu de leur poids 45 jours après l'étouffage. Le rapport sec/frais dans les deux méthodes s'équilibre.

Remarque. On note une grande différence dans le processus de séchage entre l'étouffage à contre courant et l'étouffage à courant direct.

Dans ce dernier, la plus grande partie de l'humidité des cocons est enlevée initialement. Les cocons séjournent à la fin du cycle à une température relativement faible et dans une atmosphère partiellement saturée d'humidité.

Le temps de séchage *intégral* est par conséquent *infini* à cette température de 63° et les cocons ne risquent pas d'être "brûlés" en subissant un cycle d'étouffage plus long que nécessaire pour les amener au degré de siccité voulu. Les cocons ne sont jamais séchés à l'absolu comme cela peut se produire dans l'étouffage classique.

Cette considération est d'autant plus importante que tous les cocons d'un amas ou d'un élevage n'ont pas tous le même âge ; autrement dit, la même teneur en eau.

Il apparaît immédiatement que l'étouffage à courant direct utilisé dans les étouffoirs de type japonais est nettement préférable à l'étouffage classique du type BIANCHI-DUBINI.

IV. INCIDENCE DES METHODES D'ETOUFFAGE EN FILATURE.

Les cocons étouffés suivant ces deux méthodes ont été filés avec une bassine de type courant. La filature s'est effectuée dans les mêmes conditions pour chaque lot et suivant les normes définies par le laboratoire de Technologie de la Soie de la Station.

Les résultats figurent aux tableaux n°II et III, ils donnent les produits de filature obtenus sur des lots de 3.000 cocons chacun.

TABLEAU II. PRODUITS DE FILATURE DES COCONS DE CROISEMENT BIJAUNE ETOUFFES A CONTRE COURANT.

N° DU LOT	RAPPORT SEC/FRAIS en %	NOMBRE DE COCONS SECS (kg)	RENTREE EN SEC	FRISONS EN % DU POIDS DE LA SOIE	BASSINES EN % DU POIDS COCONS FILABLES
1	34.8	1.670	3.02	9.7	1.1
2	34.9	1.675	3.00	9.9	1.4
3	35.4	1.650	2.95	9.1	1.4
4	35.2	1.660	2.95	9.5	1.4
5	35.0	1.685	2.95	9.0	1.3
MOYENNE	35.0	1.668	2.97	9.45	1.3

TABLEAU III. PRODUITS DE FILATURE DES COCONS DE CROISEMENT BIJAUNE ETOUFFES A COURANT DIRECT.

N° DU LOT	RAPPORT SEC/FRAIS en %	NOMBRE DE COCONS SECS (kg)	RENTREE EN SEC	FRISONS EN % DU POIDS DE LA SOIE	BASSINES EN % DU POIDS COCONS FILABLES
6	35	1.660	3.02	11.2	1.6
7	35	1.670	3.02	10.0	1.1
8	35	1.660	3.02	10.2	1.6
9	35	1.675	3.05	10.7	1.4
10	34.6	1.690	2.94	9.3	1.2
MOYENNE	35.0	1.671	3.01	10.2	1.4

A l'examen de ces résultats, il semble que les cocons étouffés à contre courant soient meilleurs que ceux étouffés à courant direct tant du point de vue de la rentrée que du pourcentage de déchets.

Mais les écarts entre les valeurs trouvées pour les rentrées moyennes sont de 1.33 % et sont comprises dans l'ordre de grandeur des erreurs expérimentales et des erreurs dues à l'hétérogénéité des cocons.

Pratiquement on peut considérer qu'il n'y a pas de différences sensibles entre les produits de filature des cocons étouffés par l'une ou l'autre méthode.

La qualité de filature est exprimée par les résultats figurant dans les tableaux IV et V.

Les coefficients sont exprimés pour une filature en 20/22* à une vitesse de 60 t/mn des asples.

TABLEAU IV. QUALITE DE FILATURE DES COCONS DE CROISEMENT BIJAUNE ETOUTFES A CONTRE COURANT.

N° DES LOTS	APTITUDE A LA FILATURE en %	% DES BOUTS OBTENUS AU BATTAGE	% DE CASSES DE BAVE	COEFFICIENT DE JETTES		APTITUDE AU DEVIDAGE
				MOYEN	MINIMA	
1	44.5	67.8	52.0	1.61	1.06	65.8
2	43.5	66.7	53.2	1.62	1.05	65.2
3	42.7	65.1	52.5	1.56	1.02	65.6
4	44.2	65.5	47.9	1.52	1.03	67.7
5	43.9	66.0	50.2	1.57	1.04	66.5
MOYENNE	43.7	66.2	51.1	1.57	1.04	66.1

TABLEAU V. QUALITE DE FILATURE DES COCONS DE CROISEMENT BIJAUNE ETOUTFES A COURANT DIRECT.

N° DES LOTS	APTITUDE A LA FILATURE en %	% DES BOUTS OBTENUS AU BATTAGE	% DE CASSES DE BAVE	COEFFICIENT DE JETTES		APTITUDE AU DEVIDAGE
				MOYEN	MINIMA	
6	40.6	63.5	56.5	1.65	1.05	64.0
7	43.9	67.3	53.5	1.63	1.06	65.2
8	44.5	66.8	50.3	1.59	1.05	66.5
9	38.7	61.0	57.7	1.69	1.07	63.5
10	43.7	66.0	50.8	1.57	1.04	66.4
MOYENNE	42.3	64.9	53.7	1.62	1.05	65.1

Dans la dernière colonne de ces tableaux figure l'aptitude au dévidage calculée suivant les normes japonaises.

Dans la limite des erreurs dues à l'hétérogénéité des cocons et de l'expérience, les valeurs figurant dans ces tableaux ne présentent pas de diffé-

(*) deniers.

rences d'où l'on puisse tirer une conclusion de valeur.

Pratiquement, on peut considérer qu'il n'y a pas de différence au point de vue de la qualité à la filature des cocons étouffés à contre courant et à courant direct.

Il est à noter que ces résultats sont dans l'ensemble médiocres du fait de la qualité défectueuse des élevages de vers à soie et des conditions climatiques exceptionnelles de 1957. Ils ne donnent pas des valeurs pouvant servir d'indice de qualité pour les cocons de croisement bijaune.

CONCLUSION.

Malgré le fait de résultats semblables en ce qui concerne les deux modes d'étouffage, l'étouffage à courant direct est pourtant à préconiser pour sa sécurité de séchage.

Il est d'ailleurs possible que ce dernier mode d'étouffage soit valable plus particulièrement pour les croisements de type japonais, en raison du comportement de ces cocons à la cuisson et de l'aptitude résultante en filature.

COMPARATIVE STUDY ON THE COCOON DRYING WITH COUNTERCURRENT AND DIRECT CURRENT.

Summary.

The countercurrent and direct current drying are studied on bi-yellow cross-bred cocoons, from the points of view of the drying degree and reeling qualities.

The direct current drying was realized by inverting the running of the cocoons in a laboratory dryer of the standard type BIANCHI-DUBINI. The same cycle and temperatures as in the standard countercurrent drying were kept.

The dryness degree of the cocoons is the same in both case. The direct current drying however must be recommended owing to the drying safety.

The reeling qualities of the cocoons dried by both the methods are almost the same.

LES INCIDENCES DES PRINCIPALES CARACTERISTIQUES
SPECIFIQUES DES COCONS SUR LES CONDITIONS
DE FONCTIONNEMENT DE LA BASSINE AUTOMATIQUE
DU TYPE TAMA 10.

Par M. André FROEHLY (France) (*)

Le graphique représente d'une façon générale les incidences des principales caractéristiques spécifiques des cocons sur les conditions de fonctionnement de la bassine automatique du type Tama 10.

On notera en premier lieu l'intérêt de traiter des cocons parfaitement homogènes provenant de lots soigneusement triés et calibrés.

En dehors des points communs avec les conditions de la filature en bassine classique on peut relever essentiellement les incidences :

1) de la forme des cocons sur l'uniformité de l'hydratation et sur l'efficacité du mécanisme d'alimentation des bouts.

2) de la structure de la coque et de la longueur sans rupture de la bave sur l'efficacité du triage des détachés et des pelettes.

3) de la nature et du degré de coagulation de la séricine sur la préparation à la cuiseuse où il est extrêmement difficile de concilier le degré de cuisson avec l'impératif technique de rendre les cocons plongeurs.

(*) M. André FROEHLY, Agent Technique Principal, Laboratoire de Technologie de la Soie. Station de Recherches Séréricoles d'ALES.

4) de la finesse du titre de la bave de la pelette sur le rendement au dévidage. Aucun mécanisme n'assure, en effet, l'élimination des pelettes ayant monté aux bouts.

L'expérience à la filature de Saint-Jean du Gard nous a montré que les meilleurs résultats étaient obtenus avec les cocons de croisements polyhybrides du type japonais.

CONCLUSION.

Pour avoir de bons résultats à la filature en bassine automatique de type Tama 10 il est nécessaire de travailler des cocons pour lesquels cette machine a été conçue c'est à dire des cocons de croisements polyhybrides du type japonais.

Les résultats seront d'autant meilleurs que l'étouffage appliqué à ces cocons sera plus soigné et surtout effectué en fonction de la nature de leur séricine.

RELATIONSHIP BETWEEN THE COCOON CHIEF SPECIFIC CHARACTERISTICS AND THE WORKING CONDITIONS OF THE REELING AUTOMATIC MACHINE, TAMA 10 TYPE.

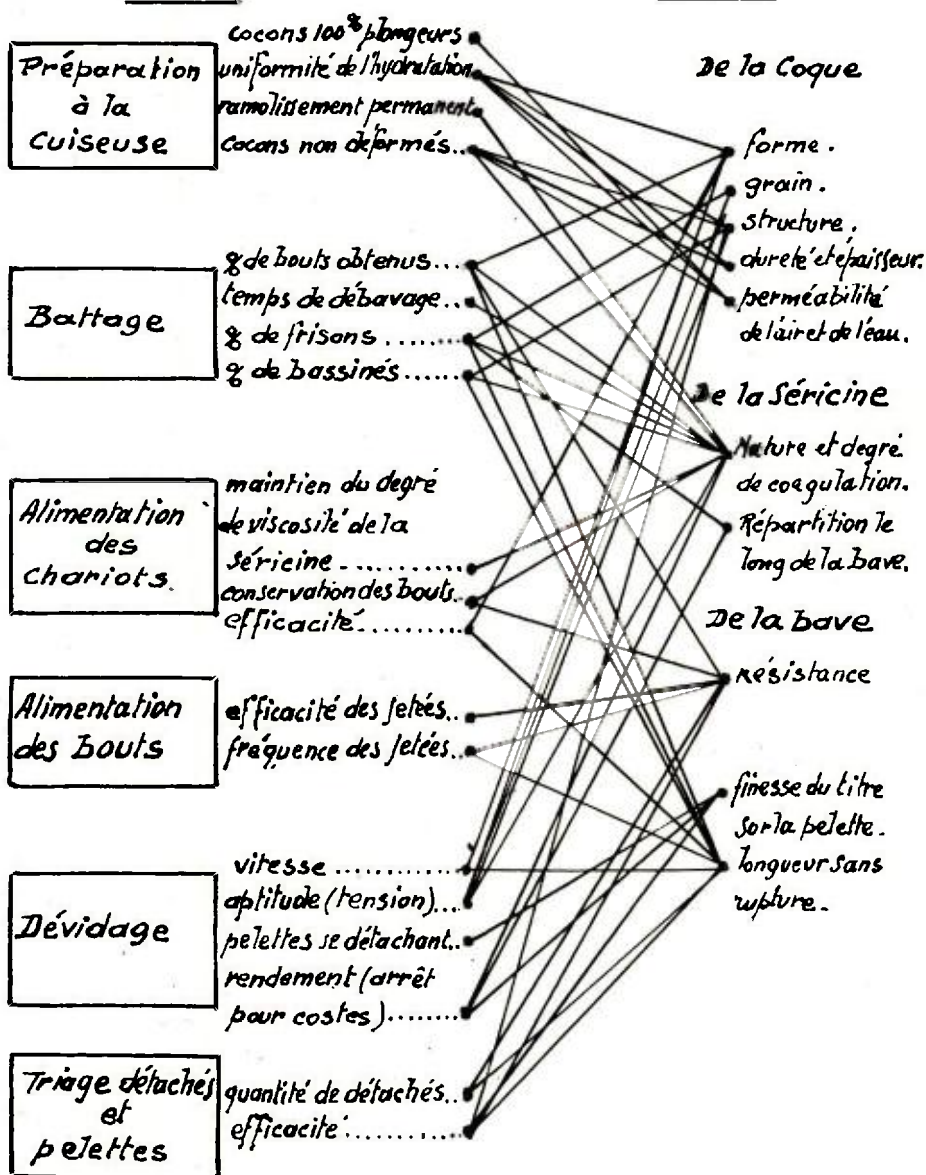
Summary.

The Author gives a graphic representation of the incidence of the principal characteristics of cocoons on the conditions of working with the TAMA 10 type automatic silk reeling machine. From the characteristics interfering directly on the working of the machine, he concludes that, to get good results, it is necessary to reel cocoons of polyhybridization which have been directed in relation with the nature of their sericin.

Les incidences des principales caractéristiques spécifiques des cocons sur les conditions de fonctionnement de la Bassine automatique du type TAMA.10 .

Processus de filature et condition de fonctionnement.

Caractères spécifiques des cocons



ON THE LOUSINESS DEFECT OF SILK

By Mr Chuji HARADA (Japan) (*)

Great efforts have been made by many breeders to breed lousiness free strains of silkworm. The results of research works by many investigators since the end of the 18th century may be summarized briefly as follows :

I. The cause of lousiness defect.

a) It may be concluded that a principal cause of lousiness defect is the fine fibres separated or branched from main cocoon filaments. They make dusty or hairy appearance on the silk fabrics together with dust or other foreign matters entangled with each other. They are originated from silk substances inside silk gland. In general, the amount of them mainly depends upon nature of silkworm strains themselves and in some degree, upon some environmental factors also, such as over-maturing of silk worm larvae at mounting stage or too much feeding of larvae to make heavy cocoon shells.

b) There are other secondary causes of lousiness defect. One of them is cellulose matter originated from silk gland which is one of factors which bring about lousiness defect and was discovered by M. SHIMIZU recently. It gives very similar pattern to rami-cellulose on the X-ray diffraction and the degree of polymerization is nearly the same as β -cellulose.

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Other secondary causes of lousiness defect are cut brin, split fibrillae which are originated mechanically by careless treatment of raw silk in the course of reeling, degumming and staining, and foreign matter contamination.

Poor neatness of raw silk also, in a slight degree, brings more lousiness defect together with above-mentioned causes.

II. Preventing methods of lousiness defect.

a) Selection of lousiness free strain.

Principal cause of lousiness defect comes from the fine fibres separated or branched from main cocoon filament and the amount of them depend upon the silkworm strain themselves as mentioned above. It is a key point that a selected lousiness free strain must have good quality of other commercial characters too. Anyway, in Japan, selection of strain without lousiness defect has been started from about 40 years ago. Principle of breeding of lousiness free strain has been found by H. TANAKA (about 1920) who has succeeded in making a standard photograph showing amount of the fine separated or branched fibres from main cocoon filament ranging from zero (-) to abundant (+--+). The preparation which is made of a cut small piece of seed cocoon shell being degummed with NaOH 5% solution, is classified comparing with the standard photograph.

This standard photograph has been improved more by ASANO and KOIWAI (1939). Now, in Japan, many breeders are making efforts to select lousiness free strains using the standard photograph. And some of them have already succeeded to breed several strains having good quality (75 points for exfoliation test) and excellent class (85 point for exfoliation test) or more.

b) A special treatment of raw silk to prevent lousiness defect.

In degumming, boiling soap solution is used, but a certain acid or buffer solutions are found to be effective to decrease lousiness defect. It is also very important to let 2 or 3% of sericin covering fibroin remain after finishing. Such small

amount of remaining sericin does little affect the luster, touch feeling and other characters of silk fibre.

c) Careful treatment of raw silk to prevent lousiness defect.

In the course of reeling, degumming and staining, careful treatment of raw silk are necessary to prevent to originate cut brin, split fibrillae which are both bad factors bringing about lousiness defect.

LE DEFAUT DE PERLAGE DE LA SOIE

Résumé.

De considérables efforts ont été faits par les éleveurs pour obtenir des souches de vers à soie exempts de perlage. Les résultats de la plupart des travaux effectués en la matière par un grand nombre de chercheurs se trouvent résumés là par l'auteur.

Il examine les aspects suivants du problème : les causes du défaut de perlage, les moyens de prévenir ce défaut (sélection et traitement spécial de la soie).

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TECHNOLOGICAL STUDIES OF THE SERIC BAVE OF DIFFERENT SILKWORM RACES (*Bombyx mori* L.).

By Mr H. HASSANEIN and Mr F. EL CHARAWY (U.A.R.) (*)

INTRODUCTION.

The silk bave is composed of two filaments or brins which issue from the sericteries of the silkworm and are struck together with sericin in the threader.

The production of silk is a synthetic method by which the silkworm during its larval period disposes the waste products of the scission of alimentary albumins which otherwise would become a source of intoxication. This theory was based on the observations of PIGORINI according to CARBONI (1946).

The construction of the silk cocoon could thus be regarded as resulting from the necessary elimination of toxic products, some confirmation of this theory would be derived from the fact that the mature worm secretes its silk even under the most unfavourable conditions for spinning a cocoon.

Secretion of the bave does not take place by construction of the sericteries, but passively by the movement of the worm's head which effects a continuous extraction of the thread little by little as the thread already becomes used up in construction of the cocoon.

The technological properties of the silk bave of the different silkworm cocoons differ enormously due to some known and unknown factors. The Egyptian research workers in sericulture field have paid a special interest of selection and introduction of standard breeds of silkworm due to their relative efficiency of the seric bave technological properties as

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tools of national program of silk culture improvement for increasing silk production.

Many silkworm races were imported to the Egyptian Sericulture Department and were distributed without any test for their superiority in the quantity and quality of silk bave.

The present investigations were carried out to make a comparative technological studie on the silk bave of the selected local and imported races of the silkworm, Bombyx mori L.

REVIEW OF LITERATURE.

LOMBARDI (1943) studied the relationship between the length and diameter of silk for each individual cocoon. She reported that in a race of Bombyx mori L., are found individuals with a long silk and other with short one, at the same time she recognized that the silk length varied according to the races. Her results indicated also that there is a relation between the silk length and its diameter, the longer the silk, the finer is its diameter. The results show that it is possible to improve the races by the continuous selection.

LEGAY (1949) carried out biometric study on the silk gland of the silkworm and came to the following conclusions :

- 1) The third and fourth moults of the larvae are properly considered the most important organ in the larval cycle.
- 2) The secretion of silk in a normal quantity which is precisely one of the characteristics of the silkworm, became only so from the beginning of the fourth moult.

LOMBARDI Lorenza (1951) studied the characters of two new races, S.A. N°64 and S.A. N° 86 for 12 years, their origin and their production. The races S.A. N° 64 is a yellow cocoon breed gave about 90 kg of fresh cocoons for one ounce of grains, the medium length of the seric bave was about 1.000 meters with titre of 2.5 deniers, the filament was of good quality and little defaults. It was crossed with S.A. N°2 and gave a bave with a titre of 2.5 deniers. The race S.A. N°88, was a white cocoon breed, gave 65 kg of fresh cocoons for 30 g of grain, the medium length of the seric bave was about 750 meters and the diameter of the filaments was 1.68 deniers. It may be well utilized for the summer and autumn breeding.

HARADA et al. (1954) compared the amount of divisible fibre in the normal cocoons with that of the experimentally obtained from deformed cocoons made in larvae in the three kinds especially designed frames. By these frames the larvae were forced to spin round, long flat shaped cocoons respectively. The control larvae were mounted on the ordinary "Kay-ryo-mabusni". In the normal cocoons which were obtained experimentally, the divisible fibre is more abundant than the normal ones. During the

spinning of the cocoon the larvae were able to move and spin out freely in the cavities, but the larvae spinning long and flat cocoons seem to be restructured in moving and spinning actions. The correlation between the divisible fibre and shape of cocoon is not distinct in the individual cocoons of control.

LOMBARDI (1954) observed the silkworm rearing of first crossing coming from Japanese and Italian races, and were reared either in Japan or Italy. Her results showed that the Japanese crosses presented serie have longer by about 400 meters.

FRAISSE and VAGO (1955) made a comparative study on two industrial japanese silkworms reared in France with white cocoons and three French races with yellow cocoons. The type FO was mal-adapted under the French climatic conditions. On the contrary the type KY was not susceptible to the different diseases and gave a good production of cocoons.

JERZEY (1957) studied the influence of temperature on the technological value of the Gros Var race cocoon during rearing. A serie of experiments were carried out taking as a base the various temperature as applied by different authors. The results allowed to notice that the temperature has a definite influence on the value of the cocoon.

1) A noticeable difference can be seen between the cocoons obtained by the method of a permanent and more rapid decrease of temperature as also by a permanent and slow decrease of temperature, these methods result in obtaining heavier cocoons.

2) The method of raising the temperature and the tons of keeping the same temperature as the silkworm grows, gave more favourable conditions for the development of the silkworm, the cocoon are lighter.

3) By using different grades of temperature it has been noticed that the ratio of the weight in relation to the development of different organs in silkworm change in favour of the silk glands. Therefore in using the thermic method it had been possible to obtain the biggest possible amount of silk. It was clearly shown that the cocoons obtained with the method where the temperature is decreasing as the silkworm grows are characteristic of lesser silk richness.

4) The method of lowering the temperature as the silkworm grows allowed obtaining more fibre than the method of increasing the temperature permanently, as also than the method of keeping the same temperature during all the stages of silkworm.

MATERIAL.

The silkworm races used in this study were the standard breed in many countries in the world. During 1957 and 1958 breeding the different

races were carried out in the Faculty of Agriculture, Ain Shams University and in the Sericulture Department, Ministry of Agriculture, Egypt. The races used in these investigations were :

	1957	1958
1	Gobio	-----
2	Bagdad	-----
3	Green	-----
4	Var	Var
5	Ungari gelbspinner	Ungari gelbspinner
6	Cellar weibspinner	Cellar weibspinner
7	Kitpinh erxopia	Kitpinh
8	Oro chinese	Oro chinese
9	Yinhan x Huachiu	Yinhan x Huachiu
10	Huachiu x Yinhan	Huachiu x Yinhan

The Gobio, Green, Bagdad and Var are considered as local races. They were bred in Egypt since the establishment of the Sericulture Department, Ministry of Agriculture in 1926. The races Ungari-gelbspinner (U) , Cellar weibspinner (C) , and Oro chinese (O) were imported from the German Sericulture Research Station, Germany. Kitpinh erxopia was imported from the Sericulture Laboratory , Ministry of Agriculture, Greece. The hybrid Yinhan x Huachiu and its reciprocal cross were imported from China. The races Gobio (Go) , Bagdad (B) , and Green (G) were highly infected by the pebrine epidemic during the year 1958.

METHODS.

The rearing of the selected silkworm races was in accordance with the principle properties of the various species of the silkworm and was properly controlled , so that the different breeds should not be mixed with each other during the rearing period. Environment sanitation during rearing stages were perfectly treated and precautions were strictly taken against possibilities of infecting the silkworm with certain epidemic diseases which may be attached to the mulberry leaves in the orchards.

The various breeds of silkworm in the different rearing stages have different requirements, so it was necessary to feed them with properly matured mulberry leaves no too tough nor too tender. The mulberry leaves were supplied to the worms six times daily and were given to the first and second larval instars as stripes and afterwards the diet was distributed in a manner that the larva do not suffocate.

The silkworm eats incessantly consuming more food during the last week of her life, its appearance changes gradually which indicates that the silk glands are preparing the silk and the worm is ready to make its cocoon. The silkworm after choosing the suitable site for spinning, starts to emit from its body a thick viscous protein which solidifies on contact

with air into the silk bave. Before spinning the actual cocoon the worm emits a course thread which attaches from on support to another until after five or six hours, it makes safety net from the middle of which it spins its cocoon.

It is necessary to kill the chrysalis of the selected cocoon for the seric bave test before its transformation, as when the moth emerges and pierces the sheath, the bave will be unreliable. The simplest and easiest manner for the chrysalis suffocation and drying the cocoons has been found to be submission of the cocoons to the action of heat and we used for this purpose the dessicator. Desiccation was carried out to a maximum of 90-95° C. After desiccation the cocoons were kept in a dry storage.

In order to examine the nature of the bave, it is unwound from the cocoon by a special apparatus which provides without occasioning any mechanical changes in it, for measuring the total length of the bave and for cutting it into any specified lengths for special examination (resistance and elasticity).

The apparatus designed by DUSUZEAU (1886) and modified by VERNON and QUAIAT (1896), after Paolo CARBONI (1946), it comprises a parallelepiped in which the cocoon is placed after being softened by soaking, the water was heated by a gas jet under the container. The winder on which the bave is reeled is provided with girrometer and with a guiding arm with forward and backward movement along the whole length of the winding frame allowing the bave to be wound, if required in separate skeins.

Tensile Properties.

The dynamometric properties of the bave, as also those, of raw silk are measured by a special apparatus called a serimeter in which a dynamometer records in grammes or decigrammes the weight required to break the thread, and is connected with another indicator that shows the elongation of the thread up to breaking point.

The dynamometer used in serimeters consists of a single lever with elbow action of which the extremity of the long arm in a graduate are while the other arm is connected with a small shaft on which there is a thread holder. In the serimeter its fall is regulated by a small endless chain running on two sprockets, one of these through gears, works a fan governor which is called a chain serimeter. When the bave is being tested, stretched between the two thread holders, it holds up the stopping lever of the fan which falls at once, when the thread breaks immobilizing the second thread holder. A scale in centimeters indicates the elasticity of the thread. The figs. in table I are double the actual stretch of the thread. In order to give a percentage reading from the length of 50 cm used. A geared notal indicator attached to the top of the apparatus gives the suspending weight in grammes or decigrammes.

Cocoon Compactness Test.

The cocoon compactness is measured by the cocoon compactness tester in objective manner. A scale graduated in hundredths of millimeters indicates the size of longitudinal deformation to which the cocoon is subjected by the effect of the force transmitted by means of a spring built in the tester. The deformation is inversely proportional to compactness and therefore to the silk yield of the cocoon, the more thinner is the cocoon shell and more smaller is the silk yield of the cocoon, and vice versa.

Description of the apparatus.

Three operations are required to a successful functioning of the apparatus.

- 1) The insertion of the cocoon in the cocoon holder,
- 2) The exertion of the force with aid of a hand wheel,
- 3) Reading the size of the force and the deformation respectively.

A cocoon holder which may be removed from a wedge-shaped guide is used to receive the cocoons which are fastened in central position by the cocoon holder with the aid of concentrically arranged spring blades. The spring is devised to prevent any longitudinal displacement of the cocoon. After placing the cocoon in its holder the latter is inserted in the wedge shaped groove of the machine together with the cocoon. The cocoon holder is moved with the aid of the friction wheel until the cocoon reaches the counter (4). When contact is arising care was to be taken that no deformation of the cocoon occurs. We may make sure of it on the dial gauge (11) by making it in zero position. Compactness that will start after by turning the hand wheel (8), a force is exerted on the cocoon by means of the spring (6) giving the load and the threaded spindle (7) moving it, the size the force was read on the scale (10). A force of 3000 gms is exerted on the cocoon. The cocoon on the effect of the force, undergoes a deformation and is compressed. The size of the compression is read on the dial-gauge on the small graduation of which the compression is in mms. on the large graduation compressions is read in the hundredths of mms.

RESULTS.

Colour of the cocoon

The colour of the cocoon is one of the important characteristics that at least affected by the environmental, cultivation, and breeding. Colour may be of great variety of shades classifiable in these basic hints in the studied breeds.

White : This may vary from the silver white of Yinhan, Huachiu, and Cel-lar breeds to dull white of the Bagdad strain.

Yellow : This may be of many shades , it varies from the pale yellow in the race Var and Golden yellow as the race Oro Chinese.

Green : The race green was named according to its green colour of cocoon.

Rose : This tint is peculiar to certain breeds as the race Ungar. The rose colour cocoons however are only externally so tinted and yield a yellow silk. Pigment then present is not distributed uniformly throughout the length of the bave, but concentrated in certain layers of the cocoon. Its distribution varies with the breed. Thus in the race Gobio, Kitpinh , Ungari and Green , the crust is colourless , while the layers of cortex show little variation of colour to the end of the bave. On the other hand in the golden yellow breed Oro Chinese pigment is found almost entirely concentrated in the upper layers of the cocoon, while the silk reeled from the lower layers of the cocoon vary slightly coloured.

Shape of the cocoon.

The common shape of the Bombyx mori L., cocoons are spherical, oval, and waisted, the spherical cocoons as in the races Cellar and Oro Chinese. Cocoons are called oval, in shape when the longitudinal axis is appreciably greater than the transverse such as the cocoons of the Yinhan and Huachiu cross breeds. Waisted or belted cocoons have a central contraction more or less accentuated, such as the races : Bagdad, Kitpinh, Gobio, Var, Green and Ungari. If the construction is pronounced it may be a serious obstacle in reeling the bave, because when the inner layers are reached, the cocoon tends to double up and get torn in the process ending as waste instead of thrown silk. The length of the cocoon varies in the different races, the maximum length of the cocoon for the races reared in 1957 ranged from 7.8 to 11.1 cms., the minimum length of cocoon varies from 5.9 to 10.0 cms, with mean value ranged from 6.8 to 10.5 cms as it is indicated in table 1. The highest length of the cocoon was in the races : Gobio and Bagdad, as their mean length of cocoon were 10.5 and 9.5 cms, respectively.

The least length of cocoon was 6.8 cms, in the race Oro Chinese , in the races studied in 1958. The maximum length of cocoon ranged from 8.2 to 9.3 cms, the minimum length varied from 6.2 to 8.0 cms , with a mean value ranged from 7.4 to 8.6 cms. Table 1 shows that the highest length of cocoon was 8.6 cms, in the race Var, Huachiu , and Yinhan while the least length was 7.4 cms, in the Oro Chinese.

Width of the cocoon was also measured in the different breeds. In the races reared in 1957, the maximum width varied from 5.0 to 7.5 cms, the minimum width ranged from 4.0 to 6.4 cms, with a mean value from 3.6 to 7.2 cms. It is evident from table 1 that the highest mean width of cocoon was 7.2 cms in the race Gobio and 5.8 in the race Bagdad , while the least mean width was 4.6 cms in the race Oro Chinese and the cross breed Yinhan. Table 1 and Fig. 1 show also the maximum width of cocoon reared

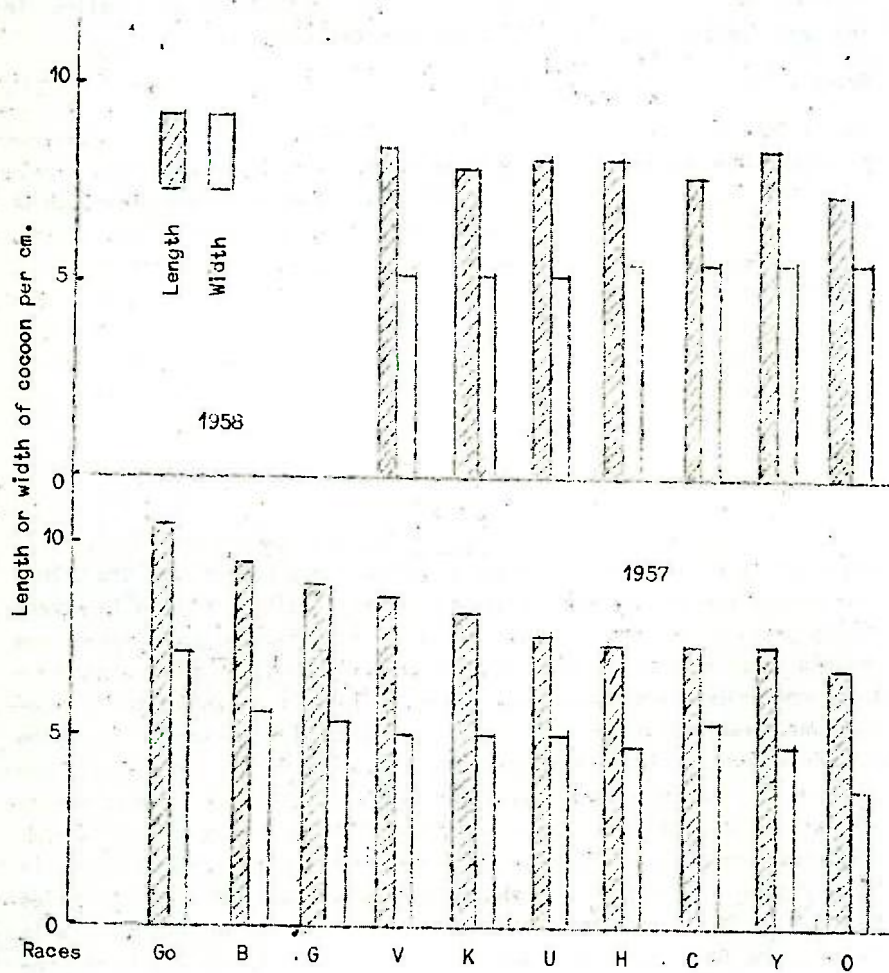


FIG. 1 - LENGTH AND WIDTH OF COCOONS IN THE DIFFERENT RACES.

in 1958, it ranged from 5.3 to 5.8 cms, while the minimum width ranged from 4.4 to 5.1 cms and their mean ranged from 5.22 to 5.99 cms in the different races. The highest mean width of cocoon was 5.9 cms in the race Cellar and the least mean width of cocoon was in the race Var 5.2 cms. The highest variation in the cocoon length was among the races Ungari and Gobio 17.07 and 12.0 % respectively in the first year. The highest variability in the cocoon length for the races in 1958 was 13.72 % in the race Var. The highest coefficient of variation of the mean width of cocoon for the races reared in 1957 and 73.21 % in the race Cellar, while the least variability in the cocoon width was among the race Gobio 2.70 %. In the year 1958, the highest coefficient of variation of the cocoon width was 3.70 % in the race Ungari. The mean value of length and width of cocoons in the races reared for two years is clearly indicated in Table 2. The mean length of the cocoons was in the race Ungari. The mean width of the cocoon ranged from 4.65 to 5.75 cms, in the different races, and the highest width of the cocoon was in the race Cellar.

Weight of the cocoon.

The cocoon shows continuous loss of weight from time of its completion until the maturity of the pupa, due to the respiration of the chrysalis and simple evaporation. This loss of weight may be considerable, in the process of dessication. The weight of the cocoon is reduced by about two thirds, mainly by elimination of water. The average weight of the cocoon varies in a single strain according to conditions of rearing, and also variations are found among breeds. Uniformity of individual weight of cocoons is very important as an indicator of the uniformity behaviour to be expected from them in reeling process. Cocoons were apparently weighed to determine their maximum, minimum and average weight. Statistical analysis of the standard deviation and coefficient of variation were also recorded. Table 3 and Fig. 2 indicate the maximum, minimum, and average weight of fresh cocoons in the different races. In 1957, the maximum weight of fresh cocoon ranged from 1.140 to 2.340 grammes, the minimum weight varied from 0.608 to 1.750 grammes with a mean value varied from 0.961 to 1.916 grammes. It is clearly shown from table 3 that the highest mean weight of the fresh cocoon was in the race Gobio, Bagdad and Green their weights were 1.936-1.621, and 1.509 grammes respectively. The least mean weight of fresh cocoons was 1,175-1,112-0,997 and 0,961 in the races : Ungari, Cellar, Huachiu, Yinhan and Oro Chinese respectively. The results of the fresh weight of the cocoons for the races reared in the year 1958 are presented in Table 4 and illustrated in Fig. 2. It may be noted that the maximum weight of the fresh cocoon ranged from 1,811 to 2,164 grammes, the minimum weight varied from 1,266 to 1,574 grammes. The highest mean weight of fresh cocoon was among the races : Ungari, Yinhan and Var, as their weight of fresh cocoon were : 1,574-1,537 and 1,524 grammes respectively, and next to the previous races : Huachiu, Kitpinh and Cellar, their weights were 1,495, 1,479, 1,400 grammes successively. The least mean weight were 1,266 grammes in the race Oro Chinese.

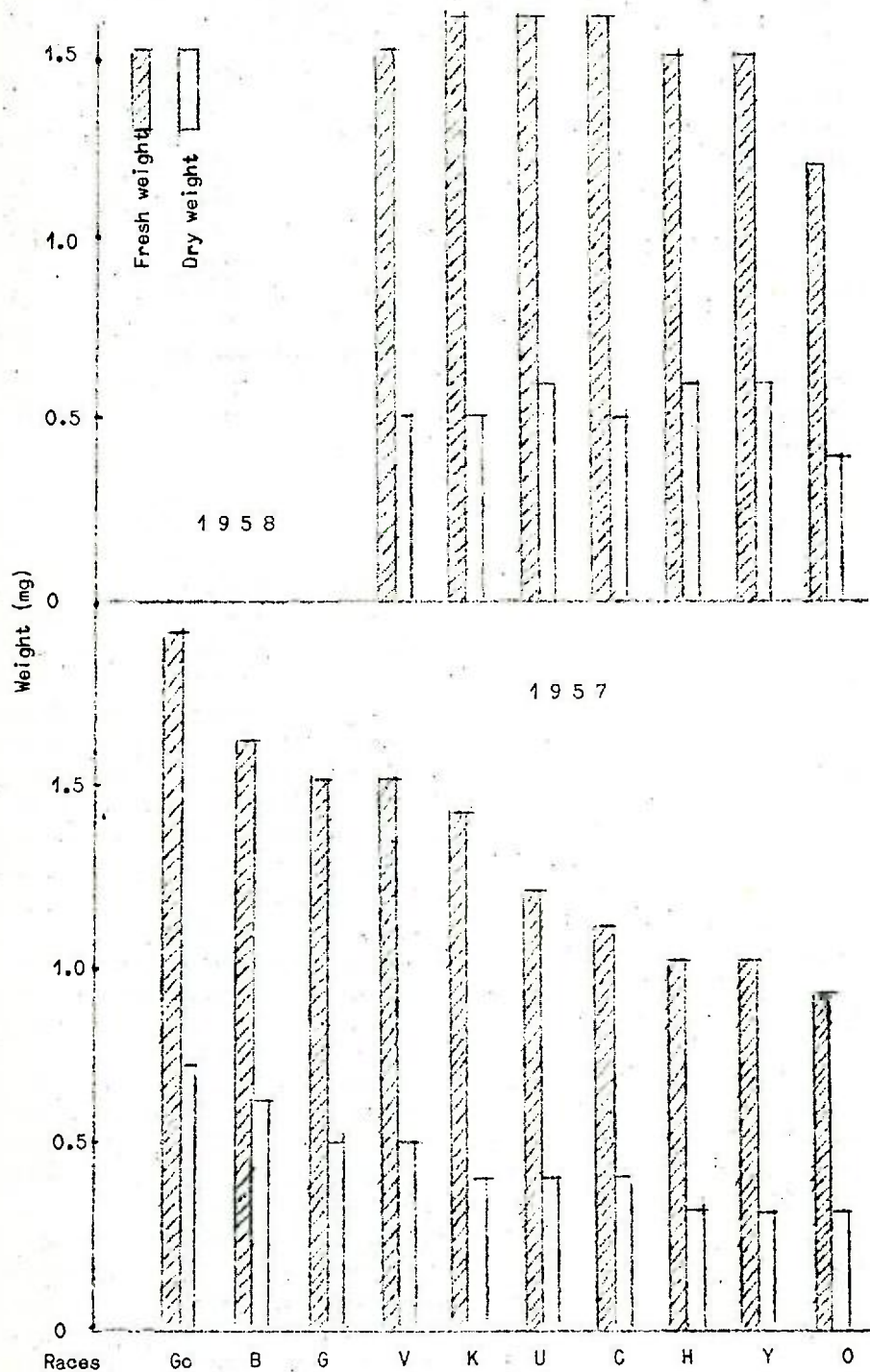


FIG. 2 - FRESH AND DRY WEIGHT OF COCOON IN THE DIFFERENT RACES.

The weight of the dried cocoon has long been considered as an important factor on silk yield. Tests have been conducted to evaluate and study the maximum, minimum and average weight of the dried cocoons. It is clearly shown in Table 3 and illustrated in Fig. 2 that the maximum weight of the dried cocoon ranged from 400 to 804 milligrammes and the minimum weight varied from 190 to 590 milligrammes with a mean value ranged from 345 to 673 milligrammes in the different races reared in the first year. The highest weight of dried cocoon was in the race Gobio, Bagdad and Green their weight of dried cocoon was in the race Gobio, Bagdad and Green their weights were 0.673, 0.563, 0.505 grammes respectively. The strains Var and Kitpinih were next to the previous races as their mean weight of the dried cocoon varied from 0.486 to 0.457 grammes. The least mean weight was in the races Ungari, Cellar, Huachiu, Yinhan and Oro Chinese, their weights were 0.383, 0.370, 0.357, 0.356 and 0.345 grammes respectively. The maximum weights of the dried cocoons in the races reared in 1958 are recorded in Table 3 and presented in Fig. 2. It varied from 554 to 540 milligrammes and mean value from 440 to 613 milligrammes. The highest mean weight of dried cocoon was in the cross breeds Yinhan and Huachiu, their mean weights were : 0.613 and 0.612 respectively. The race Var, Ungari and Kitpinih were next to the previous races, their weights were 0.559, 0.556 and 0.515 grammes respectively. The least weight of dry cocoon was 0.485, 0.440 gms in the races Cellar and Oro Chinese.

The mean weight of the fresh cocoons in the two experimental years varied from 1.093 to 1.540 gms, while the mean weight of the dried cocoons varied from 427 to 5.22 mgms in the different races.

It is evident from the data obtained that the major number of fresh cocoons in one kilogramme vary from 500 to 907 cocoons in the different races, the number of dried cocoons in one kilogramme vary from 1.470 to 2.595 cocoons. A comparison of the average weights of the fresh cocoons show that the major number was among the races Oro Chinese, Huachiu, Cellar and Ungari as their numbers were 907, 840, 807 and 727 fresh cocoons and 2.595, 2.407 and 2.197 dried cocoons respectively.

The races Kitpinih, Yinhan, Var, Green, Bagdad and Gobio were the next to the previous strains as their number were 699, 683, 670, 660 and 550 fresh cocoons and 2.050, 2.105, 1.995, 2.000, 1.740, 1.470 dried cocoons in one kilogramme.

THE SERIC BAVE.

The seric bave is composed of two brins united together by sericin. The seric bave is deposited in the cocoon with a certain regularity in the form of loops or eyelets, with the exception of the first layers, which constitutes the crust or husk of the cocoon.

In order to examine the seric bave it is reeled from the cocoon by a special apparatus for measuring the total length of the seric bave and for cutting it into any special lengths for special tests.

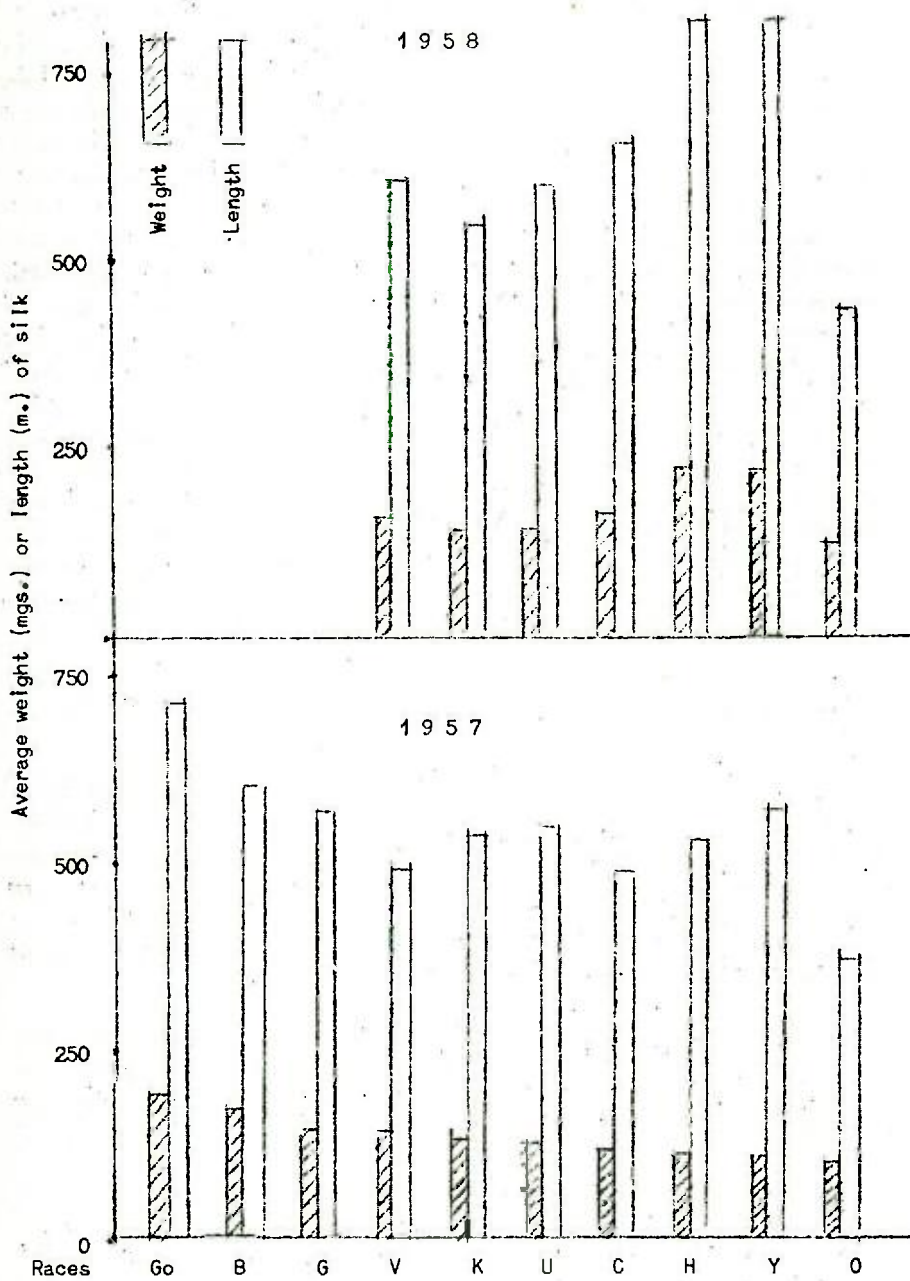


FIG. 3 - LENGTH AND WEIGHT OF SILK IN THE DIFFERENT RACES.

Length of the seric bave.

The length of the reelable bave varies greatly in the different breeds. The oocoon of the different breeds were reeled and their length were recorded and illustrated in Fig. 3. The average length of the reelable bave of the experimented breeds was between 500-700 meters with a maximum length of 1.000 to 1.030 meters. It is evident from the results that the average length of the silk bave in the race Gobio was 714.3 meters and this is considered the highest length of the silk bave in the experimental breeds. The races Bagdad, Green, Var, Cellar, Yinhan, Huachiu, Kitpinih and Ungari were the next to the previous race and the length of their baves were 602, 562.3, 546.2, 539.4, 535, 497.9 and 495.5 meters respectively, while the least average length of silk bave was 139 meters in the race Oro Chinese, in the year 1957. The average length of silk for the races studied in 1958 are illustrated in Fig. 3. Their length ranged from 440.9 to 822.6 meters. The highest length of silk bave was in the cross breeds Huachiu and Yinhan their lengths were 822.6 and 817.4 meters respectively, the races Kitpinih, Ungari, Var and Cellar were next to the previous breeds, the length of their baves were : 666.3 ; 579.8, 549.8, meters successively. The least length of silk bave was 440.9 meters in the race Oro Chinese. The highest variability was in the cross breed Yinhan, 30.3 %. The race Ungari, Gobio, Var, Green and Kitpinih were next to the previous race as their coefficient of variation were 25.89, 25.39, 22.24 and 15.72 % respectively. The least coefficient of variation was that of the races Bagdad, Huachiu and Cellar, 7.70, 7.05, 6.76 % respectively. The coefficient of variation for the mean length of silk among the races reared in 1958 ranged from 16.85 to 46.8 % in the different races. The highest coefficient of variation was that of the race Kitpinih 46.8 % and the least variability was in the cross breed Yinhan 16.85 %.

The mean length of silk bave in the races reared in the two years ranged from 415.3 to 678.4 meters. The highest mean length of silk bave was in the cross breed Yinhan.

WEIGHT OF SILK.

The weight of the bave emitted by the worm in constructing the cocoon can be determined by weighing the silk in the different races. The maximum weight of the reelable silk is presented in Fig. 3. It ranged from 163 to 240 mgms and the minimum weight varied from 14 to 112 mgms with a mean value ranged from 96.2 to 201.6 mgms. In the year 1957, the heaviest weight of silk was that of the races Gobio, and Bagdad their weights were 201.6 and 167.5 mgms successively and the least weight was 96.2 mgms in the race Oro Chinese. The maximum weight of silk bave from the races reared in 1958 is illustrated in Fig. 3. It ranged from 126.2 to 336 mgms, the minimum weight ranged from 38 to 160 mgms with a mean value ranged from 116.3 to 235 mgms. The heaviest weight of the silk bave was in the cross breed Yinhan and Huachiu, their weights were 235.4 and 232.2 mgms. The least weight of silk was that of the race Ungari its weight was 116.3 mgms.

FIG. 4 - NUMBER OF COCOONS YIELD 1KG. OF SILK.

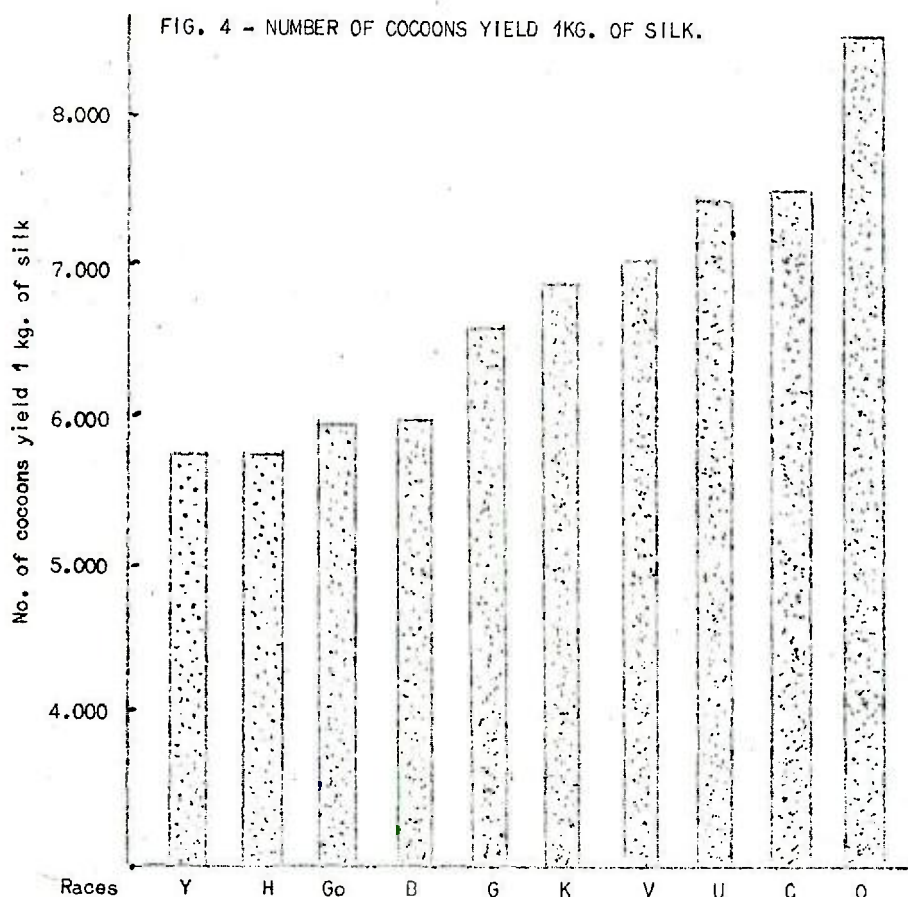
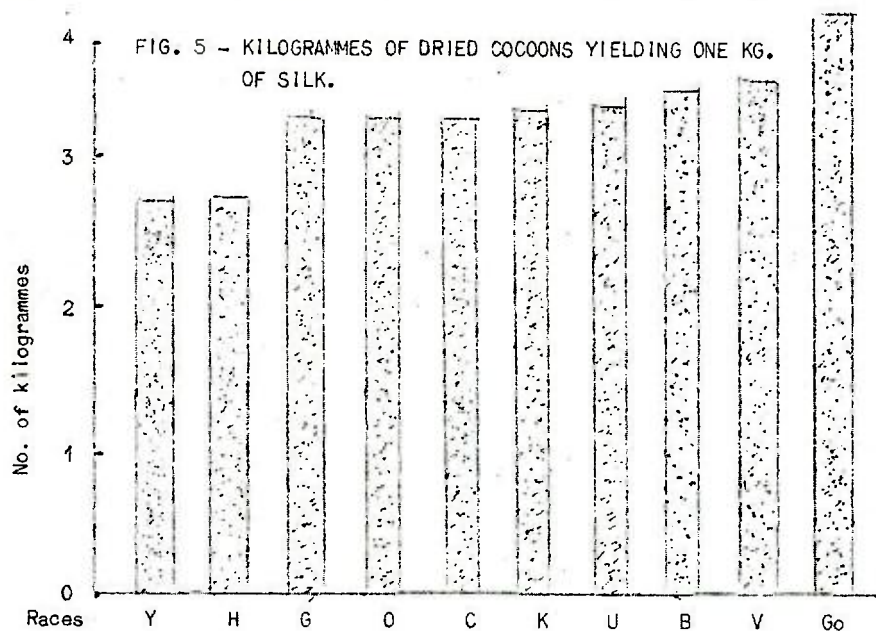


FIG. 5 - KILOGRAMMES OF DRIED COCOONS YIELDING ONE KG. OF SILK.



The coefficient of variation of the mean weight of silk in the races reared in 1957 shows that the highest variability was 49.38 % in the race Gobio and the least coefficient of variation was 11.58 % in the race Var. The coefficient of variation of the mean weight of silk bave of the race reared in 1958 ranged from 6.60 to 28.95 %, the highest coefficient of variation was in the race Cellar, and the least variation was in the cross Huachiu.

The mean value of silk weight in the races reared in the two years ranged from 111.3 to 175.4 mgms, the heaviest weight of silk bave was in the cross breed Yinhan and Huachiu, their weights 175.4 and 173.2 mgms. The races Kitpinih, Var, Ungari were next to the previous races their weight were 145.4, 141.5, 135.2 and 134.3 mgms respectively and the least average weight was 117.3 in the race Oro Chinese.

The investigations were carried out to determine the value of selecting the best silkworm races in silk production. It is well known that the numbers of kilogrammes of cocoons to obtain one kilogramme of reeled silk called "Renditi", yield. The average usage of dried cocoons required for reeling one kilogramme of silk varies in the different races.

Measurements were used to secure information on the relationship between the number of cocoons and silk yield, Fig. 4 and 5. The results of the data indicate that the cross-breeds Yinhan and Huachiu were the best races in the silk production. The data indicate conclusively that the weight of cocoons required to give one kilogramme of silk was 2.714 kgs in the cross breeds Yinhan and Huachiu. The number of dried cocoons required to reel one kilogramme of silk was 5.714 cocoons in the race Yinhan and 5.780 cocoons in the race Huachiu. The races Green, Oro Chinese, Cellar, Kitpinih, Ungari were next to the previous races, as their number of kilogrammes of cocoons required for reeling one kilogramme of silk was 3.267, 3.23, 3.308, 3.361, 3.368, 3.481 and 3.508 kilogrammes respectively. The number of dried cocoons required for reeling one kilogramme of silk in these races were 8.535, 8.547, 7.460, 6.890, 7.400, 5.953, 7.000 cocoons successively. The highest number of kilogrammes was 4.047 kilogrammes cocoons in the race Gobio, and it required 5.950 dried cocoons for reeling one kilogramme of silk. The race Var is considered as a standard race in Egypt and was breed for a long time. It is clearly observed, from the results and data obtained in the present investigation that the race Var is not of an economic value if it is compared with the cross breed Yinhan and Huachiu. It required 3.508 kilogrammes of dried cocoons for reeling one kilogramme of silk, while the two cross breeds Yinhan and Huachiu required 2.714 and 2.743 kilogrammes, of dried cocoons

Tensile Properties.

Tests on the tensile properties of the seric bave is given by the serimeter. The data obtained are grouped to present a general picture in its simplest terms, this procedure may obscure important details especially those necessary for under-estimation of resistance and elasticity. The

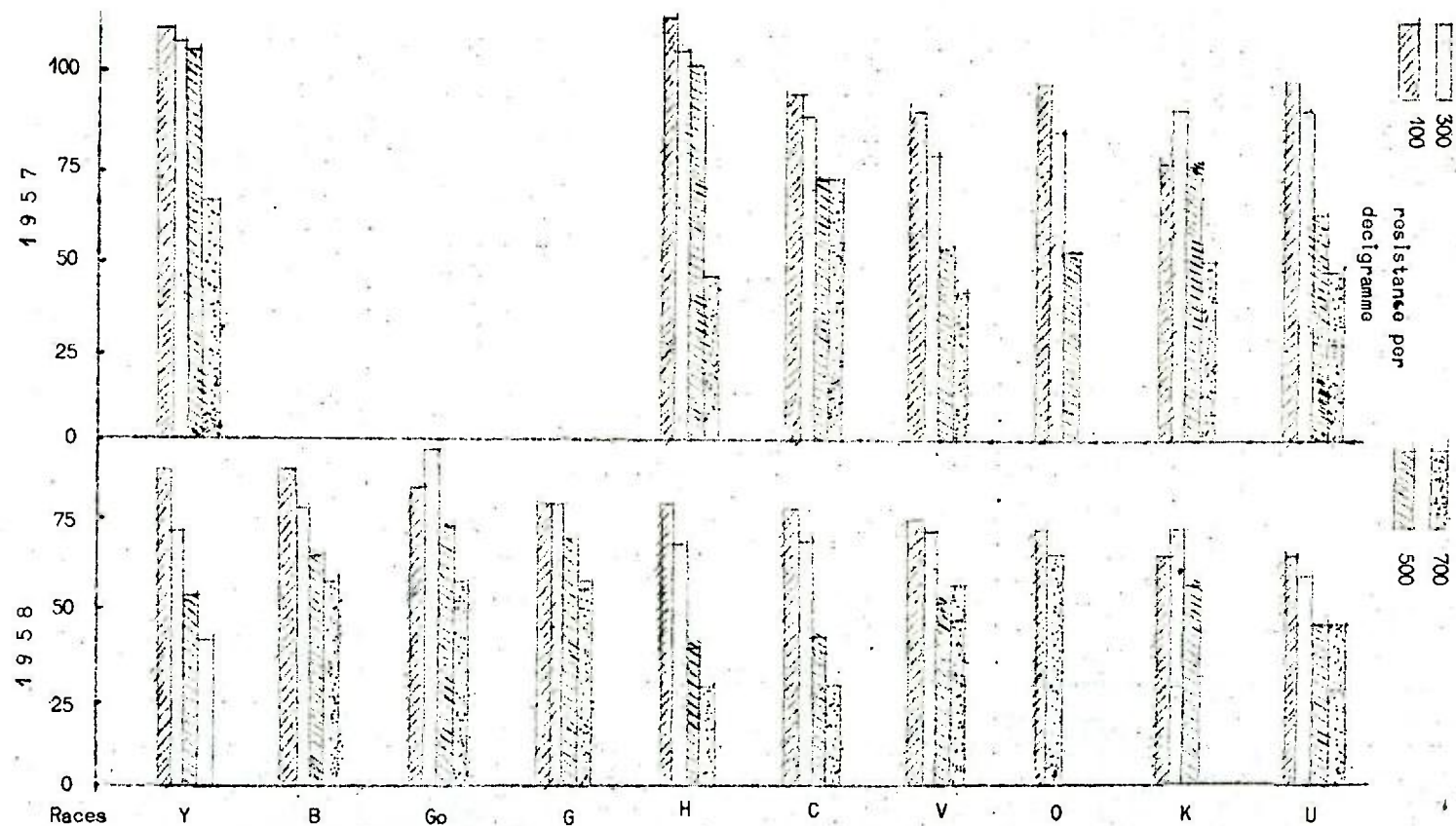


FIG. 6 - MEAN RESISTANCE OF THE SERIC GAVE IN THE DIFFERENT RACES.

average resistance of the seric bave of the breeds and cross breeds in the first year varied from 57.5 to 34.1 decigrammes with elasticity ranged from 47.3 to 53.8 millimeters. The maximum resistance of the seric bave ranged from 78.3 to 120.6 decigrammes while the minimum resistance varied from 20 to 58 decigrammes with a maximum elasticity ranged from 62 to 79 millimeters and minimum elasticity ranged from 60 to 41.5 mms in the different races.

Studies on the resistance and elasticity of the seric bave clearly show that the highest resistance was among the races Gobio, Bagdad, Green, and Yinhan, their mean elasticity were 84.1, 75.2, 74.8 and 71.5 decigrammes successively. With elasticity of 49.9, 50.2, 50.9 and 49.5 mms. The races Oro Chinese, Var, Cellar and Huachiu were next to the previous races as their mean resistance of the seric bave were 86.5, 63.7, 63.1, 61.8 and 61.1 decigrammes, with mean elasticity of 47.3, 50.7, 50.0, 48.4 and 51.4 millimeters. The bave of the race Ungari had the least resistance, it was 57.8 decigrammes with elasticity 53.8 millimeters.

Coefficient of variations of the mean resistance of the seric bave, ranged from 18.43 to 39.91 %. Coefficient of variation of the mean elasticity of the silk bave varied from 12.02 to 36.10 % in the different breeds. The average seric bave resistance of the different breeds reared in the second year varied from 71.9 to 95.8 decigrammes with elasticity ranged from 46 to 54.5 mms. The maximum resistance varied from 116 to 139.3 decigrammes, the minimum resistance ranged from 63.3 to 88.0 millimeters and minimum elasticity varied between 27 and 40 mms. The results obtained clearly show that the highest resistance was that of the cross breeds Huachiu and Yinhan, their resistance were 95.8 and 93.5 decigrammes with elasticity 49.7 and 46.0 mms. The races Ungari, Cellar were next to the previous cross breeds, their resistance were 86.7, 84.2 and 83.9 decigrammes with elasticity 51.1, 52.0 and 46.0 mms. The least resistance was in the races Kitpinih and Var, their resistance were 78.5 and 71.9 decigrammes with elasticity of 54.1 and 53.1 mms.

The coefficient of variation of the mean resistance of the seric bave varied between 17.65 and 26.60 % and the coefficient of variation of the mean elasticity ranged from 11.89 to 21.73 % in the different races.

Investigations were also conducted on the seric bave from the external, middle and the internal layers of the same cocoon on the dimensions, 100, 300, 500 and 700 meters, it was clearly observed that the tensile properties increase from the external to the internal of the cocoon as it is illustrated in Fig. 6 and 7.

Cocoon Compactness.

The silk yield of the cocoon is one of the most important quality characteristics. It means the weight of the unreeled grege in relation to the cocoon weight. Investigations concerning the cocoon compactness are

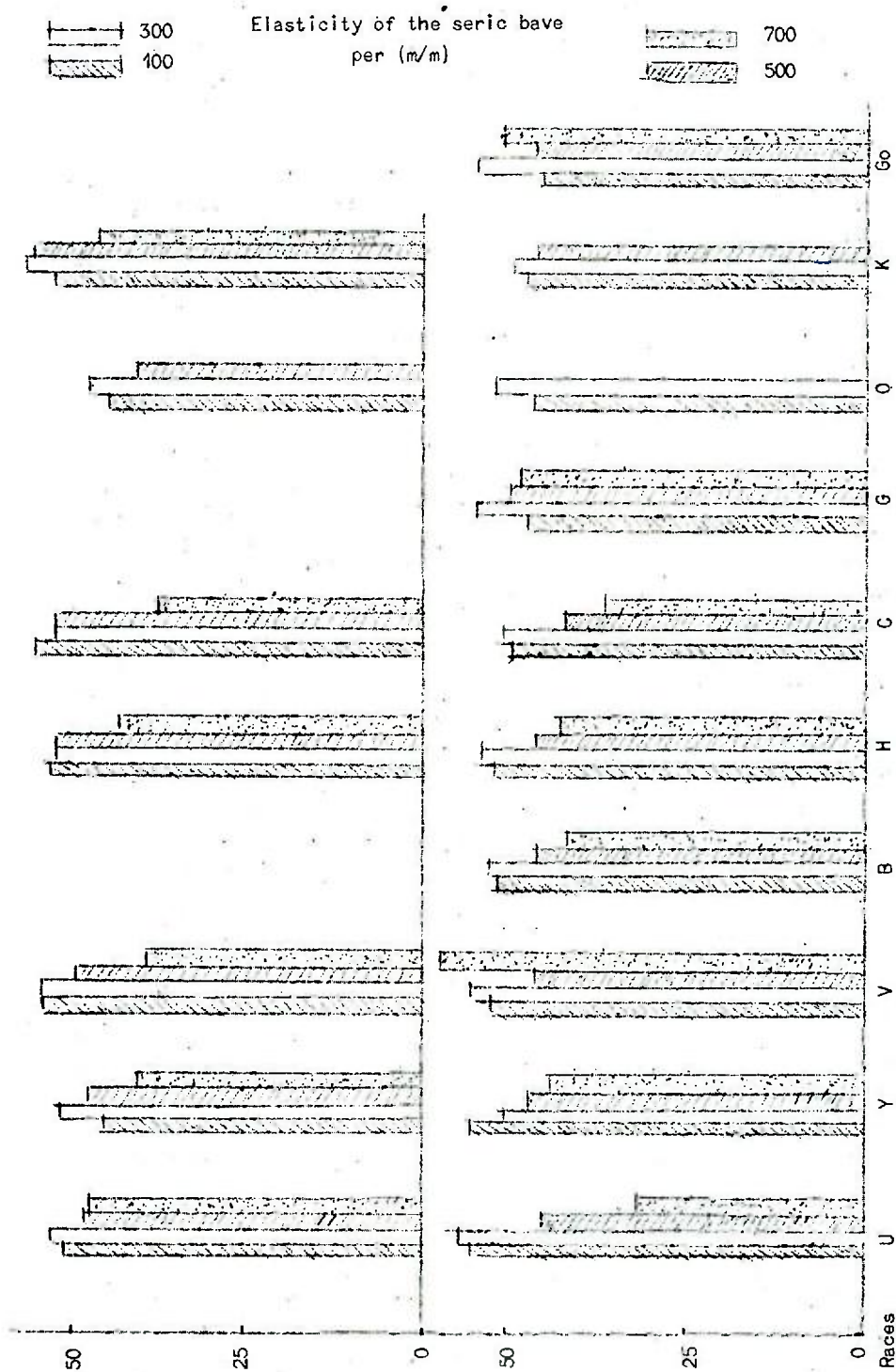


FIG. 7 - MEAN OF ELASTICITY OF THE SERIC BAVE IN THE DIMENSIONS 100 - 300 - 500 - 700 m. IN THE DIFFERENT RACES.

extremely important from the stand point of silk production. The silk yield of a cocoon item can therefore be accurately determined only by test spinning mill. In accordance with the practice followed until now the silk yield of the cocoon was tested by compressing the cocoon with two fingers and from the size of the resistance of the cocoons against the pressure stated the cocoon compactness and the silk yield respectively.

In the present investigation, the cocoon compactness was measured by the cocoon compactness tester. The mean value of the measurement states the grades of the cocoon item in question. The mean value of the cocoon compactness ranged from 5.27 to 10.61 mms in the different races. The highest cocoon compactness was that of the cross breeds Huachiu and Yinhan. Their compactness were 2.91 and 2.92 while the least compactness was 6.10 mms in the race Oro Chinese.

Coefficient of variation of the mean cocoon compactness ranged from 26.39 to 41.16 %. The highest variability was among the race Ungari and the least coefficient of variation was that of the race Kitpinih.

TABLE 1 : THE LENGTH AND WIDTH OF THE COCOON IN THE DIFFERENT RACES PER CMS.

R A C E S	L E N G T H					
	1 9 5 7			1 9 5 8		
	MAX.	MIN.	MEAN $\pm$ S. D.	MAX.	MIN.	MEAN $\pm$ S. D.
GOBIO	11.1	10.0	10.5 $\pm$ 1.3	...	...	.....
BAGDAD	10.7	7.8	9.5 $\pm$ 0.4	...	...	.....
GREEN	10.0	8.3	9.9 $\pm$ 0.6	...	...	.....
VAR	9.3	7.4	8.6 $\pm$ 0.2	9.5	7.6	8.6 $\pm$ 0.4
KITPINIH	8.6	7.5	8.4 $\pm$ 0.1	9.2	7.5	8.2 $\pm$ 0.3
UNGARI	8.3	6.9	7.7 $\pm$ 1.3	9.1	7.7	8.4 $\pm$ 0.3
HUACHIU	8.3	6.2	7.5 $\pm$ 0.2	9.7	7.9	7.6 $\pm$ 0.5
CELLAR	8.3	6.8	7.4 $\pm$ 0.3	8.7	7.3	7.3 $\pm$ 0.5
YINHAN	8.0	6.3	7.4 $\pm$ 0.5	9.3	8.0	8.6 $\pm$ 0.4
ORO CHINESE	7.4	5.9	6.8 $\pm$ 0.2	8.2	6.2	7.4 $\pm$ 0.3
	W I D T H					
	MAX.	MIN.	MEAN $\pm$ S. D.	MAX.	MIN.	MEAN $\pm$ S. D.
GOBIO	7.5	6.4	7.2 $\pm$ 1.9	...	...	.....
BAGDAD	6.7	4.9	5.8 $\pm$ 0.6	...	...	.....
CELLAR	6.5	5.0	5.6 $\pm$ 1.4	6.7	4.8	5.9 $\pm$ 0.4
GREEN	6.1	4.3	5.4 $\pm$ 0.8	...	...	.....
KITPINIH	5.7	4.6	5.2 $\pm$ 0.9	5.6	4.6	5.3 $\pm$ 0.3
VAR	6.0	4.2	5.1 $\pm$ 1.9	5.8	4.4	5.2 $\pm$ 0.8
UNGARI	6.0	4.1	5.1 $\pm$ 0.4	5.7	4.9	5.4 $\pm$ 0.2
HUACHIU	5.3	4.2	4.9 $\pm$ 0.5	6.2	5.1	5.6 $\pm$ 0.3
YINHAN	5.2	4.0	4.6 $\pm$ 0.6	6.3	5.1	5.7 $\pm$ 0.3
ORO CHINESE	6.6	4.6	4.6 $\pm$ 0.4	6.9	5.0	5.7 $\pm$ 0.6

TABLE II : MEAN LENGTH AND WIDTH OF THE COCOON IN DIFFERENT RACES OF SILK-WORM IN TWO YEARS.

RACES	LENGTH in cm.	WIDTH in cm.	RACES	LENGTH in cm.	WIDTH in cm.
UNGARI	8.08	5.25	ORO CHINESE	7.10	4.65
VAR	8.60	5.15	HUACHIU	8.05	5.25
KITPINIH	8.15	5.25	CELLAR	7.65	5.75
YINHAN	8.00	5.15			

TABLE III : WEIGHT OF FRESH AND DRIED COCOONS IN THE DIFFERENT RACES.

RACES	FRESH COCOONS (GRAMMES)					
	1957			1958		
	MAX.	MIN.	MEAN $\pm$ S.D.	MAX.	MIN.	MEAN $\pm$ S.D.
GOBIO	2.34	1.75	1.93 $\pm$ 0.21	....	....	.....
BAGDAD	2.05	1.01	1.62 $\pm$ 0.24	....	....	.....
GREEN	2.15	1.02	1.20 $\pm$ 0.13	....	....	.....
VAR	1.99	11.05	1.21 $\pm$ 0.13	2.16	1.09	1.45 $\pm$ 0.24
KITPINIH	1.77	1.10	1.41 $\pm$ 0.24	1.96	1.18	1.48 $\pm$ 0.20
UNGARI	1.45	0.77	1.53 $\pm$ 0.18	2.14	1.12	1.57 $\pm$ 0.24
CELLAR	1.38	0.61	1.11 $\pm$ 0.15	1.88	1.01	1.40 $\pm$ 0.24
HUACHIU	1.57	0.71	0.99 $\pm$ 0.19	2.04	1.11	1.49 $\pm$ 0.10
YINHAN	1.22	0.64	0.99 $\pm$ 0.22	1.81	1.50	1.54 $\pm$ 0.18
ORO CHINESE	1.14	0.64	0.96 $\pm$ 0.16	1.64	0.73	1.27 $\pm$ 0.22
RACES	DRY COCOONS (GRAMMES)					
	1957			1958		
	MAX.	MIN.	MEAN $\pm$ S.D.	MAX.	MIN.	MEAN $\pm$ S.D.
GOBIO	0.604	0.509	0.573 $\pm$ 0.15	....	....	.....
BAGDAD	0.720	0.338	0.563 $\pm$ 0.10	....	....	.....
GREEN	0.700	0.340	0.505 $\pm$ 0.14	....	....	.....
VAR	0.616	0.296	0.486 $\pm$ 0.20	0.996	0.596	0.559 $\pm$ 0.10
KITPINIH	0.510	0.590	0.456 $\pm$ 0.26	0.652	0.540	0.515 $\pm$ 0.20
UNGARI	0.474	0.288	0.383 $\pm$ 0.06	0.822	0.410	0.536 $\pm$ 0.31
CELLAR	0.456	0.267	0.370 $\pm$ 0.10	0.646	0.340	0.515 $\pm$ 0.20
HUACHIU	0.540	0.248	0.357 $\pm$ 0.17	0.826	0.440	0.612 $\pm$ 0.20
YINHAN	0.464	0.200	0.356 $\pm$ 0.20	0.723	0.510	0.613 $\pm$ 0.20
ORO CHINESE	0.400	0.190	0.315 $\pm$ 0.22	0.554	0.270	0.410 $\pm$ 0.20

ETUDES TECHNOLOGIQUES SUR LA BAVE DE DIFFERENTES RACES
DE VERS A SOIE (Bombyx mori L.).

Résumé.

Les propriétés technologiques de la bave des cocons de vers à soie diffèrent énormément en raison de quelques facteurs connus ou inconnus. Les scientifiques égyptiens dans le domaine de la sériciculture ont porté un intérêt spécial à la sélection et à l'introduction des races standards de vers à soie et ont étudié l'efficacité relative des propriétés technologiques de la bave en vue d'établir un programme national visant à l'amélioration de la sériciculture pour augmenter la production de la soie.

Les recherches présentes ont été conduites pour faire une étude technologique comparative sur la bave des races sélectionnées locales et importées de vers à soie de Bombyx mori L.

COULEUR DES COCONS.

La couleur des cocons des croisements Yinhan, Huachiu et de la race Cellar était blanc argent, elle était blanc terne pour la race Bagdad. Les cocons de races Kitpinih, Gubbio et Var étaient jaune pâle et jaune doré pour la race Chinois doré. Les cocons de la race Ungari étaient roses et les cocons de la race Green étaient verts.

FORME DES COCONS.

La forme des cocons de Bombyx mori est sphérique, ovale ou cintrée. Les races Cellar et Chinois doré sont du premier type tandis que les croisements Yinhan et Huachiu sont de forme ovale. Les cocons des autres races sont du type cintré.

LONGUEUR DU COCON.

La longueur du cocon varie de 6.7 à 10.5 cm pour les races élevées en 1957 et de 7.4 à 8.6 cm pour celles élevées en 1958. La longueur moyenne la plus élevée a été celle de la race Gubbio.

LARGEUR DU COCON.

La largeur moyenne du cocon varie de 3.6 à 7.2 cm dans les races élevées en 1957 et de 5.2 à 5.9 cm dans celles élevées en 1958. La largeur moyenne la plus élevée a été celle de la race Gubbio.

POIDS DU COCON.

Le poids moyen des cocons frais pour les races élevées en 1958 varie de 0.761 à 1.936 g. Le poids moyen le plus élevé a été celui de la race Gubbio. Le poids moyen des cocons des races élevées en 1958 a varié de 1.574 à 1.266 g et le poids moyen des cocons frais a été celui de la race Ungari. Il a été conclu que le poids moyen des cocons secs a varié de 315 à 673 g pour les races élevées en 1957 et le poids moyen le plus élevé a été celui de la race Gubbio. Le poids moyen des cocons secs des races élevées en 1958 a varié de 410 à 613 mg et le poids moyen le plus élevé a été celui du croisement Yinhan. Le nombre moyen des cocons frais a varié de 500 à 907 dans les différentes races et le nombre moyen des

cocons secs de 1.470 à 2.595. Le nombre maximum de cocons frais a été dans la race Chinois doré et le nombre minimum dans la race Gubbio.

LONGUEUR DE LA BAVE.

La longueur de la bave filable varie grandement dans les différentes races. La longueur moyenne de la bave a varié de 250 à 714,4 m pour les races élevées en 1957, la longueur la plus élevée a été celle de la race Gubbio. Quant aux races élevées en 1958 la longueur moyenne de leur bave a varié de 440,9 à 822,6 m et la longueur de filament la plus élevée a été dans le croisement Huachiu.

POIDS DE SOIE.

Il a été conclu que le poids moyen de la soie filable a varié de 96,2 à 201 mg dans les races élevées en 1957 et le poids moyen de soie le plus élevé a été celui de la race Gubbio. En 1958, le poids moyen de soie a varié de 116,3 à 235 mg et le poids de soie le plus élevé a été dans le croisement Yinhan. Le poids maximum des cocons nécessaires pour obtenir 1 kg de soie a été de 2,714 kg dans le croisement Yinhan et le poids maximum a été de 4,047 kg dans la race Gubbio.

PROPRIETES DYNAMOMETRIQUES.

La résistance moyenne du filament des races et croisements élevés en 1957 a varié de 57,8 à 538 mm/m. Il a été conclu que la plus haute résistance a été chez la race Gubbio et la plus haute élasticité a été celle de la race Ungari. La résistance moyenne de la bave des races élevées en 1958 a varié de 71,9 à 95,8 dg avec une élasticité moyenne variant de 46,0 à 45,5 mm/m. La plus haute élasticité a été celle de la race Kitpinih. Il a été observé que les propriétés dynamométriques diminuaient de l'extérieur à l'intérieur du cocon.

COMPACTITE DU COCON.

Il a été démontré que la valeur moyenne de la compacité du cocon varie de 2,91 à 61 mm dans les différentes races. La plus petite compacité a été dans les croisements Huachiu et Yinhan. La plus haute compacité a été celle de la race Chinois doré.

Il est clairement évident, d'après les présentes recherches, que les croisements Yinhan et Huachiu ont été les meilleures races élevées au cours de ces deux années d'expériences. Les caractères des deux races sélectionnées montrent une supériorité dans la résistance de la bave, le poids de la soie et le rendement en soie (*).

(*) NDLR - Le Secrétariat Général précise que les textes et chiffres cités sont absolument identiques aux documents reçus de la part des auteurs.

The General Secretariate points out that the texts and the figures here-issued are absolutely the same as the ones appearing in the authors' documents.

11ème CONFERENCE TECHNIQUE SERICICOLE INTERNATIONALE
MURCIE (Espagne) - Avril 1960.

Troisième Partie.

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11ème CONFERENCE TECHNIQUE SERICICOLE INTERNATIONALE
MURCIE (Espagne) - Avril 1960

SEED PRODUCTION IN INDIA

submitted by Mr A. T. JANAKIRAMAN (India) (*).

The crucial role which seed production plays , in determining the success or otherwise of cocoon crop has been very well recognized in India as in other sericultural countries of the world. Stabilization of cocoon harvests and standardization of the same, are the twin objectives which the sericultural workers in India have set to achieve in a measurable time.

The importance which we have attached to "Seed Production" in India will be evident from the fact that in the nation's Second Five Year Plan, (we are now running the fourth year of this Plan) we had allocated 42.7 % for seed production from the total outlay for development of the sericulture industry. A working group for sericulture industry , which reviewed the work recently has now suggested that in the Third Five-Year Plan, it would be necessary to further amplify the useful work already initiated in the direction of rationalization of seed organizations in the different States of India and has suggested that the outlay might be increased to 47.5 % of the total expenditure on sericulture.

DURING NINETEENTH CENTURY.

It would not perhaps be redundant if we recall here that in the 19th Century, the seed supply organizations in India were quite capable of meeting not

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only the internal demands but were even able to supply seed to foreign countries. We have it on record from the book "Le Cocon de Soie" of Duseignous Kléber, that exactly a century back i.e. in 1860 A.D. two Italian seed producers viz. M.M. Orio and Consonno, were able to obtain 25,000 ozs. of silkworm seed at short notice from Kashmir and the seed is said to have been declared sound by pebrine epidemic swept through the Valley of Kashmir in 1878 and completely wiped out the extant indigenous race of silk worms.

In Mysore and West Bengal, which are the other two leading sericultural States of India, the industry survived because of the inherent vitality of indigenous races. While the Government of the day was aware of the important role which seed supply played in successful sericulture, yet attempts at rationalization of the seed organization were few and far between. Even a State like Jammu and Kashmir, which is so ideally suited for the rearing of uni and bivoltine races of silkworms, had perforce to import her entire requirement of seed from Europe.

It was only during the Second World War that attempts were made by this State to become self-sufficient in regard to seed requirement. So far as Mysore State is concerned, a definite step forward was taken in 1922 when for the first time F_1 hybrids between indigenous female and Chinese or Japanese male moths were introduced. Bengal however continued with her indigenous races Nistari, Chotapolu and Barapolu till 1940's when fixed hybrids like Nismo and Nistid were introduced.

The Sericultural areas in India can be classified in three broad types conforming to the climatic conditions : -1) Kashmir type : covers regions like Jammu and Kashmir and Himachal Pradesh which are favoured with temperate climate and marked seasonal changes : 2) Mysore type : covers regions of Mysore, Madras, Andhra and Kerala characterized by tropical climate with moderate temperature throughout the year; 3) West Bengal type : Assam, Bihar, and West Bengal with tropical climate with high temperature in summer, In Kashmir region due to severe cold in winter, mulberry trees are exposed to nature and thus are forced to hibernate. Kashmir type climate

is suitable for univoltine breeding while Mysore type for multivoltine races and West Bengal also for multivoltine races. The organization for seed production in India is therefore designed to meet the requirement of different regions and for different seasons. The total requirement for mulberry silkworm seed per annum in India are estimated at 30.9 million grams and those of non-mulberry varieties are placed about 17.01 million grams. The present production of the examined seed of mulberry and non-mulberry type represent only 46 per cent and 6 per cent respectively of the total annual demand. The seed organization is therefore being organized to meet the requirement of Indian rearers. The seed organization in this country largely consists of basic seed farms for raising P_1 seeds, hill rearing stations for preservation of stock races and production of P_2 seed, multiplication of P_1 seed through the agency of selected rearers and government grainages and aided programmes for production of industrial seed. There are six zonal stations and one main silkworm station that are now being placed under the programme of integrated rearings.

It may be stated here that, the actual attempts at rationalization of our seed organization in the different States commenced in 1949-50 when the Government of India constituted the Central Silk Board to be in overall charge of the welfare of the Silk Industry in our country. Ever since then our programme has proceeded in two distinct phases : 1) Short term programme; and 2) Long term programme.

This has essentially a short term perspective and has for its aim 5 main objectives as detailed below :

a) Increasing the production of examined seed and bridging the present gulf between requirement and production of examined seed in the different States.

b) Extending of hybrid technique in grainage programmes.

c) Amelioration of exotic races of silkworm by having recourse to hill rejuvenation.

d) Improvement of indigenous silkworm races by pure line selection.

e) Introduction of seed legislation to prevent production and sale of unexamined seed.

It would now be appropriate to deal at length the progress achieved by us in each of the 5 phases indicated above :

a) Increasing the production of examined seed.

Annual requirements of seed as also the production in three major sericultural states of India are furnished in annexure I. It would be seen that our total annual requirement is of the order of 10,90,000 ozs. of which we are at present able to supply 4,77,343 ozs. or roughly 43.4 % as examined seed. While we are happy that a significant improvement has been recorded in all the States in regard to the supply of examined seed since 1948, yet we cannot help observing that much ground remains yet to be covered. It will be significant to note that in Mysore State the production of examined seed was only about 35 % of the requirement in 1948 whereas in 1958 it has reached 47.9 %.

Similarly in the case of Jammu and Kashmir State, the total dependence on imported seed, which was the condition obtaining before the Second World War, has been completely liquidated and this State has now 4 Government Grainages which among them produce more than 96 % of the total requirement of seed. West Bengal also has made considerable progress and at present produces about 19 % of examined seed.

While on this question of increasing the production of examined seed we have to state that we are quite aware of the need to aim at bigger units of seed production rather than a large number of small units. Where efficiency is so inextricably linked with largeness of a unit, naturally, a country has to have recourse to larger grainages so that the quality of seed may be at its highest. However in a country of distances like India, and with a multiplicity of cocoon crops per year, the problem tends to become a bit more complicated and perhaps wisdom lies in creating the minimum number of grainages without in anyway impairing their production efficiency. We are moving a bit cautiously in this regard and are trying to establish an harmonious set

up of grainages, which, while not sacrificing their efficiency will at the same time serve effectively to reach the farmers in the remotest corners of our sericultural States.

b) Extending hybrid technique.

We have no doubt a number of indigenous silk-worm races. While they are quite hardy and can withstand the unfavourable climatic factors, yet they cannot be deemed commercially quite potent. The shell-content, cleanness and neatness features have been very limited in their cases and the call was naturally for more useful races. "Hybrid era" in sericulture industry had commenced fairly early in Mysore State and as early as in 1922, crosses between the indigenous Mysore race and Chinese or Japanese races were popularised in this premier State. At present almost all the crops raised are only of Hybrids of the type referred to earlier.

West Bengal also has made significant progress in the introduction of hybrid technique. This State has already got 4 fixed hybrids called Nismo, Nistid, Ichhot and Itan, all of which are decidedly better than the indigenous races. However in the course of the last few years they have deteriorated and the sericultural workers in this State are currently busy evolving some more fixed hybrids. Besides this State has also resorted to F_1 crosses between the indigenous Nistari and the exotic uni or bivoltine races since 1956. From a production of 357 ozs. of F_1 hybrid seed in 1956, the output increased to about 27100 ozs. in 1958-59. If the targets achieved were not more significant it was due to the non-availability of exotic uni and bivoltine races as male components for the crosses. West Bengal has already initiated an important scheme to solve this problem and a number of farms for raising uni and bivoltine cocoons are in the process of organisation.

In so far as Jammu and Kashmir is concerned it is to be stated that " F_1 era" has already commenced and during 1959 rearing season two important crosses of Japan were tried viz. Taihei x Choan and Hoko x Shingyoku. The yield of green cocoons which was 629,000 kilogrammes (17000 maunds of 37 kgm each) in

1959, rose to 836.200 kg (22.600 maunds of 37 kg each) in 1959, recording an increase of 17 % above the 1958 level. This State is now actively entering the "F₁ era" and has already taken a number of steps to assure a continuity of races for preparing effective hybrids.

In Assam and the Punjab also the F₁ hybrids are popular. In short Sericulture in India is definitely in the F₁ era and the question before us now is to improve the components in these crosses and the steps taken by us for the same are given below :

c) Amelioration of exotic races through hill rejuvenation.

We have at present a number of exotic races of silkworms from Japan, China and France and Italy and they are being used as male components in the preparation of the commercial hybrids in India. Needless to say, these exotic races deteriorate considerably after a few generations of rearing in the Gangetic plains of West Bengal or in the plateau of Mysore. With a view to retain their vigour and vitality, a process of "hill amelioration" is being resorted to. Each of the sericultural States in India has started one or two hill rearing stations at elevations ranging from 4000 ft. to 6500 ft. above mean sea level. The exotic races are reared in these stations as P₁ stock and released periodically for multiplication in the farms located in the plains. This Hill amelioration has to a great extent mitigated the loss of vigour of the exotic races. The technique is however being perfected.

d) Improvement of indigenous silkworm races.

While hill amelioration has been adopted to retain the vigour of the exotic component of the commercial hybrid, we have simultaneously taken suitable steps to improve the indigenous female component. Pure line selection technique has been adopted and in Mysore work has been under progress since 1949. The percent of floss has been reduced from 21 % to 14 % and the shell content has been increased to 17 % while the neatness percent has risen from 60 to 78% (results from the Central Sericultural Research Institute, Channapatna). We have also succeeded in obtaining a perfectly pure white race of silk

worm from the indigenous golden yellow pure Mysore races by subjecting the eggs to shock treatment at 5° C. soon after oviposition. This white race has given a rendita of 11.2 in filatures in 1958 (results obtained at Central Sericultural Research Institute, Channapatna). Further studies are now under progress to assess the precise potentialities of this race as the female component in our commercial seed.

The States have also started the basic seed farm for the raising of P₁ and P₂ generations of the indigenous races. Considerable headway has been made in both Mysore and West Bengal States.

e) Introduction of seed legislation to prevent production and sale of unexamined seed.

We have made considerable progress in this regard in India. So far as Jammu and Kashmir State is concerned, there is no need for such legislation as the entire sericulture industry is a state monopoly. The production of seed is done in 4 State Grainages. Mysore State has already enacted an act called "Mysore silkworms Seed (control and distribution) Act 1952". The scope of this act has been further expanded to bring the entire seed production under its compass. The Punjab, Madras and Andhra Pradesh States have also similarly passed acts prohibiting the use of unexamined seed. The seed production machinery in other States is being prepared for passing of similar acts.

2. LONG TERM PROGRAMME.

While the foregoing is an account of the progress we have achieved under "short term" programme which is more of an expedient and ameliorative nature, we have at the same time initiated steps to solve some of our seed problems on a permanent basis. In this we are conscious of the limitations of the scope to further improve our indigenous races by pure line selection and have accordingly decided to improve them, if possible, by hybridization and subsequent fixation of the hybrid. Happily we are not without experience in this field. As already stated earlier, West Bengal State has made considerable progress in this regard and has already evolved a

number of fixed hybrids. At present a number of our workers are engaged in the different States to evolve suitable fixed hybrids with the indigenous races as one of the components.

The next and most significant step is the simultaneous commencement of breeding experiments for the evolution of suitable uni and bivoltine races in the Central Silkworm Seed Station, Srinagar (Kashmir) (Central Silk Board) and the zonal stations in the States. Adopting the conventional breeding technique a number of experimental breeding essays are currently under progress. While we are aware that this process is necessarily slow, we are happy to be able to state that we have commenced this work in India and are looking forward with hope and enthusiasm to the successful evolution of suitable uni and bivoltine races in our States.

ANNEXURE I

State	Annual Demand (in ozs.)	Production in 1958 (in ozs.)
Mysore	8,00,000	3,83,000
West Bengal	2,40,000	46,000
Jammu and Kashmir	<u>50,000</u>	<u>48,343</u>
Total	10,90,000	4,77,343

L'INDUSTRIE DU GRAINAGE EN INDE.

Résumé.

En Inde, 30,9 millions de grammes de graines sont nécessaires pour l'élevage du Ver à soie du mûrier et 17,01 millions de grammes de graines pour l'élevage des Vers à soie sauvages.

La production actuelle représente seulement 50 % de la demande annuelle. Le grainage dans ce pays est surtout réalisé dans des fermes sélectionnées et spécialisées, dans des stations de montagnes où l'on conserve les souches et dans les ateliers de grainage gouvernementaux.

Un programme à long terme et un programme à court terme ont été mis sur pied par le Central Silk Board pour le développement du grainage en Inde. Ces programmes ont en vue :

- l'accroissement à la production de graines saines,
- l'extension de la technique d'hybridation,
- l'amélioration des races exotiques, grâce à la régénérescence dans les montagnes,
- l'amélioration des races indigènes par la sélection en ligne pure,
- l'étude d'une législation qui préviendrait la production et la vente de graines non contrôlées.

11ème CONFERENCE TECHNIQUE SERICICOLE INTERNATIONALE
MURCIE (Espagne) - Avril 1960

Quatrième Partie.

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11ème CONFERENCE TECHNIQUE SERICICOLE INTERNATIONALE
MURCIE (Espagne) - Avril 1960.

SELECTION OF CROSSOVER VALUE BETWEEN *STRIPED*
AND *YELLOW* IN THE SILKWORM.

By Mr Haruo HASHIMOTO (Japan) (*)

1. *THE SELECTION OF CROSSOVER VALUE BETWEEN*
Striped AND Yellow.

The crossover value of almost all the genes in the silkworm have been known to be subjected to an exceedingly wide range of variation. Only a few investigations, however, have been undertaken with the purpose of elucidating the cause of the variation.

The standard value between *Striped* and *Yellow* as reported by Tanaka, is 25.6 %. An individual variation occurs, as in other genes, in the case of *Striped* and *Yellow*. The result of selection of crossover value between the two genes, carried out by KOGURE, showed that the high series selected gave a crossover value of 24 %, and the low series of 12 %. Since in a certain crossing experiment performed by the present author with another purpose in mind a remarkable variation in crossover value between *Striped* and *Yellow* was observed to have been taken place, series of selecting experiments were undertaken. The starting materials of the experiments consisted of 11 races, some of which belong to the practical races now in use in Japanese sericulture, and others came from the races preserved in the Sericultural Experiment Station. Some of these

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ances bear both of the genes, *Striped* and *Yellow*, others carry none and the rest either one of them. By making these races two kinds of crosses, *Striped Yellow* x normal and *Striped* x *Yellow*, were raised. The resulting heterozygous *Striped Yellow* F₁ male was backcrossed with normal female. Twelve crosses obtained from the backcross were submitted to the selection of crossover value. Every succeeding generation was raised by inbreeding the segregated *Striped Yellow* male with the segregated normal female. Selection was performed in two directions, on in the increasing and the other in the decreasing. It was revealed that the effect of selection in the increasing line was conspicuous for a number of early generations, while any effect was scarcely visible in later generations ranging from the 10th to the 12th generation. The aspect of variation in crossover value in the increasing line was highly stable and showed no difference in the variation for the 3 generations. The mode of the value for these generations was found to be from 37 to 39 % and the largest value was 43 %.

Selection in the decreasing direction gave a remarkable reduction in crossover value for the first 7 generations. In the later generations the effect of selection became less conspicuous. The result of observation in 3 generations ranging from the 11th to the 13th generation showed that the variation in crossover value is highly stable, and each generation gave the same aspect. The mode of crossover value obtained between the 11th and the 13th generation was from 5 to 7 % and the smallest value was 3 %.

From the above-mentioned result it may be concluded that crossover value, once fixed, scarcely suffers a variation.

2. CROSSING EXPERIMENT BETWEEN THE CROSSOVER VALUE SELECTED LINES.

Since two distinguished lines in relation to the crossover value between *Striped* and *Yellow* seemed to have been established, a crossing experiment was undertaken to ascertain whether the two lines are really genetically fixed or not, and to observe the crossover value in the resulting F₁. The mode of

crossover value in the resulting F_1 was 20 %, being intermediate between those of the parents. The crossover value in the F_1 showed a very narrow range of fluctuation. This fact might be considered to show both parents homozygous as to the crossover value genes. The backcrosses of the F_1 with either one of the parents, however, gave a wide range of variation in the crossover value.

3. THE RELATIONSHIP BETWEEN CROSSING OVER AND THE REARING TEMPERATURE.

Concerning the effect of rearing temperature of larvae upon crossing over between *Striped* and *yellow*, only studies by KOGURE and by KAWAGUCHI have so far been communicated. Their conclusions, however, seem not to be consistent with each other. Accordingly, the effect of rearing temperature upon crossing over was investigated by utilizing the two selected lines which have been described above. Three lots of constant temperature, 22, 25 and 28° C. were applied to the larvae during a period ranging from the beginning of the 3rd instar to the cocooning stage of the 5th instar. Each temperature lot contained from 11 to 18 crosses. As a result, no difference in crossover value was observed in the increasing line, the values being approximately equal in the 3 experimental lots. The decreasing line showed also no difference in crossover value due to the variations in the rearing temperature.

Consequently, it might be concluded that the rearing temperatures have no prominent effect upon inducing variations in crossover value.

SELECTION DU TAUX DE CROSSING-OVER ENTRE ZEBRE ET JAUNE CHEZ LE VER À SOIE.

Résumé.

L'auteur essaie de fixer la variation du taux de crossing-over.

Après très peu de générations, il a obtenu très peu de lignées présentant une fixité de ce caractère : 43 % pour les lignées à fort crossing-over (10 à 12 générations) et 3 % pour les lignées à faible crossing-over (7 générations).

L'auteur a essayé ensuite de recroiser les lignées obtenues faibles et fortes, il conclut que les parents sont homozygotes. Les températures d'élevage n'ont pas d'influence sur l'expression du caractère dans toutes les lignées.

11ème CONFERENCE TECHNIQUE SERICICOLE INTERNATIONALE
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BIOLOGICAL STUDIES ON CERTAIN RACES
OF THE SILKWORM, *Bombyx mori* L.

By Mr M.H. HASSANEIN and Mr F.EL CHARAWY (E.A.U.)(*)

INTRODUCTION.

The races of silkworm *Bombyx mori* L. are either univoltine, bivoltine or polyvoltine. The taxonomists consider that these characters are changed owing to the environmental conditions. The univoltine races or annuals, have one generation in the year, the grains or eggs deposited by the moth in spring do not in fact hatch out until the following spring, having passed the summer and the autumn in aestivation and the winter in hibernation. In the other breeds, the eggs can hatch very soon after being deposited because there is no pause in the embryonic development, thus allowing reproduction of successive generations in the year.

The local breed in Egypt, was a race called "Masry", which gives yellow cocoons, coarse grains, moreover it was failure in giving good quality of raw silk. This breed had disappeared from Egypt after the pebrine epidemic spreading from France in the latter half of the last century.

Many silkworm races, were imported to the Egyptian sericulture department and were distributed without any test for their superiority in the quantity and quality of silk production.

The present investigations were carried out in the faculty of agriculture, Ain Shams University and Sericulture Section, Ministry of Agriculture, to make a comparative study on certain characters of some selected imported races of silkworms especially their adaptability to the lo-

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cal environmental conditions. Each race had been given sufficient study to be accustomed to its special characters and from the results obtained we can choose the most satisfactory race for breeding in Egypt.

LITERATURE CITED.

CHAROBIM (1925) carried out a biological study in France on certain silkworm races and concluded from his study that the race Var is considered as the best race for breeding in Europe, especially France. VAGO (1954) made his observations on the cause of the unsuccessful, summer rearing of silkworms. He mentioned that the high enfeeblement and mortality were observed in the successive summer rearing. They were attributed to physiological factors, food and climate, but VAGO's investigations put forward two distinct etiological factors:

a) The mortality was caused only by a highly infectious diseases which was favoured by the succession of rearings.

b) The food and climate factors caused only the enfeeblement of worms and the decrease of the silk yield.

SCHENK and LEGAY (1954) presented a study of silkworm layings of which the following characters were measured:

- 1) Total weight of the laying (P)
- 2) Total number of laying eggs (N)
- 3) The individual average weight: $p = \frac{P}{N}$

First it was pointed out that layings with light eggs and layings with heavy eggs could be separated, then the authors proved that each laying the total weight of eggs P and the total number of eggs N of each laying were strictly connected --- 0.901. LEGAY (1954) carried out investigations on the variations of three quantitative characters of the egg laying: the number of eggs, the total weight of the egg laying and the mean weight of the egg. He concluded that these variations could be dependent from different physiological and genetical conditions. MISTICHELLI (1955) studied the greater and lesser diameter of the cocoons and the eggs of some races of the silkworm. His results indicated that both the characters show an evident diversity under favourable seasonal conditions. LEGAY and BAUD (1956) reported that the duration of the necessary and facultative periods of alimentation expressed in number of meals were clearly different between the races of the three moulting and fourth moulting during the last stage only. The weights of cocoons, the shells and pupae were lighter in three moulting than in the fourth moulting races. The ponderal dimorphism linked to the sex equally important in these races. The silk secretion is proportionally more active during the last stage among the three moulting, than the fourth moulting races. The total weight, the number of eggs laid and the average weight of an egg of the three moulting races are smaller than in the fourth moulting ones.

MATERIAL.

The silkworm races used in this study were the standard breeds in many countries in the world. During 1957 and 1958 breeding of the different races were carried out in the Faculty of Agriculture, Ain Shams University and in the Sericulture Department, Ministry of Agriculture, Egypt. The races used in these investigations were :

	1957	1958
1 -	Gobio	-
2 -	Bagdad	-
3 -	Green	-
4 -	Var	Var
5 -	Ungari gelbspinner	Ungari gelbspinner
6 -	Cellar weibspinner	Cellar weibspinner
7 -	Kitpinh erxopia	Kitpinh erxopia
8 -	Oro chinese	Oro Chinese
9 -	Yinhan x Huachiu	Yinhan x Huachiu
10 -	Huachiu x Yinhan	Huachiu x Yinhan

The Gobio, Bagdad, Green and Var are considered as local races. They were bred in Egypt since the establishment of the Sericulture Department, Ministry of Agriculture in 1926. The races Ungari gelbspinner (U), Cellaar weibspinner (C) were imported by air mail from the German Sericulture Research Station, Germany. Kitpinh erxopia was imported from the Sericulture Laboratory, Ministry of Agriculture, Greece. The hybrid Yinhan x Huachiu and its reciprocal cross were imported from China.

The races Gobio (G), Bagdad (B) and Green (C) were highly infected by the pebrine epidemic during the year 1958.

METHODS.

INCUBATION.

Many factors must be considered carefully before making selection of the incubation of silkworms eggs. The most important factors are the local climate, the species and the growing conditions of the mulberry trees in the locality. Incubation in the right period is an important measure for enabling the embryos of silkworm eggs to develop normally and the matured mulberry leaves can be obtained in the proper time.

The grains of the different breeds were weighed and packed in a small paper boxes with musclin cloth for ventilation.

Incubation took place in an electrical incubator supplied with a source of humidity. The temperature during the incubation period ranged from 23° to 25° C. and the humidity from 75 to 80 % relative humidity. The packages were provided with a mesh cloth in the last two days so that the hatched larvae might penetrate the cloth and leave the eggshell behind.

A few tender top leaves were plucked from the mulberry trees and put over the worms. They crawl up the leaves gradually, then they were removed with the worms to the rearing trays.

REARING METHOD.

The rearing method must be in accordance with the principal properties of the various species of the silkworms and properly controlled, so that the different breeds should not be mixed with each other during the rearing period. Important points of technical treatments were noticed in rearing. Disinfection and antidiseases sanitation are very important measures against silkworm diseases. The rearing rooms and implements were disinfected. Environment sanitation during rearing stages were perfectly treated, precautions were taken against possibilities of infecting the silkworms with certain epidemic diseases which may be attached to the mulberry leaves in the orchards. The rearing room was twelve meters by six and five meters in height from the floor to the double ceiling. The windows were on each side for the ventilation and light, but the direct rays of the sun upon the reared worms was looked to be avoided. It was quite sufficient for breeding 24 grammes of grains. The wooden frames were supplied with four trays, each frame 2 meters by 30 centimeters with a boarder of seasoned wood and was lined with clean paper which were changed daily. The various breeds of silkworms in the different rearing stages have different requirements, so it was necessary to feed them with properly matured leaves, not too tough nor too tender. The mulberry leaves were supplied to the worms six times daily. The mulberry leaves were given to the first and second larval instars as stripes, afterwards the diet was distributed in a manner that the larva do not suffocate. Dried leaves and faeces were removed at different intervals by using mosquito netting in the first larval instar; and perforated papers with sufficiently large holes for the other instars.

SPINNING.

A silkworm eats incessantly consuming more food during the last week than in all the rest of its life. Gradually its appearance changes, which indicates that the silk glands are preparing the silk and the worm is ready to make its cocoon. Just before the silkworms reach this stage, bunches of Casurina branches were placed along the trays, the tops being towards each other to form a series of arches. When thousands of silkworms evacuate, the rearing room becomes damp, so it is essentially that it should be well ventilated and fresh heaps of quicklime were placed, in the corner of the room. The silkworm after choosing the suitable suite for spinning, it starts to emit from its body a thick viscous protein which solidifies on contact with air into the silk bave. Before making the actual cocoon the worm emits a coarse thread which attaches from one support to another until after five or six hours, it makes safety net from the middle of which it spins its cocoon.

BREEDING.

The selected cocoons for breeding were removed, stripped of the rough floss and carefully strung together in long "necklaces" which were hung from hooks in a dry warm after emergence of the moths, the males seek the females and they mate. The couple moths were then transferred by the wings to trays which were carried into a quiet room. At the end of the mating periods the moths were separated and the females were placed in paper bags where they lay their eggs.

SUFFOCATION AND DRYING OF COCOONS.

It is necessary to kill the chrysalis of the selected cocoons for the seric bave test before its transformation as when the moth pierces the sheath it renders it unreelable. The simplest and easiest manner has been found to be submission of the living cocoons to the action of heat, for this purpose we used the dessicator. It comprises essentially a fan in the drying chamber in which the fresh cocoons were placed, to maintain a constant air current through the mass of the chrysalides, which carries away the products formed during dessication, humid and volatile substances and a stove for heating the air driven by the fan. Dessication was started at a temperature of 50-60° C. After dessication the cocoons were kept in a dry storage.

RESULTS.

The females deposit their eggs in the egg laying paper bags after mating. The eggs vary according to the different races they are either adherent or not adherent. In the present investigations the eggs of the race Bagdad are not adherent, while the eggs of the other nine races are adherent.

The weight of the eggs varies in the different races. A study of the data shows that the number of grains ranged between 1331 to 1787 in one gramme in the tested races. The eggs in one gramme in the experimented races were : Oro Chinese 1787, Huachiu 1624, Var 1586, Bagdad 1457, Ungari 1387, Gobio 1380 and Cellar 1331.

The eggs of silkworm Bombyx mori L. are yellow in colour after oviposition, then their colour changes gradually after two or three days into grey. The colour was greenish metallic grey in the races Gobio, Ungari and Cellar, while it was metallic grey in Bagdad and Kitpinih. In the Var, the colour was pale metallic grey, and greenish grey in the race Green and Oro Chinese. The cross breed Yinhan and Huachiu the colour of their eggs were copper grey.

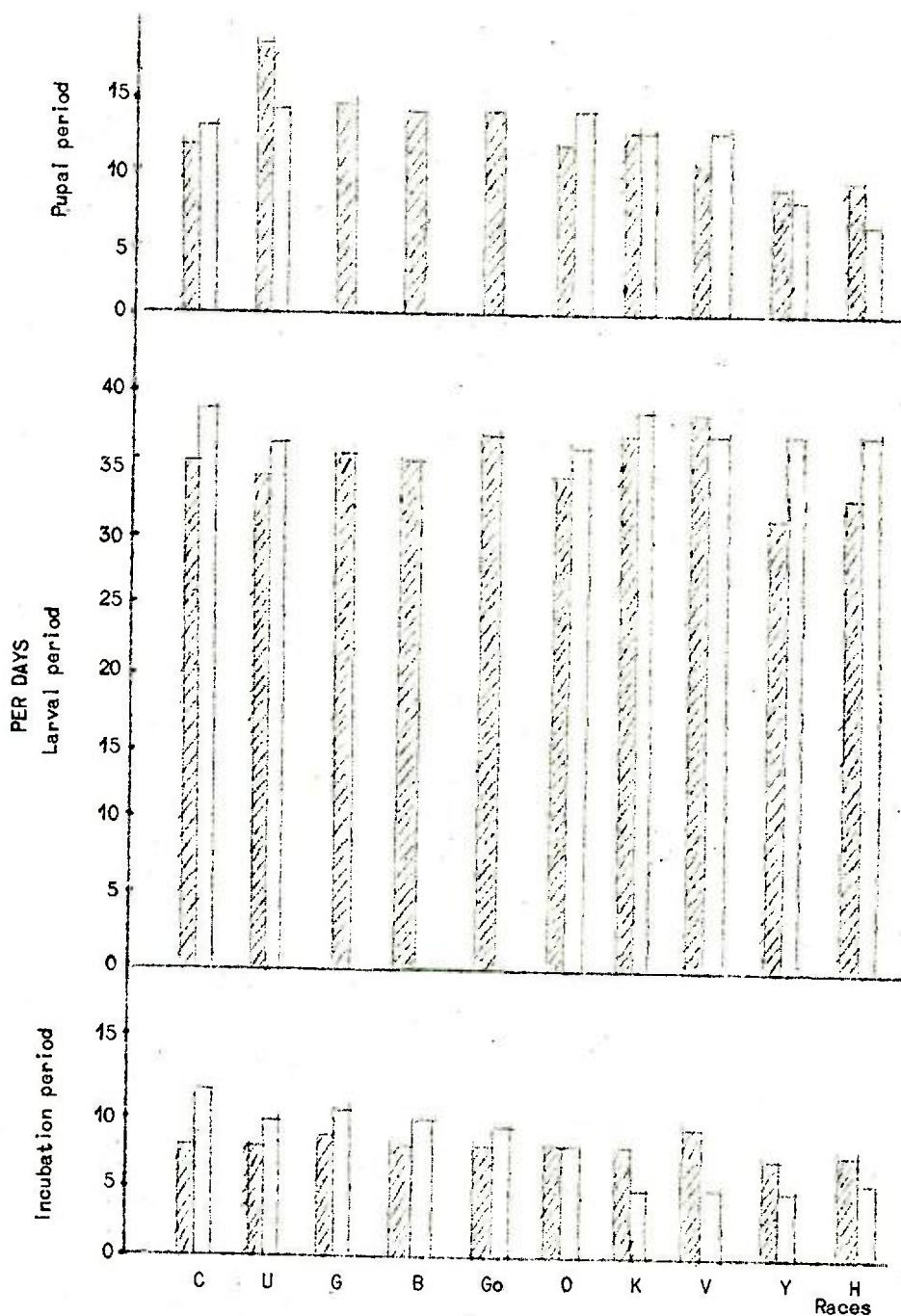


FIG. 1 - THE LIFE PERIOD OF THE SILKWORM, Bombyx mori L.

stadia ranged from four to six days. The period of the fifth stadium ranged from four to ten days during the two years of the experiments.

Growth : The rapidity with which the process of growth takes place and the increase in size and weight that accompanies it, is particularly evident in Fig. 2-3. Growth is however interrupted at each ecdysis and just after this process occurs an appreciable fall in weight takes place.

The increase in weight of the silkworm varies according to racial and other environmental conditions. After hatching the average weight of the silkworm ranged from 0.4 to 0.5 milligrams, the weight of larva in the first instar varied from 4.0 to 8.4 milligrammes and in the second instar the weight was between 17.0 and 33.2 mgms. The weight of the third instars ranged between 118 and 180 mgms, while was between 575 and 977 mgms in the fourth instar. The average weight of the mature larva ranged from 2.8 to 3.6 grammes.

A comparison of the larval weight of the different races showed that the larva of the cross breed Yinhan was heavier in weight than the larva of the other strains.

SPINNING.

The change from the larva to the pupa usually takes place after cessation of feeding. The larva deserts the mulberry leaves and wanders in search of a suitable site in which to undergo the pupation. The contents of the digestive canal voided and the body becomes contracted and distended. The larva uses the substance contained in the sericretories for the spinning of its cocoon. It emits from its body a thick viscous protein solution which solidifies in contact with air into a thread of silk called-brins, but when cemented together by the adherent material constitute the silk fibre. Before making the actual cocoon the worm emits a coarse thread which attaches from one support to another until after five to six hours, it has made a safety net from the middle of which it spins its cocoon then it starts to construct the cocoon by seripositing the thread over itself in the form of Fig. 8 setting down little bundles of these doubling on every part of the cocoon.

The cocoon of Bombyx mori L. is generally regarded as making provision for shelter from adverse elements of the worm, immobilized during its critical period of pupation. It is clearly observed from Fig. 1 that the pupal period ranged between six and nineteen days in the different races. The average weight of the pupa in the different breeds is illustrated in Fig. 4 It ranged between 195.4 and 226.6 milligrammes. The highest mean weight was in the cross breed Yinhan 152.3 for the races reared in 1957 and the highest mean weight was in the cross breed Yinhan in 1958, it was 229.9 mgms and the least mean weight was in the race Oro Chinese 221.6 mgms.

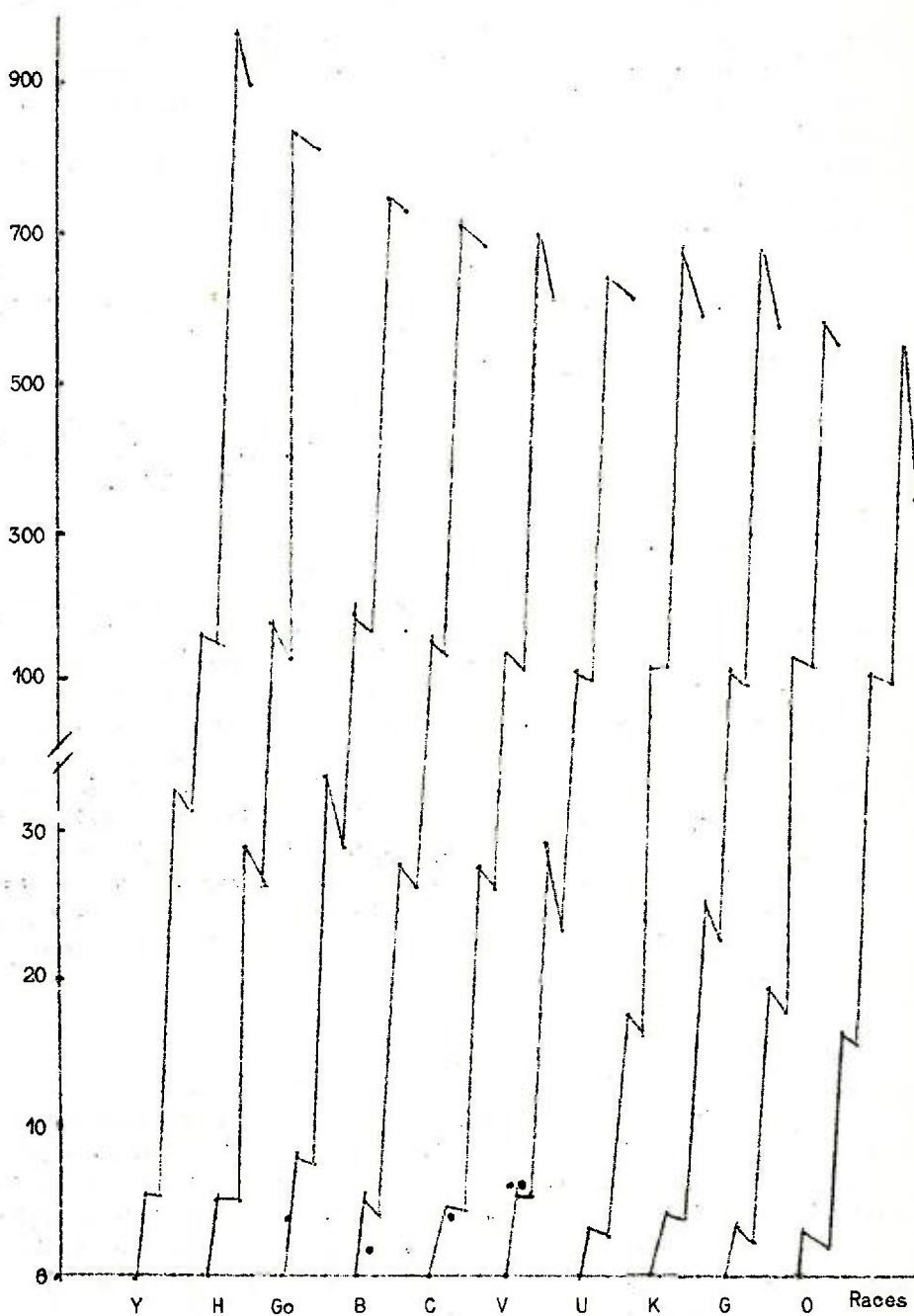


FIG. 2 - WEIGHT OF LARVA IN THE DIFFERENT INSTARS.

Coefficient of variation of the mean weight of the pupal weights of the ten breeds shows that the highest variability was among the race Ungari i.e. 51.4 %. The races Kitpinih, Var, Huachiu and Green were next regarding their coefficient of variation, 40.72, 35.88, 36.21 and 34.15 % respectively. The strains Bagdad, Gobio and Cellar were next to the previous races as their coefficient of variation were 24.68, 24.75, 21.46 % successively. The least coefficient of variation was among the race Oro Chinese, 9.32 %.

The average pupal weight in the two years ranged from 195 to 241 milligrammes. The highest mean weight of the pupa was in the race Kitpinih 241, and the least mean weight was in the race Oro Chinese and Cellar, their weights were 195.4 milligrammes.

The characters for sex differentiation in the pupae are located on the two posterior segments of the abdomen (Fig. 7). Determination of the female pupa is fairly simple and can be positively identified.

THE PELADE.

The crust of the cocoon is formed by various layers of bundles more or less solidly interplaced together. The internal layer which envelopes the chrysalis is termed the pelade. This layer is considered as a waste silk. Its weight in the different races, it was from 4 to 128 mgms with a mean value from 14.2 to 29.9 mgms. It is clearly shown from Fig. 5 that the highest mean weight of pelade for the races reared in 1957 was 29.9 mgms in the race Gobio and the least mean weight was 10.5 mgms in the race Oro Chinese. As for the races reared in 1958 the highest mean weight was 18.3 mgms in the race Oro Chinese. The coefficient of variation of the pelade weight was higher in the first experimental year, than the second year and this may be due to the adaptation of the imported races or may be due to the infestation by the pebrine epidemic disease in the local breeds.

BIOLOGICAL NATURE OF THE COCOON.

According to CARSONI (1946), FIGORINI stated that the production of silk is a synthetic method by which the worm during its larval period disposes of the waste products of the scission of alimentary albumins which otherwise would become a source of intoxication, basing this theory on the observations that the excess products are transformed into innocuous compounds (hippuric and glycol) which do not take place in the larva of the silkworm.

The construction of the cocoon could thus be regarded as resulting from the necessary elimination of toxic products and some confirmation of this theory would be derived from the fact that the mature worm secretes its silk even under the most unfavourable conditions for spinning a cocoon.

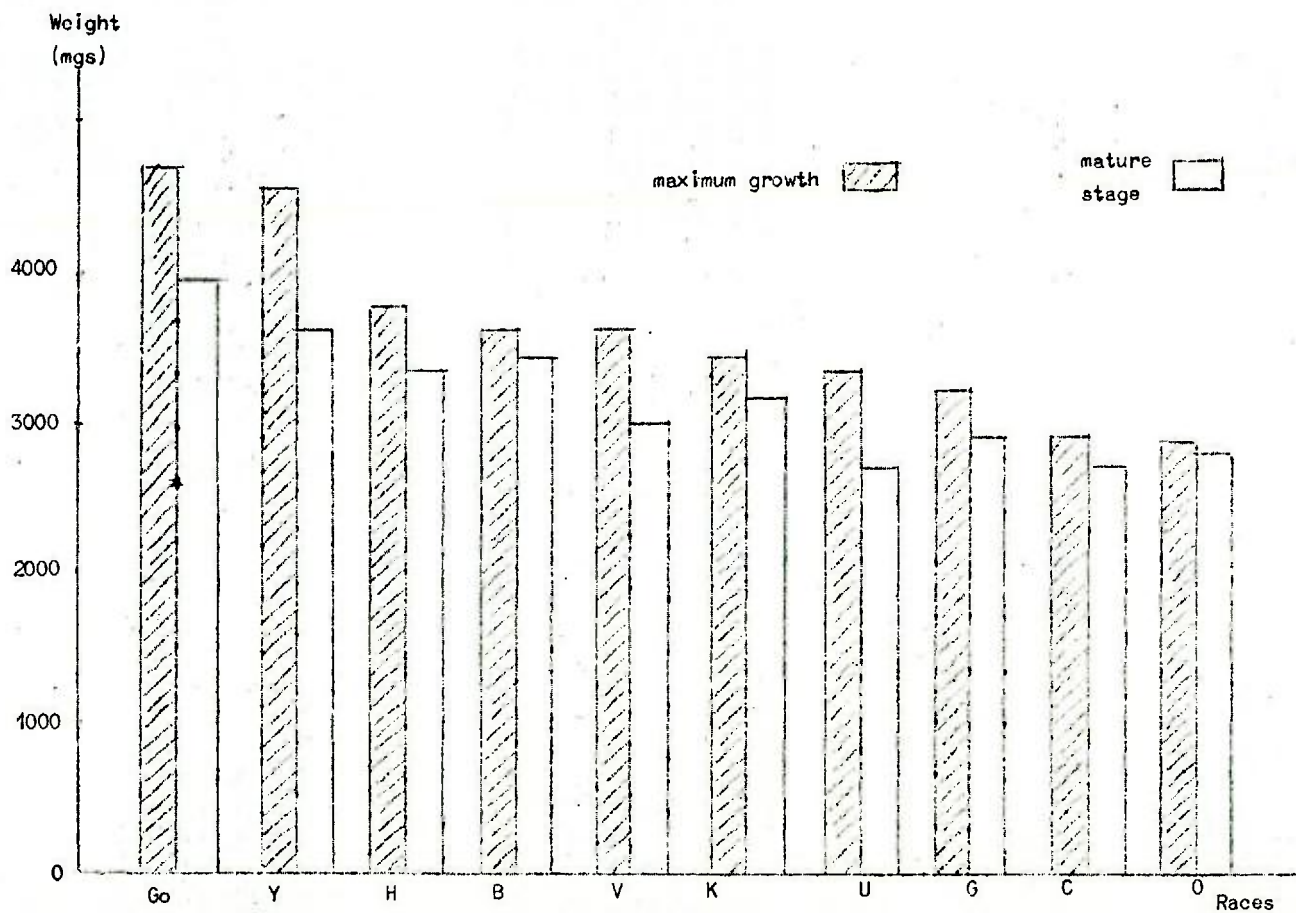


FIG. 3 - WEIGHT OF LARVA IN THE FIFTH AND MATURE STAGES.

Secretions of the silk have does not take place by construction of serictries, but passively by the movement of the worm's head which effects a continuous extraction of the thread, little by little as the thread already becomes used up in construction of the cocoon.

THE SILK GLAND.

The silkworm has two serific glands or serictries. They have three distinct parts, posterior, median and anterior known respectively as the secretory canal, the reservoir and the excretory canal.

The dimensions of the different parts of the silk gland are clearly illustrated in Fig. 6. The length of the secretory canal ranged from 17.9 to 26.9 cms in the different races, while the average length of the reservoir was from 7.6 to 11.5 cms. The length of the excretory canal ranged from 3.7 and 4.5 cms. The total length of the silk gland was between 29.2 and 42.9 cms.

These variations in length of the silk gland were among the experimented races. The maximum length of the silk gland was 42.9 cms in the race Gobio, the total length of the silk gland of the races Huachiu, Yinhan and Bagdad were 41.1, 39.5 and 38.4 cms, while it was 36.1, 35.9, 33.6 and 31.7 cms in the races Cellar, Ungari, Var, Kitpinih and Green respectively. The least length of the silk gland was 29.2 cms in the race Oro Chinese. Fig. 6 illustrates the weight of the silk glands which ranges between 0.573 and 1.150 gms. It is concluded from the comparison of the results that the weight of the silk gland of the race Gobio was heavier than the other strains.

LARVAL SEX.

The sex of the larva can be determined easily in the mature larva, since the eighth and ninth abdominal segments of the female, differ in appearance from those of the males. Four small cylindrical and semitrical depressions were found situated on the ventral site of the eighth and ninth segments of the female larva. These marks were not found in the abdominal segments of the male as it is illustrated in Fig. 7.

COLOUR OF THE COCOON.

The colour of the cocoon is one of the important characteristics that can be affected by the environment, cultivation and breeding. The colour may be of a great variety of shades, classifiable in these basic hints in the studied breeds.

White : This colour may vary the silver white of Yinhan, Huachiu and Cellar Breeds to the dull white of the Bagdad strain.

Yellow : This colour may be of different shades. It varies from the pale yellow in the races Kitpinih, Gobio and Var, and golden yellow as the race Oro Chinese.

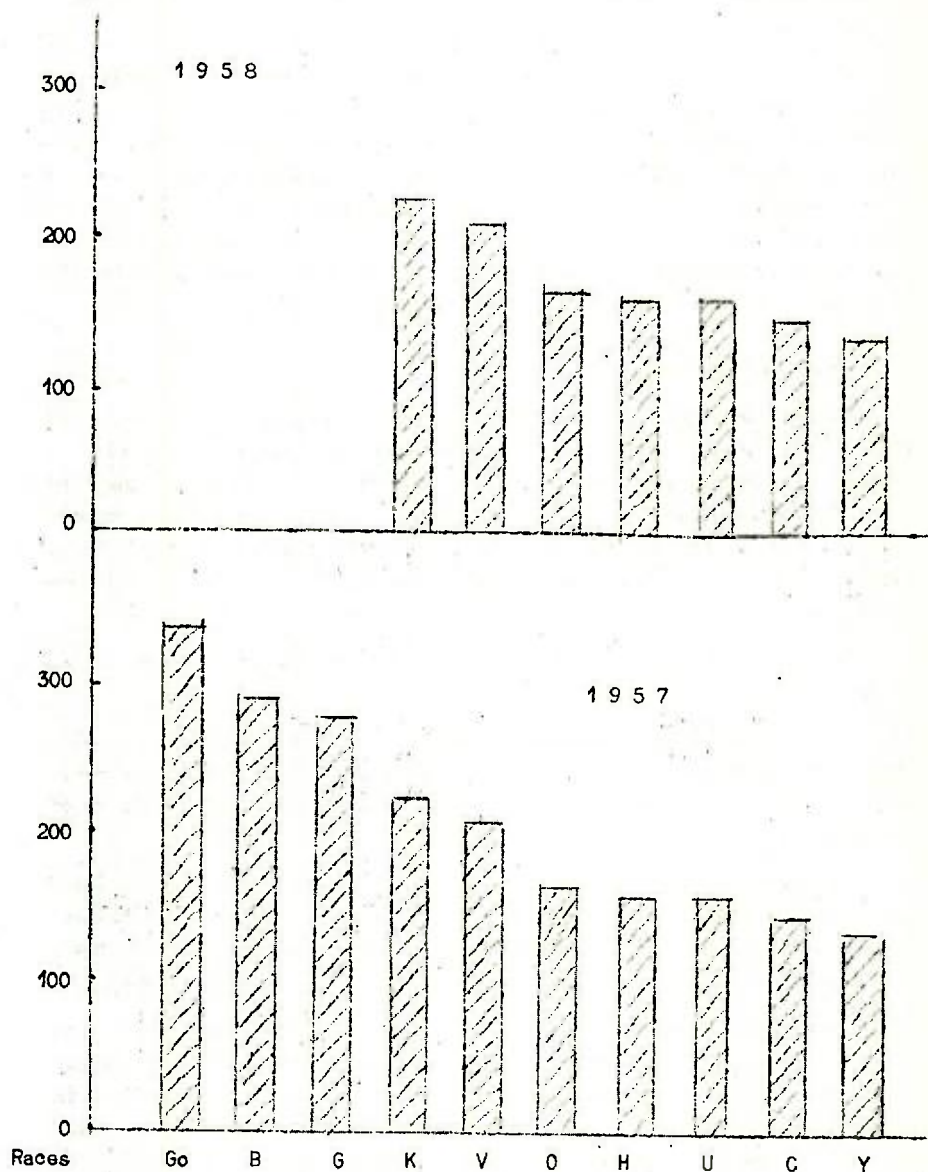


FIG. 4 - WEIGHT OF PUPA IN THE DIFFERENT RACES.

Green : The race Green was nominated according to its green colour.

Rose : This tint is peculiar to certain breeds as the race Ungari. The rose colour cocoons however are externally tinted and yield internally yellow silk.

Pigments when present is not distributed uniformly throughout the length of the bave, but concentrated in certain layers of the cocoon. Its distribution varied with the different breeds in the races Gobio, Kitpinih, Ungari and Green, the crust is colourless while the other layers of cortex show little variation of colour to the end of the bave. On the other hand in the golden yellow breed Oro Chinese, pigment is found almost entirely concentrated in the upper layers of the cocoon, while the silk reeled from the lower layers vary slightly coloured.

SHAPE OF THE COCOON.

The common shape of the silkworm cocoons are spherical, oval and waisted. Cocoons are called ovaly shaped when the longitudinal axis is appreciable greater than the transversal such as the cocoons of the Yinhan and Huachiu cross breeds (Fig. 8 and 9). Waisted or built cocoons have the central contraction more or less accentuated such as Bagdad, Kitpinih, Gobio, Var, Green and Ungari (Fig. 10, 11, 12, 13; 14, 15) respectively.

The spherical cocoons as in the races Cellar and Oro Chinese (Figs. 16 and 17).

If the contraction pronounced it may be a serious obstacle in reeling the bave because when the inner layers are reached, the cocoon tends to double up and get torn in the process ending as waste instead of thrawn silk.

The length of the cocoon varies in the different races, the maximum length of the cocoon for the races reared in 1957 ranged from 7.4 to 11.1 cms, the minimum length of the cocoon varies from 5.9 to 10.0 cms, with a mean value ranged from 6.8 to 10.5 cms.

The highest length of the cocoon was in the races Gobio and Bagdad as their mean length were 10.5 and 9.5 cms respectively. The least length of the cocoon was 5.8 in the race Oro Chinese. In the races studied in 1958 the maximum length of cocoon ranged from 8.2 cms with a mean value ranged from 7.4 to 8.6 cms. The highest length of the cocoon was 8.6 cms in the races Var, Huachiu and Yinhan. While the least length was 7.4 cms in the race Oro Chinese.

The width of the cocoon was also measured in the different breeds. In the races reared in 1957 the maximum width varied from 5.0 to 7.5 cms, the minimum width ranged from 4.0 to 5.4 cms with a mean value from 3.6 to 7.2 cms.

Weights (mgs)

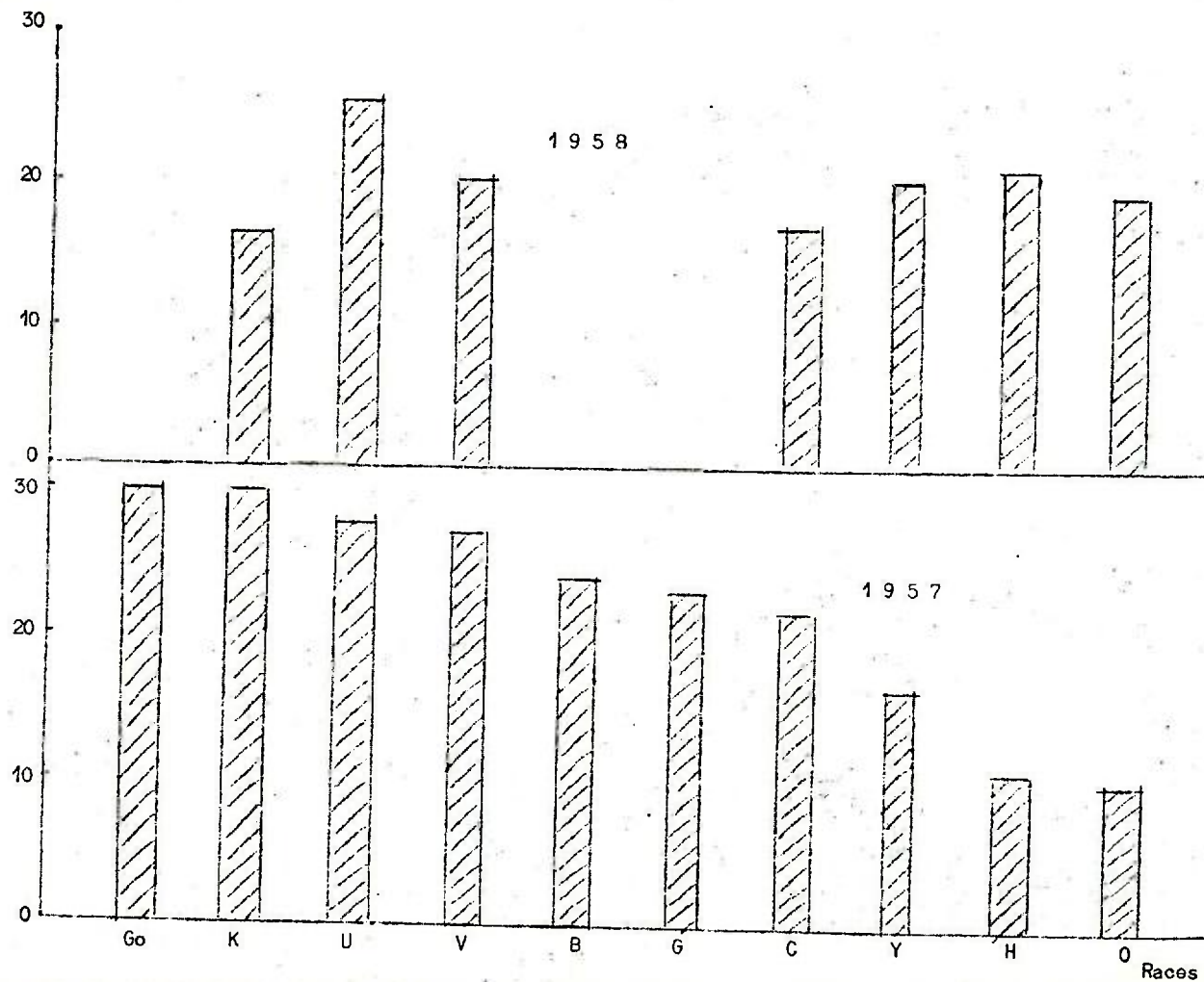


FIG. 5 - WEIGHT OF PELADE IN THE DIFFERENT RACES.

The highest mean width of the cocoon was 7.2 cms , in the race Gobio and 5.8 in the race Bagdad, while the least mean width was 4.6 cms in the race Oro Chinese and the cross breed Yinhan. The maximum width of the cocoon for the races reared in 1958 ranged from 5.3 to 6.8 cms while the minimum width ranged from 4.4 to 5.1 cms and their mean ranged from 5.2 to 5.9 cms in the different races. The highest mean width of the cocoon was 5.9 in the race Cellar and the least mean width was in the race Var 5.2 cms.

The highest variability in the cocoon length was among the races Ungari and Gobio, 17.07 and 12.0 % respectively in the first year and 13.72 % in the race Var in the second year. The highest coefficient of variation of the mean width of cocoon for the races reared in 1957 was 73.21 % in the race Cellar, while the least variability in the cocoon width was among the race Gobio 2.7 %. In the year 1958 the highest coefficient of variation of the cocoon width was 16.7 % in the race Var and the least variability was 3.7 in the race Ungari.

The mean length of the cocoon in the races reared for two years ranged from 7.65 to 8.05 cms and the highest length was in the race Ungari. The mean width ranged from 4.65 to 5.75 in the different races and the highest width of the cocoon was in the race Cellar.

WEIGHT OF THE COCOON.

The cocoons show continuous loss of weight from the time of its completion until the maturity of the pupae due to the respiration of the chrysalis and simple evaporation. In the process of dessication the weight of cocoon is reduced by about two thirds mainly by elimination of water. The average weight of the cocoon varied in a single strain according to the condition of rearing and the variation among the breed.

The cocoons were separately weighed to determine their maximum, minimum and average weight. In 1957 the maximum weight of the fresh cocoon ranged from 1.14 to 2.34 mgms , the minimum weight varied from 0.608 to 1.750 gms with a mean value varied from 0.961 to 1.916 gms. The highest mean weight cocoon was in the race Gobio , Bagdad and Green. Their weights were 1.936, 1.621 and 1.509 gms respectively. The race Var and Kitpinih were next to the previous races as their mean weights of the fresh cocoon were 1.479 and 1.413 gms. The least mean weight of the fresh cocoons was 1.175, 1.112, 0.997, 0.961 gms in the races Ungari, Cellar, Huachiu, Yinhan and Oro Chinese respectively. The maximum weight of the fresh cocoon in 1958 ranged from 1.811 to 2.164 gms , the minimum weight varied from 1.266 to 1.574 gms. The highest mean weight of the fresh cocoon was among the races Ungari, Yinhan and Var. As their weights of fresh cocoons were 1.574, 1.537 and 1.524 gms. The races Huachiu , Kitpinih and Cellar were next to the previous strains , their weights were 1.495 , 1.479 and 1.400 successively. The least mean weight of the fresh cocoon was 1.266 gms in the race Oro Chinese.

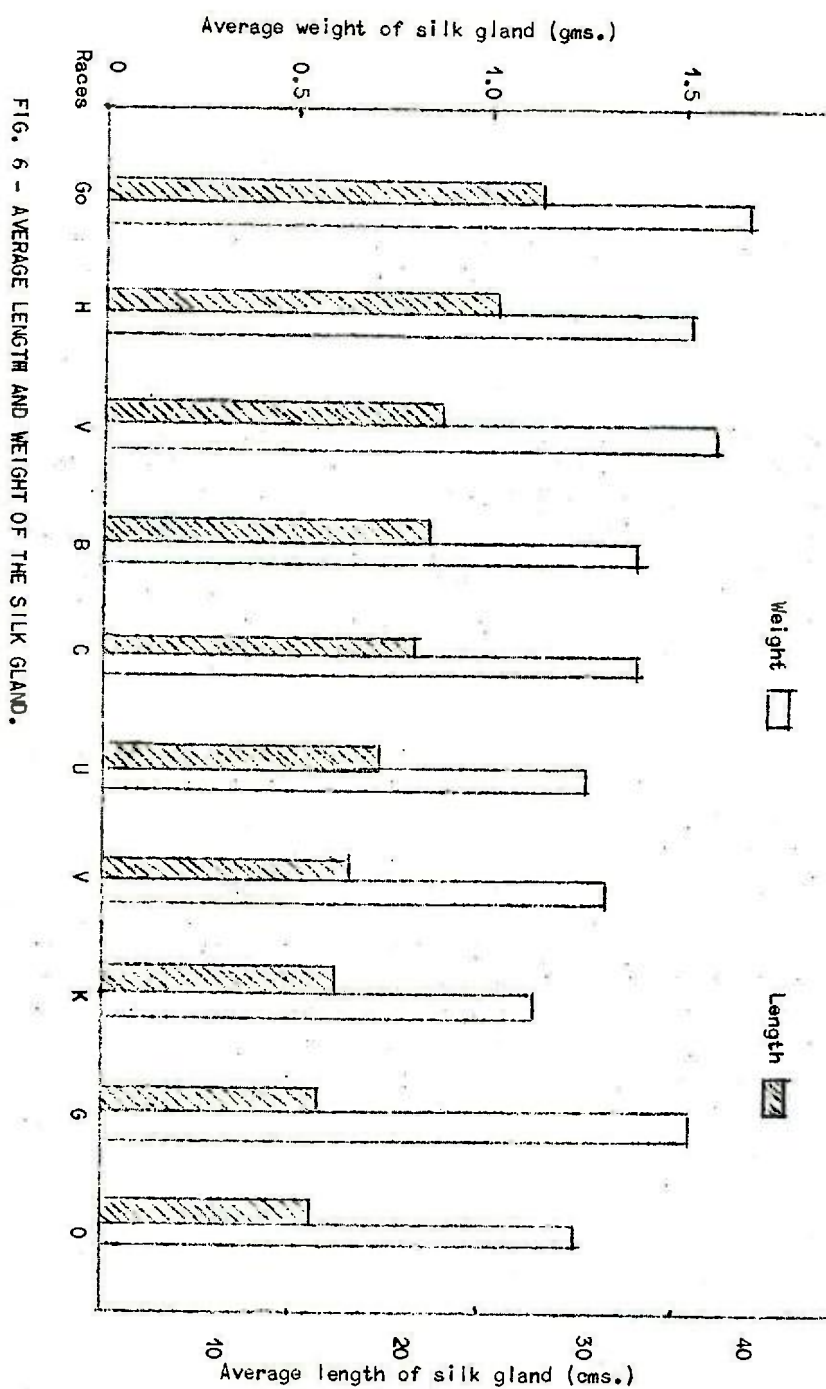


FIG. 6 - AVERAGE LENGTH AND WEIGHT OF THE SILK GLAND.

The weight of the dried cocoon is considered as an important conducted to evaluate and study the maximum and the average weight of the dried cocoons. It is clearly shown that the maximum weight of the dried cocoon ranged from 400 to 804 mgms and the minimum weight varied from 190 to 590 mgms with a mean value ranged from 315 to 673 mgms in the dried cocoon was in the race Gobio, Bagdad and Green, their weights were 0.673, 0.563 and 0.505 gms respectively. The strains Var and Kitpinih were next to the previous races as their mean weight of the dried cocoon varied from 0.486 to 0.457 gms. The least mean weight was in the races Ungari, Cellar, Huachiu, Yinhan and Oro Chinese, their weights were 0.383, 0.370, 0.357, 0.356 and 0.315 gms respectively. The maximum weights varied from 554 to 725 mgms. , the minimum weight ranged from 270 to 510 mgms with a mean value from 410 to 613 mgms. The highest mean weight of the dried cocoon was in the cross breeds Yinhan and Huachiu , their mean weights were 0.613 and 0.612 gms. The race Var, Ungari and Kitpinih were next to the previous races , their weights were 0.559, 0.556 and 0.515 gms respectively. The least weight of the dried cocoon was 0.485 and 0.410 in the races Cellar and Oro Chinese.

The mean weight of the fresh cocoons for the races reared in the two years varied from 1.093 to 1.510 gms while the mean weights of the dried cocoons varied from 427 to 522 mgms in the different races. The heaviest mean weight of the race Var. The least mean weight was in the race Oro Chinese. It was 1.093 gms in the fresh cocoon and 0.362 gms for the dried cocoon. The highest coefficient of variation of the mean weight of the fresh cocoon in 1957 was among the cross breeds Yinhan and Huachiu, 22.18 and 19.54 % respectively , and the least variability was 14.33 % in the race Ungari.

The highest coefficient of variation of the mean weight of the fresh cocoon for the races reared in 1958 was in the race Oro Chinese 18.18 %

and the least variability was in the cross breed Huachiu 6.75 %. The highest variability of the dried cocoon was that of the race Ungari 56.83 % and the least variability was in the race Var 18.6 %.

The mean number of fresh cocoons in one kilogramme varies from 500 to 907 cocoons in the different races, the number of dried cocoons in one kilogramme varies from 1470 to 2595 cocoons. It is evident from the data obtained that the major number of fresh and dried cocoons in one kilogramme was among the races Oro Chinese, Huachiu, Cellar and Ungari, as their numbers were 907, 840, 807 and 727 fresh cocoons and 2595, 2107, 2250 and 2197 dried cocoons respectively. The races Kitpinih, Yinhan, Var, Green, Bagdad and Gobio were next to the previous strains as their numbers were 699, 683, 670, 660 and 550 fresh cocoons and 2050, 2105, 1995, 2100, 1710 and 1470 dried cocoons in one kilogramme respectively.

WEIGHT OF SILK.

The weight of the silk bave emitted by the worm in constructing the cocoon can be determined by the serie bave of the reeled cocoons in the different races. The maximum weight of the reeable silk ranged from 163 to 240 mgms and the minimum weight from 14.00 to 112.0 with a mean value ranged from 96.2 to 201.6 mgms in the races reared in 1957. The heaviest weight of silk was that of the races Gobio and Bagdad, their weight were : 201.6 and 167.5 mgms respectively, the least weight was 96.2 mgms in the race Oro Chinese. The maximum weight of the silk bave was 96.2 mgms in the races reared in 1958 ranged from 126.2 to 336 mgms, the minimum weight ranged from 38 to 160 mgms, with a mean value ranged from 116.3 to 235 mgms. The heaviest weight of silk was in the cross breed Yinhan and Huachiu their weight were 235.4 and 232.2. The least weight was that of the race Ungari.

The mean value of the silk weight of the races reared for two years ranged from 111.3 to 175.4. The heaviest weight of silk was in the cross breed Yinhan and Huachiu, their weights were 175.4 and 173.2 mgms respectively. The races Kitpinih, Var, Ungari and Cellar were next to the previous races, their weights were : 145.4, 141.5, 135.2, 134.3 mgms successively and the least average weight was 117.3 in the race Oro Chinese.

Investigations were carried out to determine the value of selection the best silkworm race in silk production. It is known that the number of kilogrammes of cocoons required to obtain one kilogramme of reeled silk called "rendita" or yield and the average usage of dried cocoons required for reeling one kilogramme of silk varies in the different races. Measurements were used to secure information on the relationship between the weight of the cocoons and silk production. The results of the data obtained indicate that the Chinese cross breed Yinhan and Huachiu were the best races in silk production. The data indicate conclusively that the weight of the cocoons required to give one kilogramme of silk was 2.714 kg., in the cross breeds Yinhan and Huachiu. The races Green, Oro Chine-

se, Cellar, Kitpinih, Ungari and Var were next to the previous races, as their weight of cocoons required for reeling one kilogramme of silk was 3.267, 3.293, 3.303, 3.364, 3.68, 3.481 and 3.508 kgms. The maximum weight of cocoons required for reeling one kilogramme of silk was in the race Goble its weight was 4.047 kgms of dried cocoons.

The race Var is considered as a standard race and was bred in Egypt for a long time. It is clearly observed from the data obtained that breeding the race Var is not economic as it required 3.508 kgms of dried cocoons for reeling one kilogramme of silk while the two cross breed Yinhan and Huachiu required 2.714 and 2.743 of dried cocoons respectively.

ETUDES BIOLOGIQUES SUR CERTAINES RACES DE VERS A SOIE, Bombyx mori L.

Résumé.

Le but des présentes recherches est d'étudier les caractères biologiques de différentes races standard de vers à soie (Bombyx mori L.). Ces études peuvent aider à sélectionner la race la plus profitable dans la production de la soie et la plus appropriée pour être élevée dans les conditions du milieu égyptien. Les améliorations de la production de la soie peuvent être obtenues par multiplication et sélection des races prolifiques. Les facteurs qui contribuent à l'accroissement maximum de soie grâce à une certaine méthode d'élevage sont recherchés et étudiés.

Plusieurs races standard de vers à soie ont été importées des stations séricicoles expérimentales de différents pays européens et asiatiques. Le présent travail rapporte les résultats des caractéristiques productives des races de vers à soie en respectant leur biologie et leur faculté d'adaptation aux nouvelles conditions du milieu. Les recherches traitent principalement de la comparaison des caractères de dix souches de vers à soie qui sont étudiées en vue de les comparer en respectant leurs stades larvaire ou pupal, la biométrie des cocons, le poids du cocon et la production de la soie.

Les résultats montrent que la période d'incubation des oeufs fécondés est de 7 à 8 jours à 23-25° C. et 75 R.H. La plus courte période d'incubation a été notée dans le croisement Yinhan et Huachiu.

On a observé que la période larvaire est de 34 à 43 jours dans les différentes races et la plus courte période larvaire a été celle du croisement Yinhan et Huachiu (34 à 36 jours). Les dix races étudiées furent du type quatre mues.

Il a été enregistré que l'accroissement du poids larvaire varie selon les facteurs raciaux et de milieu. La chenille arrivée à maturité, dans le croisement Yinhan, était plus lourde que les chenilles des autres races.

La période pupale s'étale entre 6 et 19 jours selon les différentes races et le plus court stade pupal a été celui du croisement Yinhan. Le poids moyen de la chrysalide varie de 195.4 à 226.6 mgms dans les différen-

tes races. Le poids maximum de la chrysalide a été observé dans la race Gubbio.

La couche intérieure qui enveloppe la chrysalide est appelée pellette, elle est considérée comme un déchet de soie. Son poids varie dans les différentes races de 14.2 à 29.9 mgms. Le poids de la pellette a été le plus élevé chez la race Gubbio.

Le sexe a été déterminé chez la larve mâle puisque le 8ème et le 9ème segments abdominaux de la femelle sont différents de ceux du mâle.

La couleur des cocons du croisement Yinhan et Huachiu et de la race Cellar sont blancs argent, chez la race Bagdad ils sont blancs ternes. Les cocons des races Kitpinih, Gubbio et Var sont de couleur jaune pâle et ceux de la race Chinois doré de couleur jaune or. Les cocons de la race Ungari rosés et les cocons de la race "Green" étaient de couleur verte.

La forme commune des cocons de vers à soie est sphérique et cintrée. Les races Cellar et Chinois doré sont du premier type tandis que les cocons de la race Yinhan et Huachiu sont ovales. Les cocons des autres races sont du type cintré.

La longueur moyenne du cocon varie de 6.3 à 10.5 cms dans les races élevées en 1957 et de 7.4 à 6.6 cms dans les races élevées en 1958. La longueur moyenne la plus élevée a été celle des cocons de la race Gubbio.

La largeur moyenne des cocons varie de 3.5 à 7.2 cms chez les races élevées en 1957 et de 5.2 à 5.9 chez les races élevées en 1958. La largeur la plus élevée des cocons a été celle de la race Gubbio. Les poids moyens des cocons frais pour les races élevées en 1957 varient de 0.761 à 1.936 gms et le poids moyen le plus élevé a été celui de la race Gubbio. En 1958, les poids moyens varièrent de 1.266 à 1.574 gms et le poids moyen des cocons frais le plus élevé a été celui enregistré chez la race Ungari.

Il est conclu que le poids moyen des cocons secs varie de 315 à 673 mgms en 1957 et le poids moyen le plus élevé a été celui de la race Gubbio. Le poids moyen, en 1958, varia de 410 à 615 mgms et le poids moyen des cocons secs le plus élevé a été celui du croisement Yinhan.

Le nombre moyen des cocons frais dans 1 kg de cocons frais varie de 500 à 907 dans les différentes races et le nombre moyen de cocons secs de 147 à 2.595. Le nombre maximum de cocons frais a été enregistré dans la

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Les clichés représentant les cocons ont été présentés à l'exposition sericicole de Murcie et de ce fait n'ont pas été reproduits. Ils peuvent être consultés au siège de la COMMISSION.

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The photographs of the cocoons were displayed during the sericultural exhibition in Murcia. They have not been reproduced. They can be consulted at the Seat of the COMMISSION.

race Chinois doré et le nombre minimum dans la race Gubbio. Il a été conclu que le poids moyen de soie filable a varié de 96.2 à 201 mgms en 1957 et le poids moyen de soie varie de 116.3 à 335 mgms et le poids moyen de soie le plus élevé a été celui du croisement Yinhan. Le poids minimum des cocons nécessaires pour obtenir 1 kg de soie est de 2.714 kg dans le croisement Yinhan et le nombre maximum fut de 4.047 kg dans la race Gubbio.

Il est clairement évident d'après ces recherches que la race Yinhan et son croisement réciproque Huachiu ont été les meilleures races étudiées dans les deux années d'expériences sur la production de la soie.

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