

sericologia

Journal of the silkworms.

Revue des vers à soie.

publiée par la Commission Séricole Internationale.
secrétariat général : 3, quai Chauveau - 69009 Lyon - France.

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EDITORIAL

The development of sericulture does not only mean the increase in the quantity of silk produced in the world but also the improvement in the technics actually used. This improvement in technics is possible only if new knowledge is constantly acquired and if the knowledge is widely diffused.

The journal "Sericologia" is one of the means at the I.S.C. disposal to contribute to the development of sericulture. However, this journal has to meet two conditions : to be well informed, to be read.

Publication after publication, the Editorial Staff tries to improve the content and thus "Sericologia" has already reached a pretty good scientific level. The part devoted to the technical and economical aspects is not very developed yet and is still highly improvable.

To have readers is obviously the care of every editor as the budget must be balanced. As far as "Sericologia" is concerned, though we do not neglect the economical aspect of the question, our main concern is to enable a permanent link between all the specialists in sericulture and bacology and thus to contribute to the diffusion of knowledge.

When you receive this issue of "Sericologia" which is the last of the year, you may have already received a subscription offer for "Sericologia". If you wish to receive or to go on receiving our journal you will find enclosed a subscription form for 1982.

Le développement de la Sériculture, ce n'est pas uniquement l'accroissement de la quantité de soie produite dans le monde mais c'est aussi l'amélioration des techniques utilisées dans la pratique. Cette amélioration des techniques n'est possible que si de nouvelles connaissances sont constamment acquises et si ces connaissances sont largement diffusées.

Un des moyens dont dispose la C.S.I. pour contribuer au développement de la sériculture est sa publication "Sericologia". Encore faut-il que cette revue réponde à deux conditions : être bien informée et être lue.

La Rédaction essaie d'améliorer le contenu au fil des numéros et ainsi, "Sericologia" a déjà atteint un niveau scientifique déjà appréciable. Les aspects techniques et économiques qui font un peu figure de "parents pauvres" sont encore très largement perfectibles.

Avoir des lecteurs est naturellement le souci de tout éditeur car il faut bien équilibrer les comptes. Dans le cas de "Sericologia", sans négliger l'aspect économique de la question, notre préoccupation majeure est d'assurer une liaison permanente entre tous les spécialistes de sériculture et de bacologie et de contribuer ainsi à la diffusion des connaissances.

Quand vous recevrez ce numéro de "Sericologia" qui est le dernier de l'année 1981, vous aurez sans doute déjà reçu une proposition d'abonnement à "Sericologia". Si vous souhaitez continuer de recevoir "Sericologia" et que vous avez omis de répondre à cette proposition, vous trouverez dans le présent numéro un bulletin d'abonnement pour 1982.

The silkworm as a pedagogic model

For several years, the International Sericultural Commission has proposed to present the silkworm as a type or a biological model. This idea has progressed and is now well accepted by the scientific community.

So far, it seems that the most has not been made of the idea of the silkworm as a pedagogic model and it might be useful, within the framework of I.S.C. and Sericologia, to gather elements enabling to develop this idea.

Indeed, if in some countries there is a specialized training in sericulture, in many other ones this training does not exist on account of the little economical importance of the sericultural activity. Therefore, a few persons only have a minimum knowledge on the silkworm. We could object that the number of persons who should know the silkworm in a country is limited because of the slack demand of such persons in that country. In fact, this objection is not entirely valid if we try to examine the aims of this kind of training. Indeed, the study of the silkworm in itself can be considered as an activity depending on specialists and therefore there is no ground for increasing the number of specialists if the country does not need to. However, the problem becomes different if the question of teaching bacology is set in terms of way of learning or acquisition of scientific knowledge. Indeed, the silkworm can be a very efficient way of tackling some biological knowledge either at the elementary school, high school or at the university...

The Editorial Staff of Sericologia propounds this matter to be examined and asks the scientifics, technicians and teachers to let it know their experiences and results by sending the Editorial Staff the documentation they may have : schoolbooks, experiences at school, publications of vulgarisation...

Le ver à soie modèle pédagogique

Depuis de nombreuses années, la Commission Séricicole Internationale a proposé de présenter le ver à soie comme type ou modèle biologique. Cette idée a fait son chemin et est maintenant bien admise par la communauté scientifique.

L'idée du ver à soie modèle pédagogique ne semble pas avoir été beaucoup exploitée jusqu'à présent et il serait peut-être utile, dans le cadre de la C.S.I. et de Sericologia, de réunir des éléments permettant de la développer.

En effet, si dans certains pays il existe un enseignement spécialisé de sériculture, dans de nombreux pays cet enseignement n'existe pas en raison du faible poids économique de l'activité séricicole. De ce fait, un nombre restreint d'individus a un minimum de connaissances sur le ver à soie. On pourrait objecter que le nombre d'individus devant connaître le ver à soie dans un pays déterminé est limité en raison de la faiblesse de la demande en tels individus. En fait, cette objection n'est qu'en partie valable si on essaie de s'interroger sur l'objectif d'un tel enseignement. En effet, étudier le ver à soie pour lui-même peut-être considéré comme une activité relevant de spécialistes et dans ces conditions, il n'y a pas de raison d'accroître le nombre de spécialistes si le pays n'en a pas besoin. En revanche, si la question de l'enseignement de la bacologie est posée en termes d'apprentissage ou d'acquisition de connaissances scientifiques, le problème change de nature. En effet, le ver à soie peut être un moyen extrêmement efficace d'aborder certaines connaissances biologiques que ce soit à l'école primaire, à l'école secondaire ou à l'université.

La rédaction de Sericologia propose donc qu'une réflexion sur ce sujet soit menée et demande aux scientifiques, techniciens et enseignants de lui faire part de leurs expériences et de leurs acquis en la matière en lui faisant parvenir la documentation dont ils pourraient disposer : manuels scolaires, expériences à l'école, ouvrages de vulgarisation...

COMMISSION SERICICOLE INTERNATIONALE

INTERNATIONAL SERICULTURAL COMMISSION

RECORDS AND INFORMATION

ACTES ET INFORMATIONS

Meeting of the Executive Committee Board

The meeting of the Executive Committee Board was held in Lyon on September 11th 1981. Have attended this meeting : Dr. Henri BOUVIER, Mr Paul HALIMI, Mr Jean Claude HUGUES, Mr Georges LAMAZIERE and Mr RAMADORAI.

The main points of the agenda were :

- Approval of the Conference report.
- Effects of the Conference resolutions.
- Financial situation.
- Congress of Bangalore en 1984.
- The Sericultural Progress Funds.
- Examination of the Indian resolution proposal.
- Meeting of the Executive Committee in London.
- Other points :
 - . General Conference of F.A.O.
 - . Visit of the Secretary General in East Europe.
 - . Next meeting of the Executive Committee Board.

For the first time the meeting of the Executive Committee Board took place at the Commission head office. All Members wished that the next meeting would be held in the same premises when the works financed by the French Government with a view to set

Réunion du bureau du Comité Exécutif

Le bureau du Comité Exécutif s'est réuni à Lyon, le 11 septembre 1981. Ont assisté à la réunion : Dr. Henri BOUVIER, Mr Paul HALIMI, Mr Jean Claude HUGUES, Mr Georges LAMAZIERE et Mr RAMADORAI.

Les principaux points à l'ordre du jour de cette réunion étaient :

- Approbation du rapport de la Conférence.
- Suites données aux résolutions de la Conférence.
- Situation financière.
- Congrès de Bangalore en 1984.
- Fonds de Progrès séricicole.
- Examen du projet de résolution indienne.
- Réunion du Comité Exécutif à Londres.
- Questions diverses :
 - . Conférence générale de l'O.A.A.
 - . Voyage du Secrétaire Général en Europe de l'Est.
 - . Prochaine réunion du bureau du Comité Exécutif.

Il est à noter que pour la première fois, une réunion du bureau du Comité Exécutif se tenait au siège de la Commission. Tous les membres du bureau ont exprimé le souhait de tenir la prochaine réunion dans ces mêmes locaux lorsque les travaux entrepris par le

up the National Sericultural Unit are over.

Appointment of the national correspondants for Sericologia.

With reference to the Conference of Lyon, some Member-States have given the Secretary General the names of their national correspondants for Sericologia.

India : Mr M.S. JOLLY for scientific and technical questions ;
Mr K.I. AHMED for economical questions.

Japan : Mr KIGUCHI (Physiology Division Sericultural Experiment Station Ministry of Agriculture, Forestry and Fisheries).
Mr TAZAWA (Sericultural Improvement Division, Agricultural Production Bureau, Ministry of Agriculture, Forestry and Fisheries).

Lebanon :
Mr W. CHARARA, Silk Office, Beirut.

Congress of Bangalore

At the meeting of the Executive Committee Board held on September 11th, Mr Ramadorai confirmed the invitation of the Indian government to hold the next Congress in Bangalore at the beginning of 1984.

Mr SAPTHARISHI, Secretary General of the Central Silk Board was appointed organizer of the Congress for the part depending on India.

It was suggested that the Congress should last a week, from Monday to Friday. The meeting of the Executive Committee and of the Conference would take place on Saturday.

The general topic of this Congress is : 'Sericulture in tropical countries'.

A detailed information note will be sent to all Member-States and interested States in the coming months.

gouvernement français en vue de l'installation de l'Unité Séricicole Nationale seront achevés.

Désignation des correspondants nationaux pour Sericologia.

Suite à la Conférence de Lyon, certains Etats-Membres ont fait connaître au secrétariat général les noms de leurs correspondants nationaux pour Sericologia.

Inde : Mr M.S. JOLLY pour les questions scientifiques et techniques ;
Mr K.I. AHMED pour les questions économiques.

Japon : Mr KIGUCHI (Physiology Division Sericultural Experiment Station Ministry of Agriculture, Forestry and Fisheries).
Mr TAZAWA (Sericultural Improvement Division, Agricultural Production Bureau, Ministry of Agriculture, Forestry and Fisheries).

Liban : Mr W. CHARARA, Office de la Soie à Beyrouth.

Congrès de Bangalore

Lors de la réunion du bureau du Comité Exécutif du 11 septembre, Mr Ramadorai a confirmé l'invitation du gouvernement indien à tenir le prochain congrès au début de l'année 1984 à Bangalore.

Mr SAPTHARISHI, Secrétaire Général du Central Silk Board a été désigné comme organisateur du Congrès pour la partie relevant de l'Inde.

Il a été proposé que le Congrès s'étende sur une semaine, du lundi au vendredi, la journée du samedi étant réservée à la réunion du Comité Exécutif et de la Conférence.

Le thème retenu pour ce Congrès est : "la Sériculture dans les pays tropicaux".

Une information détaillée sera envoyée dans les mois qui viennent aux Etats-Membres et aux Etats intéressés.

INFORMATIONS SOIE ET SERICULTURE

SILK AND SERICULTURE INFORMATION

I. S. A.

MEETING OF THE TECHNOLOGY AND RESEARCH COMMITTEE

ZURICH, SEPTEMBER 14th-15th 1981

The General Secretary of the International Sericultural Commission had been invited to attend the meeting of Technology and Research Committee which was held in Zurich on September 14th and 15th.

35 participants, coming essentially from western European countries : France, Great Britain, Italy and Switzerland, were present to this session. The presence of Mr Ramadorai, vice chairman of the Central Silk Board, chief of the Indian delegation and member of the Executive Committee board of the International Sericultural Commission has been particularly noticed.

The first day has been devoted to the automation of tests on the raw silk and spun silk yarns. The Zellweger Uster Society presented the apparatuses adapted to the automatized control of the raw silks and of the spun silk yarns.

Automation of tests on raw silk.

The problem of the automation of tests and of the classification of raw silks had been already largely mentioned during the Congress of the I.S.A. which had been held in Lucerne in 1979.

A. I. S.

REUNION DE LA COMMISSION DE TECHNOLOGIE ET DE RECHERCHES

ZURICH, 14-15 SEPTEMBRE 1981

Le Secrétaire Général de la C.S.I. avait été invité à participer à la réunion de la Commission de Technologie et de Recherches de l'Association Internationale de la Soie, qui s'est tenue à Zurich les 14 et 15 septembre.

35 participants venant essentiellement des pays de l'Europe Occidentale, France, Grande Bretagne, Italie et Suisse, assistaient à cette session. La présence de Monsieur Ramadorai, vice chairman du Central Silk Board et également chef de la délégation indienne et membre du bureau du Comité Exécutif de la C.S.I., a été particulièrement remarquée.

La première journée a été consacrée à l'automatisation des essais de la soie grège et des filés de schappe. La Société Zellweger Uster a présenté les matériels adaptés au contrôle automatisé des soies grèges et des filés de schappe.

Automatisation des essais de la soie grège.

La question de l'automatisation des essais et de la classification des soies grèges avait déjà été largement évoquée au cours du congrès de l'A.I.S. qui s'était tenu à Lucerne en 1979.

The Zellweger Uster Society mentioned she had kept on her investigations and that her apparatus was now ready to enable the automation of tests and to give the objective results necessary to the classification of raw silks.

The present classification is based on visual and subjective examinations with frequent differences from one observer to the other. The methods of tests and classification are not exactly the same in the different producer countries.

It seems that the automation of tests would enable a best classification of raw silks provided that producers and consumers agree with the interpretation of the results. The appreciation of the different defects changes indeed according to the destination and the treatments of raw silks.

Tests on spun silk yarns.

The automation of tests on spun silk yarns is now perfected and recommendations have been given concerning the appreciation of the quality. The technology and Research Committee agreed with these recommendations which will be presented like a resolution to the I.S.A. Directing Board during the Congress of London.

A particular study of the frequency of knots on spun silk yarns has been presented. The knots constituting an important defect which could be avoided by an assemblage of the ends. A small apparatus allowing to do these assemblages has just been perfected.

The second day has been nearly entirely devoted to the problems of dyeing.

La Société Zellweger Uster a indiqué qu'elle avait continué ses recherches et que son matériel était maintenant bien au point pour permettre l'automatisation des tests et fournir les résultats objectifs nécessaires à la classification des soies grèges.

La classification actuelle est fondée sur des examens visuels et subjectifs, avec de fréquents écarts d'un observateur à l'autre. Les méthodes d'essai et la classification ne sont pas exactement les mêmes dans les différents pays producteurs.

Il semble donc que l'automatisation des essais permettrait une meilleure classification des soies grèges, à la condition que producteurs et utilisateurs arrivent à se mettre d'accord sur l'interprétation des résultats. L'appréciation des différents défauts varie en effet en fonction de la destination et des traitements que doivent subir les soies grèges.

Essais des filés de schappe.

L'automatisation des essais des filés de schappe est actuellement très au point et des recommandations ont pu être formulées concernant l'appréciation de la qualité. La Commission de Technologie a fait siennes ces recommandations qui seront présentées sous forme de résolution au Comité de Direction de l'A.I.S., lors du Congrès de Londres.

Une étude particulière de la fréquence des noeuds sur les filés de schappe a été présentée. Les noeuds constituant une imperfection importante pourraient être évités par un assemblage des bouts. Un petit appareil permettant de réaliser ces assemblages vient d'être mis au point.

La seconde journée a été presque entièrement consacrée aux problèmes de teinture.

Standards of colour fastness.

Minimum standards of colour fastness on silk had been fixed during a technical meeting in Vienna (Austria) in September 1968.

Dyers are asked to study how these standards could be more strict. The attention is drawn on the fact that some dyes are unstable with water or light and that no systematical research is done on silk dyes in account of the small quantities which are used.

Normes de solidité des teintures.

Des normes de solidité des teintures sur soie avaient été mises au point lors d'une réunion technique à Vienne (Autriche) en septembre 1968.

Il est demandé aux teinturiers d'étudier dans quelle mesure ces normes pourraient être relevées. L'attention est attirée sur le fait que certains colorants sont fragiles à l'eau ou à la lumière, et qu'aucune recherche systématique n'est faite sur les colorants soie, compte tenu des faibles quantités utilisées.

Scientific research showing the advantages of silk.

Mrs Jarrigeon, doctor-engineer at the Textile Institute of France, Lyon, made a report on the methods and techniques which could be used to show the advantages of silk : comfort and agreeableness in wearing.

Recherches scientifiques permettant de mettre en évidence les avantages de la soie.

Madame Jarrigeon, docteur-ingénieur à l'Institut Textile de France, Lyon, a fait un exposé sur les méthodes et les techniques qui pourraient être utilisées pour mettre en évidence les avantages de la soie : confort et agrément au porter.

Variations in dyeability of raw silks.

The variations of dyeability give effects of stripping on piece dyed fabrics.

After investigations made at the Stazione Sperimentale per la Seta di Milano, it can be assumed that throwing and weaving are not concerned, but that these variations of dyeability could be due to the reeling techniques or to the mixture of lots of cocoons.

Différences d'affinités des soies aux colorants.

Les différences d'affinités se traduisent par des effets de rayure sur les tissus teints en pièces.

A la suite d'examen pratiques à la Stazione Sperimentale per la Seta di Milano, on peut penser que le moulinage et le tissage ne sont pas en cause, mais que ces différences d'affinité tinctoriale pourraient provenir soit des techniques de filature, soit des mélanges des lots de cocons.

Non mulberry silks.

In the absence of Doctor Jolly, problems of non mulberry silks have been briefly mentioned. Reference has been made to the report of CIBAGEIGY Hong-Kong.

Soie non mûrier.

En l'absence du Docteur Jolly, les problèmes des soies non mûrier n'ont été que très brièvement évoqués. Référence a été faite à la note de CIBAGEIGY Hong-Kong.

Mr Ramadorai pointed out that this report was concerning the non mulberry silks from China and that apart from the tussar silk, there were other non mulberry silks (muga, eri) whose worms do not only eat oak leaves.

Monsieur Ramadorai a fait remarquer que cette note concernait les soies non mûrier de la Chine et qu'en Inde, il existait à côté de la soie tussah, d'autres soies non mûrier (muga, eri), dont les vers ne se nourrissaient pas uniquement de feuilles de chêne.

JAPAN

1. Situation of supply and demand of raw silk in 1980

The Ministry of Agriculture, Forestry and Fisheries published in June 1981 the situation of supply and demand of raw silk in Japan for the silk year 1980, which ended in May 1981 (Table 1). The figures published show a decrease of the domestic demand of 14%, a sensible reduction (34%) of imports and a very important increase of the final stock of the Japan Raw Silk Corporation.

2. Production of cocoons

2.1. Spring crop.

The Ministry of Agriculture, Forestry and Fisheries published on 15th September 1981 the figures relating to the spring cocoon crop.

2.2. Estimations.

The estimations for 1981 are indicated in Table 3.

For the late autumn crop, a decrease of 7% is believed to happen in the number of sericultural farms in comparison with the previous year, but the cocoon crop is believed to increase of 2% as compared with the 1980 crop which was particularly poor.

JAPON

1. Situation de l'offre et de la demande de soie grège en 1980

Le Ministère de l'Agriculture des Forêts et des Pêches a publié le 30 juin 1981 la situation de l'offre et de la demande de soie grège au Japon pour l'année soie 1980, qui s'est achevée en mai 1981 (Tableau 1). Les chiffres publiés font apparaître une baisse de la demande intérieure de 14%, une réduction sensible (34%) des importations et un accroissement très important du stock final de la Japan Raw Silk Corporation.

2. Production de cocons

2.1. Récolte de printemps.

Le Ministère de l'Agriculture, des Forêts et des Pêches a publié le 15 septembre 1981 les chiffres relatifs à la récolte de cocons de printemps.

2.2. Prévisions.

Les prévisions pour 1981 sont indiquées dans le Tableau 3.

Pour la récolte de fin d'automne, il est prévu une baisse de 7% du nombre d'exploitations séricicoles par rapport à l'année précédente; mais un accroissement de 2% de la récolte, par rapport à la récolte de 1980 qui était particulièrement faible.

Table 2. Spring cocoon crop in 1981
Tableau 2. Récolte de cocons de printemps en 1981

	1981	1980	1981/1980 Comparison / Comparaison	
Sericultural farms	136.910	153.680	89%	Fermes séréricoles
Silk egg boxes used	699.900	848.200	83%	Boîtes de graines utilisées
Cocoon crop (m. tons)	24.349	29.205	83%	Récolte de cocons (tonnes)

Table 1. Supply and Demand for Raw Silk
Tableau 1. Offre et Demande de la Soie Grège

(Unit : bales of 60 kg)			(Unité : balles de 60 kg)	
	Silk year 1980 / Année soie 1980 (1)	Silk year 1979 / Année soie 1979 (2)	Compared with a year ago / Comparaison	
Starting stock			%	Stock de départ
- On the market	18,328	22,379	82	- Sur le marché
- Japan Raw Silk Cor.	101,548	58,000	175	- J.R.S.C.
Total	119,876	80,379	149	Total
Production	256,846	268,417	96	Production
Imports	32,073	48,715	66	Importations
Exports	-	-	-	Exportations
Domestic deliveries	239,386	277,635	86	Livraisons intérieures
Ending stock				Stock final
- On the market	9,812	18,328	54	- Sur le marché
- J.R.S.C.	159,597	101,548	157	- J.R.S.C.
Total	169,409	119,876	141	Total

(1) June 1980 - May 1981
 (2) June 1979 - May 1980

(1) juin 1980 - mai 1981
 (2) juin 1979 - mai 1980

Table 3. Estimation of cocoon crop for 1981
Tableau 3. Prévisions de récolte de cocons pour 1981

	1981	Variation 80/81	
Spring (definite)	24 349	- 17%	Printemps (définitif)
Early autumn	15 500	- 23%	Début d'automne
Late autumn	23 800	+ 2%	Fin d'automne
Total	63 649	- 13%	Total

3. Reorganization of the Japanese filature

To face the difficult situation in which is the silk industry, Mr Tadashi ARITA, President of the Japanese Reelers Association, declared on 17th June 1981, during the general assembly of this Association, that it was necessary to reorganize the Japanese Filature by reforming the machines in surplus.

The Association which represents 90% of the raw silk produced in Japan created a special committee to examine the problems given by the reorganization of the Filature which had been preconized, together with other measures, by the Council for the development of the silk industry of the Ministry of Agriculture during the determination of prices in May 1981.

Meanwhile, several filatures stopped their production. In some cases, this interruption concerns some plants of the same group, in other cases, the firms are definitively closed. These decisions provoked a decrease of 50% of the number of operating machines.

4. Raw silk and cocoon stock from the Republic of Korea

The Japan Raw Silk Corporation (J.R.S.C.) published on 15th July 1981, an estimation of the raw silk and dry cocoons stock from the Republic of Korea :

3. Restructuration de la filature Japonaise

Pour faire face à la situation difficile dans laquelle se trouve l'industrie de la soie, Monsieur Tadashi ARITA Président de l'Association Japonaise des Filateurs, a déclaré le 17 juin 1981, lors de l'assemblée générale de cette Association, qu'il était nécessaire de restructurer la Filature japonaise en réformant les machines en sur-nombre.

L'Association qui représente 90% de la soie grège produite au Japon a créé un comité spécial pour examiner les problèmes posés par la restructuration de la Filature qui avait été préconisée, ainsi que d'autres mesures, par le Conseil pour le développement de l'industrie de la soie du Ministère de l'Agriculture lors de la fixation des prix au mois de mai 1981.

Entre temps, plusieurs filatures ont cessé toute production. Dans certains cas, cet arrêt concerne quelques unités de filature d'un même groupe, dans d'autres cas, il s'agit d'une fermeture définitive des entreprises. Ces mesures ont conduit à une diminution de 50% du parc de machines.

4. Le stock de soie grège et de cocons en provenance de la République de Corée

La Corporation Japonaise de la Soie Grège (J.R.S.C.) a publié, le 15 juillet 1981, son estimation du stock de soie grège et de cocons secs provenant de la République de Corée :

- Raw silk stock : 9100 bales
(550 m. tons)
- Dry cocoon stock : 8200 bales
(490 m. tons)

- Stock de soie grège : 9100 balles
(550 tonnes)
- Stock de cocons secs : 8200 balles
(490 tonnes)

5. Research and development of new products

1. New machine producing bulky spun silk.

The Cocoon Control Institute of Nagano department presented to the public on 24th June 1981 a new spinning-machine which produces bulky spun silk for which a patent request has been registered.

The Institute started its research work since autumn 1979 to elaborate a new process for producing spun silk for a wide range of utilization, particularly for European garment fabrics and for furnishing and decoration.

This new process consists in giving a very slight tensile strength to the yarn when reeling. The swelling is obtained during the drying of the silk yarn.

2. Silk denim for de luxe raincoats.

Toyo Trading CO., LTD (Président, Mr G. KATAOKA) succeeded in weaving silk denim with spun silk.

Mr KATAOKA indicated that the price was U.S. \$ 13 per metre (155 cm in width). This price could decrease to U.S. \$ 9 if an important production started.

This company is studying a process enabling this silk denim being washable.

3. New blend yarn, spun silk-polyester.

Tore CO., LTD succeeded in producing a new blend yarn, spun silk and polyester which has the qualities of both components. This blend yarn could be used for knitted fabrics.

This important Japanese textile Company has made researches with Takasakikenshibo (spun silk company) and Toyo Trading CO., LTD.

5. Recherche et développement de produits nouveaux

1. Nouvelle machine pour produire des filés de soie gonflants.

L'Institut de Contrôle des Cocons du département de Nagano a présenté au public le 24 juin 1981, une nouvelle machine à filer qui produit des filés de soie gonflants dont la demande de brevet a été déposée.

L'Institut a commencé ses travaux de recherche depuis l'automne 1979 pour élaborer un nouveau procédé visant à produire des filés de soie destinés à une large gamme d'utilisation, en particulier pour les tissus de vêtements européens et pour l'ameublement et la décoration.

Ce nouveau procédé consiste à appliquer une très faible tension au fil en cours de dévidage. Le gonflement est produit lors du séchage du fil de soie.

2. Toile de Nîmes en soie pour imperméables de luxe.

Toyo Trading CO., LTD (Président, Monsieur G. KATAOKA) a réussi à tisser du sergé de Nîmes en soie avec des filés de schappe.

Monsieur KATAOKA a indiqué que le prix était de 13 \$ U.S. le mètre (en 155 cm de large). Ce prix est susceptible d'être abaissé à 9 \$ U.S. si une production importante est lancée.

Cette société étudie un procédé permettant de rendre ce sergé lavable.

3. Nouveau filé mixte, mélange schappe-polyester.

Tore CO., LTD a réussi à fabriquer un nouveau filé mélange schappe et polyester qui présente les qualités des deux composants. Ce filé pourrait être utilisé pour la maille.

Cette grande compagnie textile japonaise a fait des recherches avec Takasakikenshibo (firme de filés de schappe) et Toyo Trading CO., LTD.

6. *Silk fair to be held in Tokyo*

Supported by MAFF and MITI, principal department stores in Tokyo have agreed to hold a silk fair in the season of autumn. Calling October a Silk Month, 9 department stores (offering 11 shops) will present a Silk Fair for one or two weeks to promote silk products on a large scale in order to expand their demand.

To back up this event, the Japan Silk Association will put up publicity posters in main stations of national railways, metros and private railways and inside their cars throughout Tokyo in order to raise the interest of the public.

7. *Japan Raw Silk Corporation changes its name*

Since October 1, 1981, the Japan Raw Silk Corporation has merged with the Japan Sugar Price Stabilization Agency to make a new start as the Japan Raw Silk and Sugar Price Stabilization Agency.

Although the move represents a part of the administrative structural reformation, there will be no change in the businesses they are currently conducting.

(Source : Japan Silk Association, Lyon office)

6. *Une foire de la soie à Tokyo*

Avec l'appui du MAFF et du MITI, les principaux grands magasins de Tokyo se sont mis d'accord pour organiser une foire de la soie en automne. Faisant du mois d'octobre le mois de la soie, 9 grands magasins (offrant 11 boutiques) présenteront une foire de la soie durant une ou deux semaines, afin de promouvoir les produits en soie sur une grande échelle et de stimuler ainsi la demande.

Pour soutenir cet événement et attirer l'attention du public, l'Association Japonaise de la Soie a organisé une campagne d'affichage dans les principales gares de Tokyo et dans les voitures du réseau ferré national, des métros et des chemins de fer privés.

7. *La Japan Raw Silk Corporation change de nom*

Depuis le premier octobre 1981, la J.R.S.C. a fusionné avec l'Agence de Stabilisation des Prix du Sucre, sous la nouvelle dénomination : Agence Japonaise de Stabilisation des Prix de la Soie Grège et du Sucre.

Ce changement qui entre dans la réforme de structure de l'administration ne modifie pas les activités habituelles des deux organismes.

(Source : Association Japonaise de la soie, bureau de Lyon)

INDIA

1. *New measures of limitations of imports of raw and tasar silk*

In order to avoid a too important competition of silks imported from China, the Indian Government set up a new imports policy of raw silk and tasar silk.

INDE

1. *Nouvelle politique de limitations des importations de soie grège et tasar*

Afin d'éviter une trop vive concurrence de la part des soies importées de Chine, le gouvernement indien a mis en place une nouvelle politique des importations de soie grège et de soie tasar.

Exporters of silk products will be able to import raw silk and tasar silk in a proportion of 9:1 in the limits of 20% of the FOB value of their exports.

Though duty free, the imports of raw silk, grade A and B, will be still subject to an advance licence.

Les exportateurs de produits soyeux pourront importer de la soie grège et de la soie tasar dans un rapport de 9:1 à concurrence de 20% de la valeur FOB de leurs exportations.

Les importations de soie grège de grade A et B, bien que libres de droits, seront toujours soumises à une autorisation préalable.

2. Silk mission to Ghana

SMT. CHITKALA ZUTSHI, IAS, Project Co-ordinator, Indo-Swiss Bilateral Project, Ministry of Commerce, Government of India and Dr K. SENGUPTA, Director, Central Tasar Research & Training Institute (CSB), Ranchi, toured Ghana during the first fortnight of May, at the invitation of Government of Ghana. Their mission was to explore the possibilities of introducing sericulture. According to these officials of the Board, the geo-climatic conditions in Ghana are quite favourable to sericulture. Dr Sengupta also toured Togo in the same connection.

2. Mission-soie au Ghana

M SMT CHITKALA ZUTSHI, IAS, Coordonateur du projet bilatéral Inde-Suisse, Ministère du Commerce, Gouvernement Indien, et le Dr K. SENGUPTA, Directeur de l'Institut Central de Recherche et de Formation sur le Tasar (CSB) de Ranchi, ont effectué un voyage au Ghana au cours de la première quinzaine de mai, à l'invitation du gouvernement Ghanéen. Leur mission consistait à étudier les possibilités d'introduire la sériciculture. Selon ces officiels, les conditions géoclimatiques du Ghana sont tout à fait favorables pour la sériciculture. Le Dr Sengupta s'est également rendu au Togo avec le même objectif.

3. The golden jubilee of the Mysore Government Weaving Factory

Created in 1931, this factory produces a famous crepe sari. Under the World Bank Programme, the Government has decided to further modernise the factory. For this, 70 new units of powerloom would be added to the fleet which will increase its production capacity to over 4 lakh metres! Suitable preparatory machines will also be installed simultaneously. To begin with, the output capacity will be increased by 39 per cent above the present level on single shift basis.

3. L'Usine Gouvernementale de Tissage de Mysore a fêté son cinquantenaire

Créée en 1931, cette usine produit un sari en crêpe qui est renommé. Dans le cadre du programme de la Banque Mondiale, le Gouvernement a décidé de moderniser l'usine. Pour cela, 70 nouveaux métiers mécaniques viendront s'ajouter au parc existant permettant ainsi d'accroître la capacité de production de plus de 400 000 mètres! Les machines de préparation nécessaires seront installées en même temps. Au démarrage, la capacité de production sera accrue de 39% par rapport au niveau actuel, sur la base d'une seule équipe.

(Source : Indian Silk)

(Source : Indian Silk)

F.A.O.

Traduttore, Traditore !

The summary of the report of the F.A.O. study tour in China published in n° 21 (1) has been subject to comments from F.A.O. and particularly from Mr Robert Karam.

"It is obvious that a summary cannot reconstitute all the shades existing in the whole text.

However, some opinions seem to be more critical out of their global context than in the original version. I will quote the following examples : the last paragraph of page 28 ; the first two lines of the sixth paragraph on page 30 ; the second part of the seventh paragraph on page 33 ; the second paragraph of page 34 ; the words *rudimentary* and *heterogenous* used on page 30 and 33 which do not appear in the original text.

From page 35, the word extension has been translated by *développement*. As a matter of fact, extension means *vulgarisation* in French. Then the word development is used in the English text instead of the word extension which makes a part of the text non understandable".

Welcome to the International Society of Non-mulberry Silks.

After the international seminar on non-mulberry silks held at Ranchi (India) in 1974 and the symposium organized during the XVI International Congress of Entomology held in Kyoto (Japan) in 1980, specialists decided to found an association named International Society of Non-mulberry Silks.

O.A.A.

Traduttore, traditore !

Le résumé du rapport de la mission O.A.A. en Chine paru dans le n° 21(1) a été l'objet de commentaires de la part de l'O.A.A. et en particulier de M. Robert Karam.

"Il est compréhensible qu'un résumé ne peut comporter toutes les nuances existant dans le texte in extenso.

Cependant certains jugements, pris hors de leur contexte global, semblent être plus critiques qu'ils ne le sont dans la version originale. Je citerai les exemples suivants : le dernier paragraphe de la ligne 28 ; les deux premières lignes du sixième paragraphe de la page 30 ; la seconde partie du septième paragraphe de la page 33 ; le second paragraphe de la page 34 ; les termes *rudimentary* et *heterogenous* utilisés dans les pages 30 et 33 et qui n'existent pas dans le texte original.

A partir de la page 35, le terme *extension* a été traduit par *développement*. En réalité, *extension* est l'équivalent de *vulgarisation* en français. Par la suite, on retrouve dans le texte anglais *development* là où *extension* aurait dû figurer (para. 3, p. 36). Ceci rend une partie du texte incompréhensible".

Bienvenue à la Société Internationale des Soies Non-mûrier.

A la suite du séminaire international sur les soies non-mûrier tenu à Ranchi (Inde) en 1974 et du symposium organisé lors du XVIème Congrès International d'Entomology tenu à Kyoto (Japon) en 1980, les spécialistes des soies non-mûrier ont éprouvé le besoin de se réunir en une Association dénommée Société Internationale des Soies Non-mûrier.

(Suite page 395)

NOTES ECONOMIQUES ET DOCUMENTAIRES

ECONOMICAL AND DOCUMENTARY NOTES

SERICULTURE IN THE PHILIPPINES

LA SERICULTURE AUX PHILIPPINES

The onslaught of inflation has not reduced the fancy of Filipinos for good quality clothing. On special occasions when only the best is considered good enough, silk has remained a top favorite. Its airy softness, drapy suppleness, and warm and sensuous touch has not been matched by man-made fibers. This accounts for the continued influx of imported silk goods into the country.

Central Bank estimates reveal the increasing demand for silk by the Filipino consumers. In 1976, 237 sq. meters of imported silk fabric were registered. This increased to 9.158 sq. meters costing \$ 26.499 in 1979. Moreover, the clientele for the native "barong" which is made from imported raw silk or "jusi" is increasing as more consumers move into the higher income brackets.

This flow of foreign exchange from the country, resulting from an established local market for silk, is deplorable considering the climatic and social suitability of sericulture in the Philippines. Historical records show that some 500 hectares of mulberry plantation existed in Kanlaon, Negros Occidental during the pre-war era. Old handweavers from the provinces of Rizal

Les attaques de l'inflation n'ont pas émoussé le goût des Philippins pour les vêtements de qualité. Dans les grandes occasions, lorsque seul ce qui se fait de mieux est considéré comme suffisant, la soie demeure la reine. Sa souplesse aérienne, son drapé souple et son touché chaud et voluptueux n'ont pas d'égal parmi les fibres artificielles. Ceci explique l'afflux continu des produits soyeux d'importation dans le pays.

Les estimations de la Banque Centrale révèlent une demande croissante pour la soie de la part des consommateurs philippins. En 1976 les importations de tissu de soie se sont élevées à 237m². En 1979 elles ont atteint 9158m² et 25.499 \$ en valeur. De plus, la clientèle pour le "barong" local fait avec de la soie importée ou pour le "jusi" va en augmentant à mesure que davantage de consommateurs accèdent aux classes de revenus supérieurs.

Ces importations, liées à l'existence d'un marché de la soie local, sont tout à fait regrettables quand on considère les possibilités climatiques et sociales de pratiquer la sériciculture aux Philippines. Des documents historiques indiquent qu'il y avait avant guerre quelques 500 hectares de mûriers à Kanlaon dans le Negros Occidental. Les vieux tisseurs à soie des Provinces

and Iloilo speak of a glorious past when almost 1000 handlooms were used for silk. As a result of insufficient technical expertise and meager support however, the industry died a natural death.

The first attempt to revive sericulture in the Philippines was made by the defunct Mountain Province Development Authority in the early 1960's. When the agency was abolished in 1973, the Philippines Textile Research Institute (PTRI) of the National Science Development Board took over the project which was yet in its infancy.

Through the years, the PTRI has established and currently maintains four (4) sericulture research and development stations. In La Trinidad, Benguet, the Institute has a 2.8 hectares mulberry farm, 2 silkworm rearing houses, a one-room laboratory, and a main office with 7 technical staff. In Lanise, Claveria, Misamis Oriental, 12 hectares are presently planted with mulberry while an adjoining 15 hectares more are being developed by the Provincial Government of Misamis Oriental for the same purpose. The Lanise station maintains a central rearing house, 4 cooperative rearing houses, and a staff house. At the experimental station in Kalingagan, Villanueva, Misamis Oriental, a 2.5 hectare mulberry field is being maintained to support research activities and cocoon production in one rearing house. The technical staff of the Misamis Oriental stations amount to fourteen (14) persons. At the PTRI compound in Bicutan, a Filature Pilot Plant was set up in 1978 with assistance from the National Science Development Board. Facilities for cocoon assorting, drying, cooking, silk-reeling, booking and silk yarn testing are present. With only 6 staff in the Filature Project, the plant has not attained its maximum production capacity of 16 kgs raw silk for 8 hours operation.

de Rizal et d'Iloilo évoquent un passé glorieux où près de 1000 métiers tissaient de la soie. En raison de l'insuffisance des connaissances techniques et également de la faiblesse de l'aide, cette industrie est morte de mort naturelle.

La première tentative pour faire revivre la sériciculture aux Philippines a été conduite par la défunte Agence pour le Développement de la Province des Montagnes au début des années 60. Lorsque l'Agence a été dissoute en 1973, l'Institut Philippin de Recherche Textile (IPRT) qui dépend du Conseil National pour le Développement de la Science a repris le projet qui en était alors à ses débuts.

Au fil des ans l'IPRT s'est mis en place et il entretient quatre (4) stations de recherche et développement. A La Trinidad, Benguet, l'Institut possède une ferme avec 2 hectares de mûriers, 2 magnaneries, un laboratoire d'une pièce et un bureau principal avec un effectif technique de 7 personnes. A Lanise, Claveria, Misamis Oriental, 12 hectares de mûriers sont plantés à l'heure actuelle et 15 hectares supplémentaires vont être mis en place par le Gouvernement Provincial du Misamis Oriental dans le même but. La station de Lanise dispose d'une magnanerie centrale, de 4 magnaneries coopératives et d'un bureau. La station expérimentale de Kalingagan, Villanueva, Misamis Oriental, possède une mûraie de 2,5 hectares destinée aux activités de recherche et à la production de cocons dans une magnanerie. L'effectif du personnel technique des stations du Misamis Oriental s'élève à 14 personnes. Dans l'enceinte de l'IPRT à Bicutan une filature pilote a été mise en place en 1978 avec l'aide du Conseil National pour le Développement de la Science. Les équipements nécessaires pour le tri des cocons, le séchage, la cuisson, le renvidage, la mise en échevaux et les tests des fils de soie sont en place. Avec un effectif du projet de filature limité à 6 personnes, l'usine n'a pas atteint sa capacité maximale de production de 16 kgs de soie grège pour huit heures de fonctionnement.

After seven years in the venture, 150 hectares of mulberry plantation now exist in the country. The area includes the farms owned by private entrepreneurs and other government institutions who were encouraged by the sericulture promotion program of the PTRI. Of this total, only 75 hectares are actually productive with a total annual yield of 30 tons fresh cocoons amounting to ₱ 600.000 (\$ 85.715) at ₱ 20.00/kg., which are all exported, thus earning for the country a revenue of \$ 156.000 at the present world market price of \$ 13/kg. dried cocoons. In addition, two private firms have gone into silk weaving with a total of 35 silk looms in operation. One company produces the "jusi" for the "barong" while the other weaves silk fabrics for export. Both companies import their yarns since the country is not yet in a position to meet the consumption of power looms which is 3-4 kg raw silk/loom/mo.

With the interest it has generated, sericulture will inevitably grow into a significant industry in the years to come. By the end of 1981, the total hectarage planted to mulberry is expected to grow to 400. By 1983, it will rise to 720 hectares, and by 1984, it will be nearly 1000 hectares. The prospect of a local source of raw material will also encourage the establishment of more weaving factories. Furthermore, the present two companies will expand to 50 looms each in three years time, thus increasing their silk yarn consumption.

The future of sericulture in the country seems to be bright in terms of public interest it has generated. However, a more objective assessment of actual capacities to establish and maintain a viable industry will indicate that the venture might eventually face the same fate it did during the pre-war era unless some measures are undertaken. With the limited research funds, particularly of the PTRI, more technologies are yet to be developed.

Sept ans après le début de cette aventure, il existe 150 ha de plantations de mûrier. Cette superficie comprend les fermes des entrepreneurs privés et les institutions gouvernementales qui ont été aidées par le programme de promotion de l'IPRT. Sur ce total, 75 hectares sont en production et fournissent une récolte annuelle de 30 tonnes de cocons frais, représentant 600.000 ₱ (85.715 \$) à 20.00 ₱/kg, qui sont exportés en totalité, ce qui fournit au pays un revenu de 156.000 \$ au prix actuel du marché mondial de 13 \$ le kg de cocons secs. De plus, deux sociétés privées se sont engagées dans le tissage de la soie et possèdent 35 métiers en fonctionnement. Une compagnie produit le "jusi" destiné au "barong" alors que les autres produisent des tissus pour l'exportation. Les deux compagnies importent leurs fils car le pays n'est pas en mesure de satisfaire les besoins des métiers mécaniques qui s'élèvent à 3-4 kg de soie grège/métier/mo.

En raison de l'intérêt qu'elle suscite, la sériciculture deviendra inévitablement une industrie significative dans les années à venir. A la fin de 1981 la superficie plantée en mûriers devrait atteindre 400 hectares. En 1983 elle devrait être de 720 hectares et en 1984, elle atteindra 1000 hectares. L'existence d'une source locale de matière première encouragera également l'installation de davantage de tissages. Par ailleurs, les deux compagnies existantes disposeront de 50 métiers à échéance de 3 ans, et consommeront donc plus de fils de soie.

L'avenir de la sériciculture dans le pays apparaît prometteur si on se réfère à l'intérêt qu'il a suscité dans le public. Toutefois, un examen plus objectif des capacités réelles à mettre en place et à maintenir une industrie viable, montre que l'entreprise est susceptible de subir le même sort que l'industrie séricicole d'avant-guerre si des mesures ne sont pas prises. Du fait que les fonds de recherche sont limités, particulièrement ceux de l'IPRT, d'autres technologies doivent être développées.

It will be noted that the country has been importing silkworm eggs from Korea and Japan at an average cost of \$ 15/box, taxes included. At a conservative estimate of 25 kg cocoons/box and 400 kg cocoons/hectare/annum, by the end of 1981, when the total hectareage shall have grown to 400, the annual silkworm egg demand will rise to 6.500 boxes or a drain of \$ 96.000 from our foreign exchange reserves. Although the activities for seed production have started, there is only a handful of breeders with sufficient training in the technology. Moreover, these people work on very few imported pure races which the PTRI was able to acquire through various means. Even the essential equipment like a cold storage chamber are not available.

With the expansion of the industry, more extension workers will be necessary to ensure the dissemination of the proper technologies. Unfortunately, government restrictions beset the activities of the PTRI. The existing staff are yet to be motivated with commensurate compensations. Very important too, is the relevant training which extension workers must have. As an example, the country must be ready for possible disease outbreak in the future. The industry can be saved only if there are trained technicians available. This kind of training can be acquired only if the technical staff are sent to foreign countries.

Since sericulture should benefit the small farmers, credit schemes should be devised to enable them to engage in the industry.

Finally, the weaving factories should not forever depend on imported silk yarns. Eventually, reeling factories must arise to supply their increasing demand. Moreover, there is a danger in over-reliance in the foreign market for the produced cocoons. Other countries, like Japan, usually impose restrictions on imports to safeguard their own industry. The experience of South Korea in 1974-75, when the oil crisis hit Japan and there was no local

Il est à noter que le pays importe les graines de ver à soie de Corée et du Japon à un prix moyen de 15 \$/boîte, taxes comprises. Sur la base d'une estimation de 25 kg de cocons/boîte et de 400 kg de cocons/hectare/an, à la fin de 1981, lorsque la superficie totale des mûraies aura atteint 400 hectares, les besoins en graines s'élèveront à 6400 boîtes représentant une sortie de devises de 96.000 \$. Bien que les activités de grainage aient commencé, il n'y a qu'une poignée d'éleveurs suffisamment avertis en la matière. De plus, ces éleveurs n'ont à leur disposition qu'un nombre limité de races pures que l'IPRT a pu acquérir de diverses manières. Même les équipements aussi indispensables qu'une chambre frigorifique font défaut.

A mesure que cette industrie se développe, il devient nécessaire de disposer d'un plus grand nombre de vulgarisateurs pour propager les techniques appropriées. Malheureusement les restrictions gouvernementales n'ont pas épargné les activités de l'IPRT. Le personnel existant doit encore être stimulé avec des indemnités convenables. La formation que doivent recevoir les vulgarisateurs est également un élément important. Par exemple le pays doit être préparé à une épidémie qui peut survenir. L'industrie ne peut être sauvée que s'il y a des techniciens avertis. La formation du personnel technique ne peut être faite qu'à l'étranger.

Puisque la sériciculture doit bénéficier aux petits paysans, les modalités d'attribution de prêt doivent être étudiées afin de leur permettre de se lancer dans cette activité.

Enfin les tissages ne doivent plus dépendre des importations de fils de soie. En définitive, les filatures doivent se développer pour satisfaire cette demande croissante. De plus, il y a un danger à trop s'appuyer sur les marchés extérieurs pour écouler les cocons. Les autres pays, comme le Japon, imposent actuellement des restrictions aux importations pour défendre leur propre industrie. L'expérience de la Corée en 1974-75 qui n'avait pas

market for their produce, should be a lesson in this respect. Thus, the establishment of reeling factories should be given due consideration soon but big investors will not assume this project unless the cocoon production aspect is fully stabilized.

The foregoing are only a few of the major problems that confront the sericulture industry. The absence of a strong inter-agency collaborative effort is also noteworthy. Unless serious efforts are undertaken to find a solution to these problems, the industry will eventually face its likely demise.

There is presently a consensus of opinion among the government and private sectors to expand sericulture activities, particularly the research aspects, to ensure a stable foundation for the development of the industry. The advantage that the country can reap when the industry is stabilized is tremendous.

Being highly labor intensive, sericulture could make a significant contribution to easing the employment problem. It is capable of providing part or full-time employment to economically retarded or unproductive members of the Community, such as the juveniles or elderly people.

Silkworm rearing also has high profit potential and little capital investment. Farmers can even intercrop mulberry with other farm products.

At the other extreme, the industry will eventually attract foreign investors. The foreign exchange earnings will likewise be significant. Considering 1981 projections, 400 hectares of mulberry can yield an annual cocoon production of 160 metric tons which when exported will amount to \$ 832.000. More revenues will even be realized if these cocoons are converted into silk yarns and woven into fabric. At a conversion ratio of 8 kg fresh cocoons to 1 kg raw silk, 160 metric tons

de marché intérieur pour ses produits, lorsque le choc pétrolier a frappé le Japon, doit servir de leçon à cet égard. Ainsi l'installation de filatures doit être prise en considération rapidement dans la mesure où les gros investisseurs ne prendront pas en charge le projet tant que la production de cocons ne sera pas stabilisée.

Les points évoqués ci-dessus ne sont que quelques uns des problèmes qui se posent à l'industrie séricicole. L'absence d'un effort de collaboration inter-organisation est également notable. Si de sérieux efforts ne sont pas faits pour trouver une solution à ces problèmes, l'industrie ira à une mort inéluctable.

Un consensus existe entre le gouvernement et le secteur privé pour développer les activités séricicoles, particulièrement dans le domaine de la recherche, afin d'assurer des bases solides pour le développement de l'industrie. Les avantages que pourra en retirer le pays lorsque l'industrie sera stabilisée sont importants.

La sériciculture étant une activité fortement utilisatrice de main d'oeuvre peut apporter une contribution significative à la solution du problème de l'emploi. Elle peut fournir un emploi à temps partiel ou complet à certains membres de la Communauté économiquement défavorisés ou improductifs tels que les jeunes et les personnes âgées.

L'élevage du ver à soie peut procurer des bénéfices importants pour un investissement faible. Les fermiers peuvent faire des cultures dérobées dans les mûraies.

A l'autre extrémité, l'industrie est susceptible d'attirer les investisseurs étrangers. Les gains procurés par le commerce extérieur seront significatifs. Si on considère les projections pour 1981, 400 ha de mûrier peuvent fournir une production annuelle de cocons de 160 tonnes qui représentent une valeur à l'exportation de 832.000 \$. Des revenus plus importants peuvent être obtenus si ces cocons sont transformés en fils de soie tissés. Sur la base d'un rendement en filature

fresh cocoons will produce 20.000 kg raw silk. When woven, at 50 gm raw silk per meter, 400.000 meters of silk fabric can be produced. Assuming that the fabric will be sold at ₱ 25.00/ meter, a gross income of ₱ 10.000.000 or \$ 1.428.571 will be realized.

Silk handweaving can also be a by-product of a stable silk production program. The extraordinary success of Thai silk has proved that hand reeled and home-woven exotic silk fabric can conquer the market. With the development of a genuine Philippine silk fabric, revenues from tourists will multiply.

Undoubtedly, the potential impact of the industry cannot be ignored. However the benefits will only materialize after immediate measures are undertaken to remedy the present problems. More financial support will be required but with the absence of investments from bilateral sources, assistance from the United Nations system especially the United Nations Industrial Development Organization (UNIDO) and the United Nations Development Programme (UNDP) is necessary.

NOTE.

We submitted our proposal to the UNIDO and the UNDP who were sympathetic to our efforts, but unfortunately sericulture was not included in the country program and hence we could not as yet realize any assistance.

de 8 kg de cocons frais pour 1 kg de soie grège, 160 tonnes de cocons représentent 20.000 kg de soie grège. On peut donc produire 400.000 m de tissus à 50 g de soie au mètre. En supposant que le tissu soit vendu à 25.00 ₱/mètre un revenu brut de 10.000.000 ₱ ou 1.428.571 \$ peut être réalisé.

Le tissage à bras de la soie peut être également une activité secondaire dans un programme stable de production de soie. Le succès extraordinaire de la soie Thai a prouvé que des tissus exotiques produits localement avec des soies filées à la main peuvent conquérir le marché. Avec le développement d'un tissu philippin original, les revenus tirés du tourisme se multiplieront.

Incontestablement, l'impact potentiel de l'industrie ne peut être ignoré. Toutefois, les bénéfices ne deviendront réalités que si des mesures efficaces sont prises pour remédier aux problèmes actuels. Un soutien financier accru est nécessaire, mais en l'absence de sources de financement bilatérales, l'aide des agences des Nations Unies, en particulier de l'Organisation des Nations Unies pour le Développement Industriel (ONUDI) et du Programme des Nations Unies pour le Développement (PNUD) est nécessaire.

NOTE.

Nous avons soumis nos propositions à l'ONUDI et au PNUD qui ont montré de la sympathie pour nos efforts, mais malheureusement la sériciculture n'a pas été incluse dans le programme national et ainsi nous n'avons pu encore bénéficier d'une quelconque aide.

ARTICLES SCIENTIFIQUES ET TECHNIQUES

SCIENTIFIC AND TECHNICAL PAPERS

DEVELOPMENT OF ARTIFICIAL DIETS AND THEIR APPLICATION IN SERICULTURE

LE DEVELOPPEMENT DE L'ALIMENTATION ARTIFICIELLE ET SON APPLICATION EN SERICULTURE

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The nutrition of the silkworm, *Bombyx mori*, has been a matter of concern in sericulture, both scientifically and practically. In spite of the accumulation on the knowledge on the utilisation of mulberry leaves by the silkworm, little information has been obtained on the nutritional requirements of this insect.

1. The first attempts.

Around the year 1955, Dr. Yoshida and coworkers were trying to formulate the artificial diet for the silkworm. They finally succeeded in rearing the silkworm up to the age of the mid-Vth instar, but not beyond this age, on the diet containing a large amount of mulberry leaf powder, as much as 50 % on the dry basis. Subsequently, two papers appeared independently, reporting the success of an entire rearing on artificial diets, the one identical with Yoshida's diet (Fukuda *et al.*, 1960), the other somewhat modified from it (Ito and Tanaka, 1960). Results were far from reaching the practical level ; the growth rate was poor, larval period was prolonged, larval mortality was high and cocoons were small. However, the success of rearing throughout the whole instars has become the object of public attention. With this as a momentum, various new studies have been started, such

La nutrition du ver à soie, *Bombyx mori*, a toujours été un sujet d'étude tant du point de vue scientifique que du point de vue pratique. En dépit de l'accumulation des connaissances sur l'utilisation des feuilles de mûrier par le ver à soie, peu d'informations ont été obtenues sur les besoins nutritionnels de cet insecte.

1. Les premiers essais.

Vers 1955, le Dr Yoshida et ses collaborateurs ont essayé de mettre au point un aliment artificiel pour le ver à soie. Ils parvinrent à élever des vers à soie jusqu'au milieu du Vme âge, mais pas au delà, à l'aide d'un aliment contenant une quantité importante de poudre de feuilles de mûrier : 50% en poids sec. Par la suite deux articles parurent de façon indépendante, faisant état de la réussite d'un élevage complet sur des aliments artificiels dont l'un était identique à l'aliment de Yoshida (Fukuda *et al.*, 1960) et dont l'autre était une variante de cet aliment (Ito et Tanaka, 1960). Ces résultats étaient loin de l'application pratique; le taux de croissance était faible, la période larvaire était allongée, la mortalité était forte et les cocons petits. Cette réussite d'un élevage complet a toutefois attiré l'attention du public. A partir de ce résultat, un élan était

as the analysis of the nutritional requirements, pathological studies by means of aseptic culture, establishment of the dietetics, and so forth.

2. Development and improvement of artificial diets.

2.1 Nutritional requirements

In order to proceed the study on the nutritional requirements, it was necessary to prepare the diet including known substances, as far as possible. Thus the dietary level of the mulberry leaf powder was reduced first to 20 %, then to 10 %, and finally to zero, and the semi-synthetic or synthetic diet was formulated. However, a contradiction was involved in the process of improvement of the diet. In general, a chemically-defined diet could not be formulated without knowing the nutritional requirements of the silkworm, but the nutritional requirements could not be analysed without having a chemically-defined diet. The first finding on the nutritional requirement was the necessity of the inclusion of ether extracts of soybean into the diet (Ito, 1960). This turned out the demonstration of sterol requirement by the silkworm. Information on the nutritional requirements contributed, step by step, to the improvement of the dietary composition. In this way, the requirements for amino acids, sterols, fatty acids, vitamins, and minerals have been established in a relatively short period. Nutritional roles of sugars and other carbohydrate as well as proteins have also been clarified. Not only the qualitative but also the quantitative requirements have been analysed, and it has been revealed that the nutritional balances reflect largely the rate of growth and silk production. Furthermore, the minimum and optimum level of each indispensable nutrient has been determined. One example of the synthetic diet is shown in Table 1, which is not practical because of inclusion of costly nutrients. In or-

donné au démarrage de diverses recherches nouvelles telles que l'analyse des besoins nutritionnels, des études de pathologie à l'aide d'élevages aseptiques, la mise au point des aliments, et autres.

2. Développement et amélioration des aliments artificiels.

2.1 Besoins nutritionnels.

Pour étudier les besoins nutritionnels, il était nécessaire d'inclure dans l'aliment des substances dont la composition était connue de façon aussi précise que possible. C'est ainsi que la teneur en poudre de feuilles de mûrier a été abaissée tout d'abord à 20%, puis à 10% et enfin à zéro : aliments semi-synthétiques ou synthétiques. Cependant une contradiction apparaissait dans le processus d'amélioration de l'aliment. En général, la composition d'un aliment chimiquement défini ne peut être établie sans connaître les besoins nutritionnels du ver à soie, et les besoins nutritionnels ne peuvent être étudiés sans disposer d'un aliment chimiquement défini. Le premier résultat obtenu relatif aux besoins nutritionnels concernait la nécessité d'inclure dans l'aliment un extrait de soja par l'éther (Ito, 1960). Ceci démontrait les besoins en stérol du ver à soie. Les informations sur les besoins nutritionnels ont contribué petit à petit à améliorer la composition de l'aliment. A cet égard, les besoins en acides aminés, stérols, acides gras, vitamines et minéraux ont été précisés durant une période relativement courte. Le rôle nutritionnel des sucres et des autres hydrates de carbone, de même que celui des protéines ont également été définis. L'analyse a porté non seulement sur les besoins qualitatifs mais aussi sur les besoins quantitatifs et on a pu montrer que l'équilibre entre les constituants conditionne largement la croissance et la production de soie. De plus, le niveau minimal et optimal de chaque constituant indispensable a été déterminé. Un exemple d'aliment synthétique est donné

der to accelerate the food intake by the silkworm, it was necessary to add some feeding stimulants to such a diet.

dans le tableau 1. Cet aliment n'a pas d'intérêt pratique en raison du coût élevé des constituants. Pour améliorer la prise de nourriture du ver à soie, il a été nécessaire d'inclure dans l'aliment des substances stimulant la prise de nourriture.

Table 1. An example of synthetic diet
Tableau 1. Exemple d'aliment synthétique

Substance	% (1)	Composant
Potato starch	5	Amidon de pomme de terre
Sucrose	15	Sucre
Amino acid mixture (2)	20	Mélange d'acides aminés (2)
Refined soybean oil (or fatty acids)	3	Huile de soja raffinée (ou acides gras)
β -Sitosterol (or cholesterol)	0.5	β -Sitostérol (ou cholestérol)
Salt mixture	4	Mélange salin
Agar	15	Agar
Cellulose powder	35.2	Poudre de cellulose
Ascorbic acid	2	Acide ascorbique
Vitamin B mixture (3)	+	Mélange de vitamines B (3)
Feeding stimulant (4)	+	Stimulant de la prise de nourriture (4)

(1) Percent in dry weight.

(2) 19 amino acids.

(3) 9 vitamins

(4) Morin (a flavone compound) or leaf extracts. Could be omitted from the diet for older larvae.

Citric acid and antimicrobial agents are necessary to be added.

(1) % en poids sec.

(2) 19 acides aminés.

(3) 9 vitamines.

(4) Morine (flavone) ou extraits de feuilles. Peut être supprimée dans l'aliment des vers âgés.

Il faut ajouter de l'acide citrique et des agents antimicrobiens.

The replacement of the pure nutrients, such as amino acids, with a natural product, such as soybean meal, resulted in a better larval growth. It was also necessary to include a certain amount of mulberry leaf powder as one of the ingredients in order to maintain a better growth. Dietary leaf powder was effective for feeding acceleration and presumably for growth acceleration, especially for the newly hatched larvae or younger ones. It was possible to lower gradually the level of the leaf powder in the diet according to the instar progression, and finally down to zero, even in the practical artificial diet.

Le remplacement de constituants définis tels que les acides aminés par un produit naturel comme la farine de soja entraîne une meilleure croissance des vers. Il apparut également nécessaire d'inclure une certaine quantité de poudre de feuilles de mûrier afin d'assurer une meilleure croissance. La poudre de feuilles de mûrier a une action efficace sur la prise de nourriture et sans doute sur la croissance, en particulier pour les vers néonates et les jeunes vers. On a pu diminuer progressivement la teneur de l'aliment en poudre de feuilles en fonction des stades de développement, jusqu'à atteindre zéro, même dans les aliments utilisés dans la pratique.

It was eventually confirmed that there were at least four main requirements in the formulation of artificial diets for the silkworm ; that is :

1. to meet both qualitative and quantitative nutritional requirements,
2. to possess the suitable physical properties,
3. to be free from microbial contamination,
4. not to contain any possible deterrent or repellent.

Rearing experiments were repeated to improve the diets by testing a number of combinations of the dietary ingredients. For instance, in one experiment, the dietary levels of starch, soybean meal and agar were varied mutually, and the suitable dietary levels were determined. It was also recognized that the dietary composition had to be altered to some degree according to the instar progression.

2.2 Physical characteristics of artificial diets.

Agar and cellulose powder in the diet were considered to contribute to the physical property of the diet. Physical factors of the diet often played a very important role in the maintenance of a good quality. Water content was one of the main factors, and approximately 75 % level was considered to be most favourable. However, the suitable water content must be decided by each different diet, because some dietary ingredients, such as sugar, cellulose powder, agar, and so on, have a close connection with the hardness or softness of the diets. It was also clarified that the level of the dietary cellulose powder influenced the rate of food intake.

2.3 Control of microbial and fungal contaminations

In the early days of the development of the artificial diets no effective antimicrobial agent was included in the diet. Therefore, it was necessary to replace the diet at least twice or sometimes three times daily. The larvae which had fed the highly contaminated diet died with few exceptions.

On a pu établir que la composition d'un aliment pour le ver à soie devait répondre à au moins quatre exigences, qui sont :

1. satisfaire les besoins nutritionnels tant qualitatifs que quantitatifs,
2. avoir des propriétés physiques convenables,
3. être exempt de contaminations microbiennes,
4. ne pas contenir de substances répulsives ou inhibitrices.

Pour améliorer l'aliment, on a procédé à de nombreux élevages, à l'aide d'aliments présentant diverses combinaisons de constituants. Par exemple, dans une expérience, les teneurs en amidon, en farine de soja et en agar étaient modifiées les unes par rapport aux autres, ce qui permettait de déterminer les teneurs adéquates. Il est également apparu que la composition de l'aliment devait être modifiée en fonction du stade de développement.

2.2 Caractéristiques physiques des aliments artificiels.

On considère que l'agar et la poudre de cellulose ont une action sur les propriétés physiques de l'aliment. Les facteurs physiques de l'aliment jouent souvent un rôle très important dans le maintien d'une bonne qualité. L'eau est également un facteur important. Il faut que l'aliment contienne environ 75% d'eau. Toutefois, la teneur adéquate en eau doit être définie pour chaque aliment, car certains composants tels que le sucre, la poudre de cellulose, l'agar, etc, ont une incidence sur la dureté et la tendreté de l'aliment. On a également établi que la teneur en poudre de cellulose influence la prise de nourriture.

2.3 Contrôle des contaminations microbiennes et cryptogamiques.

Dans les premiers temps, les milieux artificiels ne contenaient pas d'agents antimicrobiens. Il était donc nécessaire de renouveler l'aliment deux fois, voire trois fois par jour. Les vers qui consommaient un aliment contaminé mourraient tous, à quelques exceptions près. Des examens bactériologiques

Bacteriological examinations of the decomposed diets have been carried out extensively, and the bacteria belonging to the *Streptococcus* group were detected commonly from the decomposed diet. It was also found that they exerted the silkworm itself adversely, in addition to their infection on the diet. The contamination of several other bacteria, yeast or molds was also reported. At present, the effective antimicrobial agent(s) is recognized to be essential, by which it became possible to standardize the rearing method.

Table 2 shows another example of the artificial diet, which has been developed for the practical rearing of younger larvae at the Sericultural Experiment Station, Japan, about 10 years ago.

approfondis des aliments décomposés ont permis de mettre en évidence la présence fréquente de bactéries appartenant au groupe des *Streptococcus*. On s'est également aperçu que ces bactéries avaient une action inhibitrice vis à vis du ver à soie, en plus de leur effet sur l'aliment. Des contaminations par d'autres bactéries, des levures et des champignons ont également été signalées. A l'heure actuelle, la présence d'agent(s) antimicrobien(s) efficace(s) est reconnue comme indispensable; ce qui rend possible la standardisation de la méthode d'élevage.

Dans le tableau 2 figure un exemple d'aliment artificiel qui a été mis au point pour l'élevage industriel des jeunes larves, à la Station Séricicole du Japon il y a dix ans.

Table 2. An example of practical artificial diet for younger larvae
 Tableau 2. Exemple d'aliment artificiel destiné à l'élevage "industriel" des jeunes vers

Substance	g (1)	Composant
Dried mulberry leaf powder	25	Poudre de feuille de mûrier séchée
Corn starch	7.5	Amidon de maïs
Sucrose	8	Sucre
Defatted soybean meal	36	Farine de soja déshuilée
Refined soybean oil	1.5	Huile de soja raffinée
Soybean sterol	0.2	Stérol de soja
Salt mixture	3	Mélange salin
Cellulose powder	15	Poudre de cellulose
Agar	7.5	Agar
Ascorbic acid	1	Acide ascorbique
Citric acid	4	Acide citrique
(Total)	(108.7)	(Total)
Vitamin B mixture	+	Mélange de vitamines B
Antimicrobial agents (sorbic and propionic acids, chloramphenicol)	+	Agents antimicrobiens (acides sorbique et propionique, chloramphénicol)
Water (per g of diet)	2.57 ml	Eau (par g d'aliment)

(1) In dry weight.

(1) En poids sec.

3. Rearing conditions on artificial diets

Suitable rearing conditions were first investigated in a laboratory scale, and it was confirmed that the environmental conditions required for the rearing on artificial diets were somewhat different from those established for the rearing on mulberry leaves. Various conditions, temperature, humidity, light and dark, and air current, were investigated. For instance, a slightly higher temperature being higher by 1-2°C than the case of mulberry-rearing, was required. Photoperiodism or light-dark condition influenced the rate of larval growth and the length of instar. Approximately 85 % room humidity was necessary in order to prevent the drying of the diet during the feeding period. The proper amount of the diet to be supplied for normal larval growth was also determined for each instar. In this way, it was possible to formulate the standard rearing time table. Informations on these environmental conditions were later proved to be valid even in the rearing on a much larger scale.

4. Large scale rearing on artificial diet

4.1 Importance of silkworm rearings on artificial diets

Several years ago the Ministry of Agriculture, Forestry & Fisheries of Japan decided to examine the technical problems involved in mass rearing, in advance of the introduction of artificial diets for the practical rearing in sericulture. Rearing period was confined only to younger larvae, that is, from the beginning of the first instar to the end of the IIIrd instar. During the years 1974 to 1976, for instance, rearing experiments of about 2 million younger larvae at each season were repeated in many local Experiment Stations, so to say, in a nationwide scale. Following these, the rearing scale was enlarged by 5 times or more, that is to the practical scale, and the rearing experi-

3. Conditions d'élevage sur les aliments artificiels.

Les premières recherches sur les conditions d'élevage ont d'abord été faites à l'échelle du laboratoire et il s'est avéré que les conditions d'environnement pour les élevages sur aliment artificiel étaient quelque peu différentes de celles relatives aux élevages sur feuille de mûrier. Divers facteurs, température, humidité, éclairage et ventilation, ont été étudiés. Par exemple, la température doit être supérieure de 1 ou 2°C à celle requise pour les élevages sur feuille de mûrier. La photopériode ou l'alternance jour-nuit joue un rôle important sur la croissance et sur la durée des stades. Au cours des périodes d'alimentation, il faut que l'humidité relative soit de 85% pour éviter que le milieu ne se dessèche. La quantité d'aliment nécessaire pour chaque stade a également été déterminée. Il a été ainsi possible de fixer des règles standard d'élevage. Ces données relatives aux conditions d'environnement se sont révélées valables pour les élevages à grande échelle.

4. Elevage à grande échelle sur aliment artificiel.

4.1 Importance des élevages de ver à soie sur aliment artificiel.

Le Ministère de l'Agriculture des Forêts et des Pêches du Japon a décidé, il y a quelques années, d'étudier les problèmes techniques posés par les élevages de masse, avant d'introduire les aliments artificiels dans la pratique séricicole. Les élevages ont été limités aux jeunes vers du Ier au IIIème âge. Dans les années 1974 à 1976, par exemple, des essais d'élevage concernant environ 2 millions de jeunes vers à chaque saison ont été réalisés dans de nombreuses stations séricicoles locales, c'est à dire à une échelle nationale. Ensuite, la taille des élevages a été quintuplée, atteignant ainsi une dimension industrielle, et des essais ont été réalisés à plusieurs reprises dans des magnaneries coopéra-

ments were repeated in the cooperative rearing houses. So far, pretty good results were obtained.

At present, several companies are allowed to prepare and to sell artificial diets to farmers under the government clearance. Some farmers purchase the prepared diet, while the others purchase the pre-cooked or dry diets from the company. In the latter case the farmers prepare the diets themselves in a diet-preparation center, where various preparation apparatus can be found. The diet-preparation centers were built in the local area thanks to a financial help.

The details of the diet composition prepared by the companies are not known, but their main ingredients are considered to be more or less similar to that of table 2. The prepared diets are needed to be stored in a dark, cold room (10°C or somewhat below) until used.

4.2 Rearing methods on artificial diets

So far, the practical mass rearings with artificial diets have been carried out exclusively in cooperative houses. It is necessary to keep the inside of the rearing room highly clean, especially to avoid the possible contamination of microbials. It is encouraged to introduce the 'clean-rearing system' into each rearing house. Under the administration control, the rearing is carried out in the cooperative houses, either newly-built or re-built, in the farm area, where the well-trained farmers or experts are engaged in the rearing or other sort of works. The rearing houses must be fitted with air conditioner equipped with air filter. Before entering the rearing room, people have to take a shower, to change into a disinfected clean work dress and to put work shoes on. The diets are sliced or cut into pieces by an automatic slicer or cutting machine and usually supplied twice, sometimes only once, in each instar, that is every day or every two days at most.

Jusqu'à présent, de bons résultats ont été obtenus.

A présent, plusieurs sociétés ont l'autorisation de fabriquer et de vendre des aliments artificiels destinés aux sériciculteurs sous le contrôle du gouvernement. Certains sériciculteurs achètent l'aliment tout prêt, alors que d'autres achètent l'aliment précuit ou sec. Dans le dernier cas, les sériciculteurs préparent eux mêmes les aliments dans un centre de préparation, où divers appareils de préparation sont disponibles. Ces centres de préparation des aliments ont été édifiés grâce à des aides financières.

La composition détaillée des aliments préparés par ces sociétés n'est pas connue, mais on considère que les constituants majeurs sont plus ou moins similaires à ceux de l'aliment décrit dans le tableau 2. Les aliments préparés doivent être entreposés dans une pièce obscure et froide (10°C ou moins) jusqu'à leur utilisation.

4.2 Techniques d'élevage sur aliment artificiel.

Jusqu'à présent, les élevages de masse sur aliment artificiel sont réalisés exclusivement dans des coopératives. Les locaux d'élevage doivent être très propres, afin d'éviter d'éventuelles contaminations microbiennes. L'introduction du "clean-rearing system" dans toutes les magnaneries est encouragée. Les élevages sont réalisés sous le contrôle de l'administration dans les coopératives, soit nouvellement construites, soit réaménagées dans les régions agricoles, où des éleveurs expérimentés ou des experts sont recrutés pour faire les élevages ou assurer d'autres tâches. Les magnaneries doivent comporter un système de conditionnement et de filtration d'air. Avant de pénétrer dans les locaux d'élevage, le personnel doit prendre une douche, revêtir des vêtements de travail propres et désinfectés et enfiler des chaussures de travail. L'aliment est découpé en tranches ou en morceaux à l'aide d'une machine automatique, et est distribué générale-

In this way, rearing labour can be largely saved. Various types of automatic rearing machines are available. Under the constant illumination the larvae tend to move or disperse to the margin of the rearing bed. It seems better to put out the lights in the rearing room except during the necessary works, such as feeding diets, observing larval growth, or enlarging rearing bed. When the molting time is reached, the room humidity must be lowered down to about 65 %, by which the drying of the remaining diet is accelerated. When the larvae moult to the next instar, the diets are to be fed newly, and the humidity must be increased again to about 85 %. As for the dryness of the diet, the humidity in the room relates with the air current, and the rate of food intake drops according to the drying of diets.

At present, the rearing by the end of the IInd instar is rather common in the cooperative rearing houses, as compared with those by the end of the IIIrd instar. Newly ecdysed IIIrd-instar or IVth-instar larvae are then delivered to each farmer, where they are successively reared on fresh mulberry leaves until cocoon-spinning. In 1980 the younger larvae hatched from about 190 thousand boxed were reared on artificial diets. One box is a unit of selling silkworm eggs and contains at least 20 thousand eggs. Thus, 190 thousand boxes amount to about 3.8 billion larvae, which account still for 8.5% of the total number of larvae reared that year in the whole Japan. So far, the rearing results are reported to be more or less satisfactory, and it is expected that this new rearing system will be more and more accepted in the future.

4.3 Economical aspects of rearing on artificial diet

The economical evaluation on the 'artificial-diet-rearing' is still

ment en deux fois, plus rarement en une seule fois au cours de chaque âge, c'est à dire tous les jours ou tous les deux jours au maximum. En procédant ainsi, de larges économies de main d'oeuvre peuvent être réalisées. Divers types de machines existent. Sous éclairage constant, les vers ont tendance à migrer ou à se disperser en direction des bords de la surface d'élevage. Il semble préférable de laisser les locaux d'élevage dans l'obscurité, sauf durant les travaux indispensables tels que distribution de l'aliment, observation de la croissance des vers, ou agrandissement de la surface d'élevage. Lors des mues, l'humidité dans les locaux d'élevage doit être abaissée à 65% afin d'accélérer le dessèchement de l'aliment restant. Quand les vers ont mué, il faut distribuer de l'aliment neuf et l'humidité doit être portée de nouveau à 85%. La vitesse de circulation de l'air a une influence sur la quantité d'eau dans l'aliment, et sur l'hygrométrie de l'air. La quantité d'aliment ingérée baisse avec le dessèchement de l'aliment.

A l'heure actuelle, les élevages coopératifs jusqu'à la fin du II^{me} âge sont plus courants que ceux jusqu'à la fin du III^{me} âge. Les larves du III^{me} ou du IV^{me} âge nouvellement sorties de mue sont alors livrées aux éleveurs qui les élèvent ensuite jusqu'au filage avec des feuilles fraîches de mûrier. En 1980, 190.000 boîtes de vers ont été élevées sur aliment artificiel. La boîte est l'unité de vente pour les graines, et elle contient au moins 20.000 oeufs. Donc 190.000 boîtes correspondent à 3,8 milliards de vers, soit 85% des vers élevés au Japon cette année là. Jusqu'à présent, les résultats des élevages paraissent plus ou moins satisfaisants et on espère que ce nouveau mode d'élevage sera de mieux en mieux accepté dans le futur.

4.3 Aspect économique de l'élevage sur aliment artificiel.

L'évaluation de l'élevage sur aliment artificiel du point de vue écono-

insufficient, in spite of a rapid progress in the scientific and technological fields. However, it seems that the 'artificial-diet-rearing' in cooperative houses could be managed as nicely as the 'mulberry-rearing', unless the diet cost rises steeply. In the 'artificial-diet-rearing' it is not necessary any longer to harvest leaves and to have special mulberry fields for younger silkworms. The cost for purchasing artificial diets amounts to more than a half of the total rearing cost, while the personal expenses are largely saved. Both seem to be offset each other. Furthermore, a certain amount of money for the investment in building or re-building rearing house and in installing various equipments is necessary. However, several advantages are expected, that is, the rearing itself is not directly controlled by the bad conditions, such as the frost damage to mulberry trees, a good care could be made for larvae under the clean-rearing conditions, the rearing could be done at any time when needed, and so forth.

4.4 Future improvements

At present, it is most important to settle down this new technique as a truly renovating method, and for this, both scientific research and administrative actions are necessary. Although the rearing results are reported to be generally good, further improvement in the diet is necessary. The control of larval growth by applying photoperiodism seems to be one of the prospects to be established. Furthermore, the breeding of new silkworm races specifically suitable for the 'artificial-diet-rearing' would bring more stable and fruitful results in the future. The study on the establishment of the rearing system through the whole instar with artificial diets is now in progress.

mique est encore insuffisante, en dépit des progrès rapides, tant scientifiques que technologiques. Toutefois, il semble que l'élevage sur aliment artificiel dans les coopératives peut être comparable à l'élevage sur mûrier, à condition que le coût de l'aliment n'augmente pas. Avec l'élevage sur aliment artificiel, il n'est pas nécessaire de récolter les feuilles de mûrier et de disposer de mûraies spécialisées pour les jeunes vers. Le coût de l'aliment représente plus de la moitié des charges d'élevage, alors que des économies substantielles sur le poste personnel sont réalisées. Les deux s'équilibrent. De plus, des investissements doivent être faits pour la construction ou l'aménagement des bâtiments, et la mise en place des équipements. Mais les avantages sont nombreux : l'élevage ne dépend plus des conditions atmosphériques, telles les gelées sur les mûriers, les vers sont maintenus en bon état sanitaire grâce au "clean-rearing system", l'élevage peut être réalisé à n'importe quel moment selon les besoins, etc...

4.4 Amélioration dans l'avenir.

A présent, il importe de faire de cette technique, une technique réellement novatrice et pour cela, la participation de l'administration et des scientifiques est nécessaire. Bien que les résultats soient généralement bons, il convient d'améliorer encore l'aliment. Le contrôle du développement des vers par le jeu de la photopériode est un des points qui restent à définir. De plus, la création de nouvelles races adaptées à l'élevage sur aliment artificiel devrait apporter des résultats fructueux dans l'avenir. Les études visant à la mise au point de l'élevage complet sur aliment artificiel progressent.

SILK. II. SERICIN CHEMICAL STRUCTURE.

SOIE. II. STRUCTURE CHIMIQUE DE LA SERICINE.

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Abstract. - In cocoon and raw silk, the fibroin core of the silk thread is surrounded by layers of sericin synthesized in the middle silk gland of the silkworm *Bombyx mori*. It is well known, that sericin is mainly removed by alkalines during the degumming process. Sericin is heterogenous contrary to fibroin and made up by several components, which differ in their physico-chemical properties, amino acid composition and solubility in hot water. Their dissolution behaviour reveals a stratified structure assumed to be generated by four distinct sites in the middle silk gland. The functional value of the thin film of sericin IV is emphasized as lubricant or shock absorbent during in vivo silk fiber formation. Amino acid compositions of sericins I, II and III, rich in serine and threonine (40-46 %) and acidic residues (21 %) and that of the more apolar sericin IV can be partly related to their dissolution patterns. Sericins are partly made of glycoproteins; they content 1% sugar.

Résumé. - Dans le cocon et la soie grège, l'âme fibroïque du fil de soie est enrobée par des couches de sérécine synthétisée dans la partie moyenne de la glande sérécigène du ver à soie *Bombyx mori*. On sait que la sérécine ou grès est en grande partie enlevée par traitement alcalin au cours du décreusage. Contrairement à la fibroïne, la sérécine est hétérogène, constituée de plusieurs composantes qui diffèrent par leurs propriétés physico-chimiques, leur composition amino-acide et leur solubilité dans l'eau chaude. Leurs profils de dissolution révèlent une structure stratifiée qui proviendrait de quatre sites distincts de la partie moyenne de la glande. On insiste sur la fonction du film mince constitué par la sérécine IV qui joue de rôle de lubrifiant ou d'absorbant de choc pendant la formation in vivo du fil de soie. Les compositions en acides aminés des sérécines I, II et III, riches en sérécine et thréonine (40-46 %) et résidus acides (21 %) et celle de la sérécine IV plus apolaire peuvent être en partie associées à leurs profils de dissolution. Les sérécines sont des glycoprotéines; elles renferment 1 % de sucre.

INTRODUCTION

Sericin, along with fibroin, is an important component of the cocoon filament to which it confers many of its properties. Many techniques used in filature and silk manufacture (from fresh cocoon to silk goods) are based on the characteristics of sericin and make efficient use of its occurrence. However, because sericin is often eliminated in the final processing stages of silk manufacture and because its properties and its behaviour are easily changed by heat water - thus making sericin very difficult to handle - sericin has not been investigated as actively as fibroin has been in the past. Many data on the amino acid composition, on the constitutive proteins, on the molecular weight and conformation, on higher order structure and transition as well as its thermal properties have been accumulated by recent studies. These results, which hopefully will contribute to sericultural technology, are briefly summarized in the present contribution divided into two parts : chemical structure, and molecular conformation and crystal structure.

1. THE CONSTITUENT PROTEINS OF SERICIN

It has long been a controversy about the protein components of sericin, i.e. whether it consists of one or more proteins. At present, the most popular opinion is that sericin is heterogeneous.

According to the histochemical studies of OBA (1957) and SHIBUKAWA (1959), the secreted proteins of the anterior, middle and posterior sections of the middle silk gland (divided by the curved structure) are different. Different kinds of sericin, secreted from each section, would therefore cover the liquid fibroin with three layers in the gland lumen. This finding was supported by the sedimentation analysis of TASHIRO and OTSUKI (1970). Later on, GAMO *et al.* (1977) showed by using gel electrophoresis that five species of sericin (s-1 to s-5) with different molecular weights are secreted from different sections of the

INTRODUCTION

La séricine ainsi que la fibroïne est une composante essentielle du filament du cocon auquel elle confère la plupart de ses propriétés. De nombreuses techniques utilisées dans les industries de la soierie (du cocon frais aux articles en soie) sont fondées sur les caractéristiques de la séricine. Néanmoins, comme la séricine est souvent éliminée dans les opérations finales de traitement de la soie et que ses propriétés et comportement changent aisément dans l'eau chaude - ce qui rend la séricine très difficile à manipuler - son étude a été beaucoup moins active que celle de la fibroïne. Des études récentes ont fourni de nombreuses données concernant la composition amino-acide, les protéines constitutives, le poids moléculaire et la conformation, les structures d'ordre supérieur et leur transition ainsi que ses propriétés thermiques. Ces résultats prometteurs pour la technologie séricicole sont brièvement résumés dans le présent mémoire divisé en deux parties : structure chimique et conformation moléculaire et cristalline.

1. LES PROTEINES CONSTITUTIVES DE LA SERICINE.

On a longtemps discuté des composants protéiques de la séricine pour savoir si elle est constituée d'une ou de plusieurs protéines. Aujourd'hui, l'opinion la plus répandue est que la séricine est hétérogène.

Sur la base des études histochimiques de OBA (1957) et de SHIBUKAWA (1959), les protéines sécrétées par les sections antérieure, moyenne et postérieure du réservoir (partie moyenne de la glande séricigène) sont différentes. Ces différentes espèces de séricine sécrétées par chacune des sections enrobent par conséquent de trois couches la fibroïne liquide dans la lumière de la glande. Cette observation a été confirmée par une analyse de sédimentation de TASHIRO et OTSUKI (1970). Plus tard, GAMO *et al.*, (1977) ont montré par électrophorèse sur gel que les différentes sections de la glande moyenne sécrètent cinq espèces

middle silk gland; they have been compared with previous histochemical findings (Table 1). In a study on genetic variation, GAMO (1973) compared the constituent proteins of the liquid sericin of mutant and normal silkworms. In the *Nd-s* silkworm, there is a large amount of highly mobile component, which is absent in normal strains. These studies suggest that the liquid sericin in the middle silk gland is heterogenous.

de sérécine (s-1 à s-5) différant par leur poids moléculaire; elles ont été comparées à celles mise en évidence par histochimie (Tableau 1). Dans une étude de variation génétique, GAMO (1973) a comparé les protéines constitutives de la sérécine liquide de vers à soie mutants et normaux. Dans la souche *Nd-s*, on trouve une abondante composante très mobile qui est absente des souches sauvages. Ces études suggèrent que la sérécine liquide de la glande moyenne est bien hétérogène.

Table 1. Polypeptides of sericin secreted from the different section of silk gland, and their relations with the components given by histological observation (Gamo, *et al.* 1977).

Tableau 1. Polypeptides de la sérécine sécrétée par les différentes sections de la glande sérécigène et leurs relations avec les composants révélés histologiquement.

Gland section for secretion	Polypeptides obtained from this work	Components given by histological observation*
Middle gland		
Posterior	s-4	S ₁ -sericin
Middle	s-1	S ₂ -sericin
Middle to anterior	s-3	S ₃ -sericin
Anterior	s-2, s-5	

*YAMANOUCHI (1922) and OBA (1957)

Fractionation of sericin has often been based on differences of solubility of its components in hot water (see details in chapter 3). Typical methods used for these studies are salting out (KANEKO, 1931) and isoelectric precipitation (MOSHER, 1932). The latter one has often been used, but the results appear to be conflicting. For some authors, the amino acid composition of the two sericins are different (OKAMOTO, 1952; SASAKI and MIYAUCHI, 1950; WATANABE, 1960), while for others there is no significant difference (SHELTON and JOHNSON, 1925; BRYANT, 1952). In addition, sericin can be fractionated into more than two components by changing methods. For these

Le fractionnement de la sérécine est souvent basé sur les différences de solubilité de ses composantes dans l'eau chaude (voir les détails dans le chapitre 3). Les méthodes les plus typiques pour ce genre d'étude comprennent le relargage (KANEKO, 1931) et la précipitation isoelectrique (MOSHER, 1932). Celle-ci a souvent été utilisée, mais les résultats divergent. Pour certains auteurs, les compositions amino-acides des deux protéines sont différentes (OKAMOTO, 1952; SASAKI et MIYAUCHI, 1950; WATANABE, 1960) tandis que d'autres ne voient pas de différence significative (SHELTON et JOHNSON, 1925; BRYANT, 1952). En somme, la sérécine peut être fractionnée en plusieurs

reasons, the significance of the fractionation methods based on salting out and isoelectric precipitation needs to be reexamined. KOMATSU (1975) reported that the above methods are useful for a fractionation based on molecular weights; indeed, the easily and hardly soluble sericins fractionated by KANEKO's method and MOSHER's one do not always show the same amino acid composition. Further, when the characteristics of the two sericins are compared (see Table 2), clear differences in molecular weight rather than in chemical structure are often observed. He suggested that the easily and the hardly soluble fractions have low and high weight respectively. TSUKADA's investigations (1979) led to a similar conclusion: the characteristics of the two components of sericin fractionated by MOSHER's method reflect differences in molecular weight rather than of molecular conformation or crystal structure.

composantes à condition de changer de méthode. C'est pourquoi la signification des méthodes évoquées doit être revue. KOMATSU (1975) a montré que ces méthodes font appel à un fractionnement basé sur les poids moléculaires; aussi, les sérícines facilement et difficilement solubles préparées selon les méthodes de KANEKO et MOSHER n'ont pas toujours la même composition en acides aminés. En outre, la comparaison des propriétés de ces deux sérícines (cf Tableau 2) fait ressortir les différences de poids moléculaire plutôt que celles de structure chimique. Il a donc suggéré que les fractions à solubilité rapide et lente ont des poids moléculaires respectivement faibles et élevés. Les études de TSUKADA (1979) confortent ces conclusions: les caractéristiques des deux composantes de la sérícine fractionnées par la méthode de MOSHER diffèrent par le poids moléculaire ou leur structure cristalline.

Table 2. Comparison of various properties of Mosher's sericin A and B
Tableau 2. Comparaison des diverses propriétés de la sérícine A et B de Mosher

Properties	Sericin A	Sericin B
Solubility (Mosher, 1932)	Easy	Difficult
Thermal decomposition temperature (Tsukada, 1979)	258°C	270°C
Relative viscosity (Tsukada, 1979)	1.26	1.34
Protective action for silver iodide sol (Watanabe, 1968)	A > B	
Coagulation with precipitant (Kaneko, 1932 a)	A < B	
Solubility after melting frozen sericin (Kaneko, 1932 c; Otsu, Hattori, 1951)	Soluble	Insoluble
Swelling ability with water (Kaneko, 1932 b)	A > B	
Fractionation of sericin A and B from native liquid sericin (Komatsu, 1975), by means of isoelectric point	Can't fractionate	
salting out with sodium sulphate	Can't fractionate	
Optical rotatory dispersion (Iizuka, 1969)	Similar pattern	
Isoelectric point (Kaneko, 1933 b)	4.1	4.3
Buffer action (Kaneko, 1932 a)	Similar behaviour	
Optimum pH in enzymic decomposition for sericinase (Nishizawa Ogawara, 1953)	7.2	7.8
for protease (Nishizawa Ogawara, 1952)	8.0	8.0
X ray diffraction pattern (Tsukada, 1979)	Similar pattern	
Infrared absorption spectrum (97)	Similar pattern	

2. THE MOLECULAR WEIGHT OF SERICIN

The reported molecular weight of sericin obtained from different sources varies from 1.6×10^4 to 3.09×10^5 (see Table 3).

2. LE POIDS MOLECULAIRE DE LA SERICINE.

Les poids moléculaires signalés pour la sérécine provenant de différentes sources varient de 1.6×10^4 à 3.09×10^5 (cf Tableau 3).

Table 3. Molecular weight of Sericin
Tableau 3. Poids moléculaire de la Sérécine

Author	Origin	Analytical method*	Molecular weight
Hayashi (1956)	Easily soluble fraction separated from cocoon shell	SA	$3.5 \sim 4.0 \times 10^4$
	Difficulty soluble fraction separated from cocoon shell	SA	$1.1 \sim 1.5 \times 10^5$
Passent (1967)	Sericin extracted with deoxycarbonate from cocoon shell	GF	$1.61 \sim 1.82 \times 10^4$
	Sericin extracted with deoxycarbonate from cocoon shell	GF	$1.68 \sim 1.76 \times 10^4$
	Sericin extracted with deoxycarbonate from cocoon shell	DA	$1.64 \sim 1.78 \times 10^4$
	Sericin extracted with deoxycarbonate from cocoon shell	SA	1.846×10^4
	Sericin extracted with deoxycarbonate from cocoon shell	SA	1.846×10^4
Tokutake et al., (1972)	Cocoon shell protein regenerated with cuppro ethylendiamine	GE	2.4×10^4
Komatsu (1975)	Sericin I and II of cocoon shell	GE	$1.0 \sim 1.2 \times 10^5$
	Sericin I and II of cocoon shell (added 2% SDS)	GE	$3.5 \sim 4.0 \times 10^4$
Sprague (1975)	Sericin extracted from anterior division of middle silk gland	GE	$2.0 \times 10^4 \sim 2.2 \times 10^5$
Gamo et al., (1977)	s-4 separated from posterior division of middle silk gland	GE	8.1×10^4
	s-1 separated from posterior division of middle silk gland	GE	3.09×10^5
	s-3 separated from posterior division of middle silk gland	GE	1.45×10^5
	s-2 separated from anterior section of middle silk gland	GE	1.77×10^5
	s-5 separated from anterior section of middle silk gland	GE	1.34×10^5

* SA : Sedimentation analysis

DA : Density gradient analysis

GE : Acrylamide gel electrophoresis

GF : Sephadex gel filtration

No immediate conclusions can be drawn from these values, but the reported values can roughly be divided into two groups : those in the 10^4 and those in the 10^5 range. The sericin with a molecular weight around 10^5 can be postulated to be composed of several particles or subunits in the 10^4 range, if the conditions of sericin preparation and the following facts are taken into account : firstly, light scattering, sedimentation constant and diffusion constant measurements suggest that one molecule of the hardly soluble sericin consists of three molecules of easily soluble sericin associated in the line of apsides of the rotating ellipse (HAYASHI, 1957). Secondly, the viscosity of the solution decreases rapidly by a brief exposure to ultrasonic waves (ENOMOTO and HARA, 1952) and finally, the molecular weight of sericin is decreased by brief boiling or by addition of sodium dodecylsulfate detergent (KOMATSU, 1975).

De tels résultats n'autorisent pas de conclusions rapides. Toutefois ces valeurs peuvent être grossièrement réparties en deux groupes : autour de 10^4 et de 10^5 . La sérécine ayant un poids moléculaire voisin de 10^5 est probablement composée de plusieurs particules ou sous-unités de 10^4 , si l'on prend en considération le mode de préparation de la sérécine et les résultats suivants : tout d'abord, les mesures de diffusion de la lumière, de constante de sédimentation et de diffusion suggèrent qu'une molécule de sérécine difficilement soluble est constituée par l'association de trois molécules de sérécine facilement soluble autour de l'axe de rotation d'une ellipse (HAYASHI, 1957). Ensuite, la viscosité de la solution décroît rapidement après une brève sonication (ENOMOTO et HARA, 1952). Enfin, le poids moléculaire de la sérécine diminue après une rapide ébullition ou addition d'un détergent comme le dodécylsulfate de sodium (KOMATSU, 1975).

3. THE DISSOLUTION BEHAVIOUR AND STRATIFIED STRUCTURE

Many workers have distinguished several components in sericin on the basis of their solubility behaviour in hot water (INOUE *et al.*, 1924).

The sericin of cocoon filaments dissolves in hot water in three stages. Accordingly, SHIMIZU (1941) named the three fractions occurring in a ratio of 2:2:1 sericin I, II and III, in the order of dissolution. He stated that sericin I, II and III form in this order a layered structure around the fibroin core in the cocoon filament. He also elucidated the relationship between these fractions and their crystal structure. NAKAMURA and TAKEUCHI (1962) studied the kinetic dissolution process of sericin in the cocoon filament. They pointed out that among the two fractions dissolved within three hours, one is easily dissolved and the other is hardly dissolved. KOMATSU (1975), using UV absorption for a quantitative analysis

3. LE PROFIL DE DISSOLUTION ET STRUCTURE STRATIFIEE.

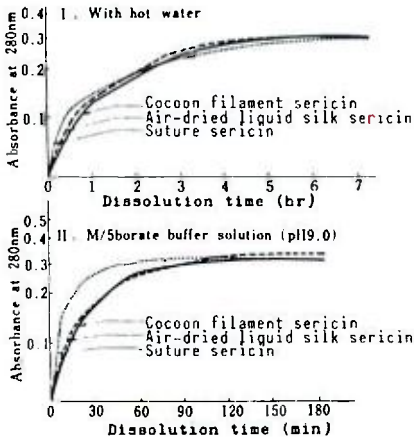
De nombreux expérimentateurs ont distingué plusieurs composantes dans la sérécine sur la base de leur solubilité dans l'eau chaude (INOUE *et al.*, 1924). La dissolution de la sérécine du cocon dans l'eau chaude s'effectue selon trois paliers, correspondant à trois fractions dans les rapports 2:2:1 nommées sérécine I, II et III par SHIMIZU (1941) dans l'ordre de leur dissolution. Il affirma que les sérécines I, II et III forment dans cet ordre une structure en couches entourant la fibroïne centrale du fil de soie dans le cocon. Il a aussi expliqué la relation entre ces fractions et leur structure cristalline. NAKAMURA et TAKEUCHI (1962) ont étudié la cinétique de dissolution de la sérécine du cocon. Ils signalèrent que parmi les deux fractions dissoutes au bout de trois heures, l'une est aisément dissoute et l'autre difficilement. KOMATSU (1975) s'appuyant sur un dosage par

of sericin (KOMATSU *et al.*, 1968), obtained the dissolution curve for sericin in three different states : in the cocoon filament, after stripping from silk suture and from the liquid silk of the middle silk gland after air-drying (so-called air-dried silk protein). The degradation curves for sericin in the presence of proteolytic enzymes were also determined (see Fig. 1). This analysis shows that

absorption ultra-violette de la sérécine (KOMATSU *et al.*, 1968) obtint une courbe de dissolution pour trois états différents : dans le filament du cocon, dans un fil de suture obtenu par étirement et à partir de soie liquide de la glande moyenne séchée à l'air. Les courbes de dégradation de la sérécine en présence d'enzymes protéolytiques ont été aussi déterminées (cf Fig. 1). Cette analyse montre que la sérécine

Fig.1. Dissolution or degradation curves of sericin (Komatsu, 1975)

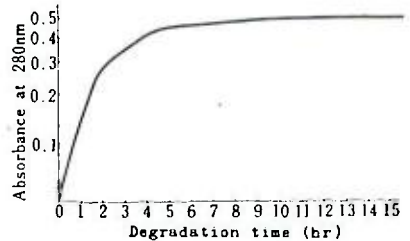
Fig.1. Courbes de dégradation ou de dissolution de la sérécine (Komatsu, 1975)



A. Dissolution curves of various sericin.

A. Courbes de dissolutions de diverses sérécines.

sericin is made up of four fractions with different dissolution speeds. These sericin fractions were named sericin I, II, III and IV in their order of solubility. The dissolution coefficients and weights ratios (Table 4) as well as their relation to the higher order structure were determined. In fact, the number of fractions differs from those of SHIMIZU (1941) and NAKAMURA and TAKEUCHI (1962) because the times of dissolution are different. Presently, no essential



B. Degradation curve of air-dried liquid sericin with proteolytic enzyme solution (Pronase P, 750 tyrosine-unit/ml).

B. Courbe de dégradation de la sérécine liquide séchée à l'air par une solution d'enzyme protéolytique (Pronase P, 750 unité-tyrosine/ml).

est constituée de quatre fractions douées de vitesse différente de dissolution. Elles sont appelées sérécine I, II, III et IV par ordre de solubilité décroissante. Leurs coefficients de dissolution et leurs rapports pondéraux (Tableau 4) ont été déterminés ainsi que leur relation à des ordres de structure supérieurs. En fait, le nombre de fractions diffère de celui de SHIMIZU (1941) et de NAKAMURA et TAKEUCHI (1962) étant données les durées différentes de dissolution.

Table 4. Ratios (%) and dissolution or degradation velocity coefficients of four fractions of sericin ($\times 10^{-4} \text{ g.l}^{-1} \cdot \text{min}^{-1}$) (Komatsu, 1975)

Tableau 4. Rapports et coefficients de vitesse de dissolution ou de dégradation des 4 fractions de sérécine.

Material	Dissolving solution	Fraction of sericin				Dissolution or degradation velocity coefficients			
		I	II	III	IV	k_I	k_{II}	k_{III}	k_{IV}
Cocoon filament	Hot water	41.2	38.1	17.9	2.8	5.33	1.76	0.70	0.22
Cocoon filament	M/5 borate buffer solution (pH9)	42.3	37.2	17.8	2.7	4.76	1.65	0.59	0.21
Silk suture	Hot water	39.9	39.7	17.1	3.3	2.36	1.36	0.45	0.11
Silk suture	M/5 borate buffer solution (pH9)	40.0	40.1	16.4	3.5	17.12	7.20	1.43	0.16
Sericin stripped from air-dried silkgland silk	Hot water	41.2	37.8	17.9	3.1	13.19	4.67	1.06	0.40
Sericin stripped from air-dried silkgland silk	M/5 borate buffer solution (pH9)	40.7	38.1	19.6	3.6	12.45	5.21	1.50	0.24
Sericin stripped from air-dried silkgland silk	Proteolytic enzyme solution a)	41.5	39.2	16.6	3.7	2.34	0.14	0.08	0.03
	Mean	41.0	38.6	17.6	3.1				

a) Pronase P (Kaken kagaku Co.) was applied in 750 tyrosin-unit/ml of the solution as proteolytic enzyme.

discrepancy exists in the results obtained by the three workers, when judged from the ratio of the fractions based on their weights. Furthermore, since the fractions are obtained in similar ratios for the sericins from the cocoon filament, the silk suture and the air-dried silk protein, it may be assumed that these fractions are not artefacts generated by physical procedures such as spinning or artificial stretching, but that they rather exist as original fractions in the gland lumen.

Reasons in favour of a stratified structure in four layers are as follows: if the four fractions were a homogenous mixture, they would be continuously dissolved, and the dissolution pattern would agree with the average coefficients of dissolution. However, all the dissolution curves have

Actuellement, il n'y a pas de désaccord profond entre les trois auteurs si l'on se fonde sur les rapports molaires des fractions. En outre, comme ces rapports sont similaires pour les fractions de sérécine de provenance diverse (cocon, fil de suture et soie séchée à l'air), nous pensons que ces fractions ne sont pas des artefacts produits par les procédés physiques tels que le filage ou l'étirement artificiel, mais qu'elles existent bien dans la lumière de la glande.

Les raisons qui plaident en faveur d'une structure stratifiée en quatre couches sont les suivantes: si les quatre fractions étaient un mélange homogène, elles se dissolveraient de manière continue de telle sorte que leur profil de dissolution s'accorde avec le coefficient moyen de dissolu-

four bends and the dissolution coefficient for each fraction is different. From a histochemical point of view, the secretion function of sericin in the middle silk gland must differ according to its location; indeed various sections were found to secrete different species of sericin (OBA, 1957; SHIBUKAWA, 1959). Sericin IV is assumed to be secreted in the posterior section of the middle silk gland - close to the posterior part of the gland - whereas sericins III, II and I are secreted in that order in the middle and anterior sections of the middle gland. Thus each sericin species forms a layer surrounding the fibroin core to make a stratified structure. However, since the bend of the dissolution curve is mild, the borderlines of the sericin fractions are not very distinct, allowing minor contamination of adjacent fractions. Several layers of sericin have been reported to be present in the radial plane from optical microscopic observations of the swelling caused by alkalines and subsequent dissolution process or air-dried silk protein (KOMATSU, 1975) and from observations of dichroism of the cross section of a cocoon filament stained with metal (OHARA, 1933).

4. SERICIN IV AND ITS FUNCTIONAL VALUE

Sericin IV has been reported to have functional importance by KOMATSU (1975). A major property of this sericin species is that it is the one most difficult to dissolve in alkali out of the four fractions. It is found adjacent to fibroin in liquid silk and cocoon filament. It is mainly composed of the thin film (Fig. 2) left in a sack-like shape when the liquid silk in middle silk gland is allowed to stand in ethylene-diamine solution at pH 11. This thin film is made of 20-30% cocoon wax (KOMATSU, 1969) and of a protein, which shows an X-ray diffraction pattern specific to sericin. This protein species contains a relatively large amount of basic and non-polar

tion. Or, toutes les courbes de solubilité ont quatre inflexions et les coefficients diffèrent d'une fraction à l'autre. D'un point de vue histochimique, la sécrétion de sérécine dans la glande moyenne doit varier d'un bout à l'autre du tissu; en effet, différentes sections sécrètent différentes espèces de sérécine (OBA, 1957; SHIBUKAWA, 1959). On suppose que la sérécine IV est sécrétée dans la section postérieure de la glande moyenne - contiguë à la glande postérieure qui sécrète la fibroïne - tandis que les sérécines III, II et I sont sécrétées dans cet ordre dans les sections moyenne et antérieure de la glande moyenne. Ainsi chaque espèce de sérécine forme une couche qui enrobe l'âme de la fibroïne pour constituer une structure stratifiée. Néanmoins, comme l'inflexion de la courbe de solubilité est douce, les frontières des fractions de sérécine ne sont pas nettes, chaque fraction étant légèrement contaminée par la fraction adjacente. On a signalé que plusieurs couches de sérécine occupent le plan radial sur le vu d'observations au microscope de fibres gonflées par traitement alcalin, puis dissoutes, ou provenant de séchage à l'air (KOMATSU, 1975) ainsi que d'analyses par dichroïsme de coupes d'un filament de cocon coloré par des métaux (OHARA, 1933).

4. SERICINE IV ET FONCTION.

KOMATSU (1975) a signalé l'importance fonctionnelle de la sérécine IV. Une propriété majeure de cette espèce de sérécine est qu'elle est, des quatre fractions, la plus difficile à dissoudre dans les alcalins. On la trouve adjacente à la fibroïne dans la soie liquide et le filament du cocon. Elle est généralement composée d'un film mince (Fig. 2) déposé sous la forme d'un sac lorsque la glande moyenne baigne dans une solution d'éthylène diamine à pH 11. Ce film mince est constitué de 20-30% de cire (KOMATSU, 1969) et d'une protéine qui a un profil de diffraction aux rayons X spécifique de la sérécine. Cette espèce de sérécine contient une proportion élevée d'acides



Fig.2. White thin film obtained from liquid silk in silk gland of matured silkworm larva (The film is insoluble with 0.5% solution of ethylenediamine (Kowatsu, 1975)).

Fig.2. Fin film blanc obtenu à partir de fibroïne liquide provenant de la glande séricigène de vers mûrs (Le film est insoluble dans une solution d'éthylènediamine à 0,5% (Kowatsu, 1975)).

amino acids (SHIMIZU *et al.*, 1957). Such an amino acid composition is similar to that of sericin IV (Table 5). Therefore, sericin IV is thought to be the main constituent or the thin film from the posterior section of middle silk gland and accumulates on the liquid fibroin that flows in from the posterior silk gland part, and moves to the anterior part of the gland lumen to form a thin layer.

This thin film therefore acts as a physical sheet between the liquid sericin and the liquid fibroin in the middle silk gland lumen and possibly prevents the two silk proteins from mixing. It also prevents fiber formation by the liquid fibroin by friction when fibroin molecules touch the intima of the gland cell during its moving through the anterior silk gland. It is a lubricant or shock absorbent by which the cocoon filament is smoothly formed. Generally sericin is assumed to be removed completely by the degumming

aminés basiques et apolaires (SHIMIZU *et al.*, 1957). Une telle composition est analogue à celle de la sérécine IV (Tableau 5). C'est pourquoi, on pense que la sérécine IV est la composante principale du film mince de la section postérieure de la glande moyenne qui s'accumule sur la fibroïne liquide qui s'écoule de la glande postérieure et s'achemine vers la partie antérieure de la lumière de la glande et forme ainsi une couche mince d'enrobage.

C'est la raison pour laquelle ce film mince agit comme une pellicule physique entre la sérécine liquide et la fibroïne liquide au sein de la lumière de la glande moyenne et empêche probablement tout mélange des protéines soyeuses. Il empêche aussi la fibrillation de la fibroïne liquide par friction des molécules de fibroïne contre la paroi interne ou intima des cellules de la glande antérieure ou conducteur. Ce film joue le rôle d'un lubrifiant ou d'un absorbeur de choc qui permet la formation sans à coup de la bave.

Table 5. Amino acid composition of sericin fraction prepared by fractional dissolution with hot water from cocoon filament (Komatsu, 1975)

Tableau 5. Composition en amino-acides des fractions de sérécine obtenues à partir de la bave du cocon par dissolution fractionnée à l'eau chaude

Amino acid	Sericin fraction				Whole sericin b)
	Sericin I	Sericin II	Sericin III	Sericin IV	
Gly	13.21	12.81	15.69	11.89	13.49
Ala	4.68	6.69	6.68	9.30	5.97
Val	2.97	2.21	3.21	4.16	2.75
Leu	0.86	0.96	1.27	6.26	1.14
Ile	0.59	0.57	0.85	3.50	0.72
Pro	0.58	0.63	0.66	2.75	0.68
Phe	0.45	0.44	3.50	2.83	0.53
Try a)	0.19	0.20	0.25	0.23	0.21
Cys	0.17	0.15	0.12	0	0.15
Met	0.04	0.04	0.04	0.12	0.04
Ser	34.03	36.64	28.15	12.40	33.43
Thr	10.34	8.48	11.36	7.25	9.74
Tyr	2.53	2.43	3.15	2.45	2.61
Asp	16.94	16.95	16.13	12.64	16.71
Glu	4.73	3.64	4.09	11.32	4.42
Arg	3.20	2.65	3.68	3.93	3.10
His	1.25	1.22	1.49	1.87	1.30
Lys	3.28	3.29	2.64	7.11	3.30
Recovery of amino acids c)	104.69	101.00	98.7	96.6	100.27
Hydroxy of amino acids	46.90	47.54	42.66	22.10	45.78
Acidic amino acids	21.67	20.59	20.22	23.96	21.13
Basic amino acids	7.73	7.16	7.81	12.91	7.70
Amino acids having polar side chain (Ap)	76.30	75.29	70.69	58.97	74.61
Amino acids having nonpolar side chain (An)	23.74	24.70	29.27	41.03	25.68
Ratio (Ap/An)	3.21	3.05	2.42	1.44	2.91

a) Using p-dimethylaminobenzaldehyde and glyoxalic acid, the colorimetric determination (Spies, J.R., Chamber, D.C.; Anal. Chem. 20, 30 (1948) : ibid, 21, 1249 (1948)) was applied to the hydrolyzate obtained by alkaline hydrolysis.

b) The values were calculated as the weighted average attended on weight ratio, sericin I : II : III : IV = 41.0 : 38.6 : 17.6 : 3.1, in Table 5.

c) The values were shown as the total amino acids (g) determined from 100g of sample.

of silk, but a small amount of sericin left on the silk thread is assumed to give elastic properties to silk fabric and to improve its handling and texture. Therefore, mild techniques of degumming such as boiling in sacks and foam degumming are preferable and would prevent fibroin damage by degumming agents, thus making the silk goods wear resistant, since they leave part of sericin IV on the cocoon filament.

5. THE AMINO ACID COMPOSITION OF SERICIN AND ITS CHEMICAL REACTIVITY

The amino acid composition of sericin has for a large part been elucidated during the 1960's. Lets say however, that a century ago CRAMER in 1865 discovered a new amino acid by analyzing the raw silk composition, called *serine* (from *sera* = silk). KIRIMURA (1962) analyzed the amino acids of sericin by microbiological assays. He confirmed that sericin has a high content of hydroxy, acidic and basic amino acids and that the hydroxy-amino acids (serine and threonine) represent nearly 40% of sericin. Later, KOMATSU (1966, 1975) studied the relationship between the amino acid composition of the sericin fractions and their dissolution behaviours (see chapter 3). Since the content of polar amino acids tends to be higher, the greater the solubility of the sericin fraction, the amino acid composition might be an important factor responsible for the solubility of sericin. Except for sericin IV, however, the differences in the amino acid contents are directly related with their solubility. Even sericin IV which has low hydroxyamino acid content and a low ratio of polar residues has an amino acid composition characteristic of sericin. Therefore, we suggested that the differences in solubility of the four sericin fractions is largely governed by the higher order structure of each fraction.

En général, la séricine est supposée être complètement éliminée lors du décreusage de la soie grège, mais la faible quantité de séricine qui adhère au fil de soie contribue aux propriétés élastiques des tissus soyeux et en améliore la manipulation et la texture. C'est pourquoi les techniques douces de décreusage comme l'ébullition en sachets et le décreusage en bain de mousse sont préférables et préviendront toute altération de la fibroïne par les agents de décreusage, rendant ainsi les vêtements de soie résistants puisqu'une partie de la séricine IV accompagne le filament du cocon.

5. COMPOSITION AMINO-ACIDE DE LA SERICINE ET REACTIVITE CHIMIQUE.

La composition en acides aminés de la séricine a été, pour une grande part, élucidée dans les années 1960. Ajoutons toutefois qu'il y a environ un siècle, CRAMER en 1865, découvrait un nouvel acide aminé en analysant la composition de la soie grège, appelée *sérine* (*sera* = soie). KIRIMURA (1962) analysa la composition en acides aminés par voie microbiologique. Il confirma la teneur élevée de la séricine en acides aminés basiques et hydroxylés (sérine et thréonine); ces derniers représentent environ 40% des acides aminés totaux. KOMATSU (1966, 1975) étudia la relation entre la composition amino-acide des fractions de séricine et leur solubilité (cf chapitre 3). Lorsque la teneur en acides aminés polaires augmente, la solubilité de la fraction de séricine augmente aussi. La composition amino-acide pourrait être un facteur important responsable de la solubilité de la séricine. A l'exception de la séricine IV toutefois, les différences de composition amino-acide sont directement associées avec leur solubilité. Même la séricine IV qui a un faible contenu en acides aminés hydroxylés et un faible taux de résidus polaires a une composition amino-acide caractéristique d'une séricine. C'est pourquoi nous suggérons que les différences de solubilité des quatre fractions de séricine sont en grande partie gouvernées par la structure d'ordre supérieur de chaque fraction.

GAMO *et al.* (1977) reported as already mentioned (see chapter 1) that the amino acid contents of s-1 to s-4 fractions were similar to those described in the literature although the values for glutamic acid and threonine varied. The serine content of s-5 fraction secreted from the anterior section in small amount was found to be only half of the serine determined in the other fractions. They suggested that this fifth additional sericin fraction is secreted as separate polypeptide chain (Table 6).

GAMO *et al.*, (1977) ont signalé comme nous l'avons déjà indiqué (cf Chapitre 1) que la composition amino-acide des fractions s-1 à s-4 est analogue à celle décrite dans la littérature avec quelques variations pour l'acide glutamique et la thréonine. La teneur en sérine de la fraction s-5 sécrétée par la section antérieure en petite quantité est la moitié de celle des autres fractions. Ils suggèrent que la cinquième fraction additionnelle est sécrétée sous la forme d'une chaîne polypeptidique séparée (Tableau 6).

Table 6. Amino acid composition of polypeptides in sericin fractionated by gel electrophoresis at acid pH in 4M urea (Gamo, *et al.* 1977)

Tableau 6. Composition en amino-acides des polypeptides de la séricine fractionnée par électrophorèse sur gel à pH acide dans l'urée 4M

Amino acid	Our data (mole %)					Reference data
	s-1	s-2	s-3	s-4*	s-5*	Sericin**
Gly	18.0	12.5	14.2	11.4	17.5	13.9
Ala	6.2	5.9	6.2	4.2	7.2	4.6
Val	3.7	2.8	1.0	3.8	0.3	3.2
Leu	2.1	1.5	0.6	2.8	2.7	1.2
Ile	1.6	1.3	0.4	1.8	2.2	0.7
Ser	29.1	30.2	38.1	32.5	16.4	32.3
Thr	8.5	8.0	4.1	11.1	4.0	8.4
Asp	13.0	12.9	12.6	11.6	13.9	14.5
Glu	5.4	5.2	10.7	6.1	10.3	4.8
Lys	2.2	4.8	5.3	2.2	6.3	8.4
Arg	4.0	3.9	3.0	3.6	3.5	2.3
His	1.6	1.5	0.8	1.9	3.1	1.6
Tyr	3.3	6.8	2.1	2.8	9.0	2.6
Phe	1.5	0.7	0.4	3.4	1.2	0.4
Pro	Trace	Trace	Trace	Trace	Trace	0.4
Me	Trace	Trace	Trace	Trace	Trace	0.1
Cys (half)***	Trace	1.0	0.5	0.7	2.5	0.3

* 20 hours hydrolysis

** Average of three data by DHAVALIKAR (1962), KIRIMURA (1962), and LUCAS and RUDALL (1968)

*** S carboxyamidomethylated cysteine

There are few reports about the amino acid sequence of sericin, although the development of the studies on the sequence is a most important theme, that has to be proceeded, for the elucidation of the amino acid sequence which is a fundamental thing to understand fully the physical and chemical characters of sericin.

The technology of genetic engineering would yield in a near future the primary structure of sericin by analyzing the nucleotide sequence in the DNA of the sericin gene(s) or in the RNA of the sericin messenger-RNA(s).

Since carbohydrates have been reported to comprise nearly 1% of sericin (SHINOHARA and ASANO, 1965; ASANO and SHINOHARA, 1968) and N-D-glucoside seryltyrosine has also been isolated (INOUE and KUDO, 1942), it may be assumed that some of the carbohydrates are bound to polypeptide chains, and part of the sericin may have a glycoprotein-like structure.

New methods of sericin fixation are being studied in relation to chemical reactivity. KAKINOKI and ISHIZAKA (1972) reported that various percentages of the raw silk can be fixed by using different concentrations of dimethylol-ethylene urea in the presence of an acidic catalyzer. SHIOZAKI *et al.* (1973) described the fixation of sericin by using the chemical reaction of epoxy compounds in the presence of salts such as potassium thiocyanate and potassium iodide as catalyzers. SHIOZAKI and OZAKI (1975) reported that raw silk sericin is almost completely fixed by treatment with 0.5 to 1% glutaraldehyde for 15 hours at 20°C, which alters lysine residues. The fixed raw silk sericin is slightly more bulky and soft, but retains the same tensile strength, elongation properties and hygroscopicity as raw silk sericin does.

Il y a peu de travaux sur la séquence de la sérécine bien que son élucidation soit fondamentale pour comprendre complètement les propriétés physiques et chimiques de la sérécine.

La technologie du génie génétique contribuera dans un proche futur à l'établissement de la structure primaire des sérécines en procédant à l'analyse de la séquence des nucléotides du DNA des gènes de sérécine ou de celle des RNA messagers des sérécines.

Depuis que des sucres ont été trouvés à raison d'environ 1% dans la sérécine (SHINOHARA et ASANO, 1965; ASANO et SHINOHARA, 1968) et la N-D-glucoside seryltyrosine également isolée (INOUE et KUDO, 1942), on peut supposer que certains sucres sont liés aux chaînes polypeptidiques et qu'une partie de la sérécine a une structure apparentée aux glycoprotéines.

On a étudié de nouvelles méthodes de fixation de la sérécine en relation avec sa réactivité chimique. KAKINOKI et ISHIZAWA (1972) ont montré que diverses quantités de soie grège peuvent être fixées en utilisant des concentrations variables de diméthylol-éthylène urée en présence d'un catalyseur acide. SHIOZAKI *et al.*, (1973) ont décrit la fixation de la sérécine en faisant appel à la réaction chimique des composés époxy en présence de sels comme le thiocyanate et l'iodure de potassium comme catalyseurs. SHIOZAKI et OZAKI (1975) ont signalé que la sérécine de la soie grège est presque totalement fixée par un traitement avec 0.5 à 1% de glutaraldéhyde pendant 15 heures à 20°C qui altère les résidus lysine. La sérécine de la soie grège fixée est un peu plus gonflante et souple, mais conserve la résistance à la traction, les propriétés d'allongement et l'hygroscopicité de la sérécine de la soie grège.

CONCLUSION

In the present paper, the characteristics of sericin such as the constituent proteins, molecular weight and amino acid composition have been revealed mainly from a chemical aspect. However, little information on the amino acid sequence has been given and it was difficult to form a chemical image of sericin. Elucidation of the amino acid sequence both chemically and biologically is awaited since it is the utmost fundamental theme in the research of the protein sericin.

Chemically, the largest characteristic of sericin is that amino acids with highly reactive side chains comprise up to 2/3 of all the amino acids. This suggests the possibility of adding new properties to silk by various chemical modification of sericin.

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CONCLUSION.

Dans cette communication, les propriétés de la séricine telles ses protéines constitutives, son poids moléculaire et sa composition amino-acide ont été traitées d'un point de vue chimique. Néanmoins, l'information sur la séquence est pauvre et il est encore difficile d'avoir une image chimique correcte de la séricine. Pour des raisons chimiques et biologiques, l'établissement de la séquence amino-acide est attendue et devrait constituer un sujet de recherche essentiel.

Chimiquement, la caractéristique majeure de la séricine réside dans le fait que 2/3 de ses acides aminés sont constitués par des résidus à chaînons latéraux actifs. Ceci suggère la possibilité d'ajouter de nouvelles propriétés à la soie en modifiant la séricine par diverses voies chimiques.

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EFFECT OF APPLICATION OF JUVENILE HORMONE ANALOGUES ON THE SILK PRODUCTION IN THE SILKWORM, *Bombyx mori*.

EFFET DE L'APPLICATION D'ANALOGUES D'HORMONE JUVENILE SUR LA PRODUCTION DE LA SOIE CHEZ LE VER A SOIE, *Bombyx mori*.

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In 1971, Akai and Kobayashi found that the feeding period was prolonged in the 5th-instar silkworm larvae injected with juvenile hormone and that they made larger cocoons than the untreated larvae. When larvae were treated with a large dose of hormone, some of them became so-called permanent larvae or molted to the VIth instar. Recently, many analogues with juvenile hormone activity have been synthesized, and the hormone activity in relation to the chemical structures on the silkworm has also been examined (6, 16, 23, 25, 26).

Effects of the dose of juvenile hormone analogues (JHA) and of application time on the weight of the cocoon layer were studied in different rearing seasons. Attention was also focused on the effect of JHA administration on the nucleic acid synthesis in the posterior silk glands of the silkworm. Furthermore, the nucleic acid synthesis was investigated in various tissues of the permanent larvae induced by JHA application (3).

More recently, the practical application of the JHA in sericulture has been tested. At present the analogue

En 1971, Akai et Kobayashi ont montré que la période d'alimentation était allongée chez des vers à soie du Vme âge ayant reçu une injection d'hormone juvénile, et que ces derniers produisaient des cocons plus gros que les vers non traités. Quand les vers reçoivent une dose importante d'hormone, certains deviennent des larves permanentes ou effectuent une 5me mue. Récemment, de nombreux analogues présentant une activité de type hormone juvénile ont été synthétisés, et leur activité sur le ver à soie a été étudiée en relation avec leur structure chimique (6, 16, 23, 25, 26).

L'effet de la dose d'analogues d'hormone juvénile (AHJ) et des moments d'application sur le poids de la coque soyeuse a été étudié lors des différentes saisons d'élevage. L'effet de l'application d'hormone juvénile sur la synthèse des acides nucléiques dans la partie postérieure des glandes séricigènes du ver à soie a été l'objet de recherches approfondies. De plus, la synthèse des acides nucléiques a été étudiée dans les divers tissus des larves permanentes produites par l'application des AHJ.

Tout récemment, l'utilisation dans la pratique séricicole des AHJ a fait l'objet d'essais. A présent, les analo-

is available commercially, and is being used by farmers to yield a larger quantity of cocoons. Many reports on the increase in silk production by means of JHA application are already available.

1. Effect of JHA application on duration of feeding period and growth of larvae.

Administration of JHA to the Vth instar larvae prolonged their feeding period of the instar. The rate of prolongation, depended on the amount of the JHA administered (1, 3, 5, 20, 32) (Table 1). Maximum prolongation was found in larvae applied in the mid-Vth instar (3, 7, 11, 20). The larvae kept on feeding one day more than the untreated ones. In other words, JHA did not accelerate the growth rate, but merely prolonged the feeding period.

gues sont disponibles sur le marché et sont utilisés par les agriculteurs pour obtenir des quantités plus importantes de cocons. De nombreuses publications concernant l'accroissement de production de soie par application des AHJ existent à l'heure actuelle.

1. Effet de l'application d'AHJ sur la durée de la période d'alimentation et sur la croissance des larves.

L'administration des AHJ à des vers du Vme stade allonge la période d'alimentation de ce stade. Le degré d'allongement dépend de la quantité d'AHJ administrée (1, 3, 5, 20, 32) (Tableau 1). L'allongement est maximal chez les chenilles traitées au milieu du Vme stade (3, 7, 11, 20). Les chenilles continuent à s'alimenter pendant une journée de plus que les témoins. En d'autres termes, les AHJ n'accélèrent pas le taux de croissance mais ont pour principal effet d'allonger la période d'alimentation.

Table 1. Effect of JH on larval-pupal development of *Bombyx* larvae during the Vth instar.

Tableau 1. Effet de l'AHJ au cours du Vme stade sur le développement larvo-nymphal du *Bombyx*.

Time JH-administered (1) Moment de l'administration d'AHJ (1)	Administered dose (µg per g body weight) Dose administrée (µg par g de ver)					
	0.001	0.01	0.1	1	10	100
0	N	N	N	P(1.0)	P(1.3)	DL
24	N	N	N	P(1.7)	P(4.5)	DL
48	N	N	P(1.0)	P(2.6)	P(7.4)	DL
72	N	N	P(1.0)	P(3.9)	DL	DL
96	P(0.7)	P(0.8)	P(1.8)	P(3.3)	LM	LM
120	P(0.6)	P(1.0)	P(1.0)	P(1.3)	P(1.3)	LM
144	N	N	N	N	N	N

(Akai et al., (1973)

(1) Hours from the beginning of the Vth instar.

(1) En heures à partir du début du Vme stade.

N : normal pupation

N : nymphose normale

P() : prolongation of the fifth instar period (in days)

P() : allongement de la durée du Vme stade (en jours)

DL : dauer larva

DL : larves permanentes

LM : extra larval molt

LM : mue surnuméraire

2. Effect of JHA application on growth of silk glands.

Even when a proper dose of JHA was administered in the early Vth instar, the growth rate of silk glands was slightly lowered, and more or less influenced according to the dose applied. However, the normal growth was soon resumed, and finally the growth rate exceeded the control. In spite of the lowered growth of the silk glands, no effect was observed on the weight increase of the larvae (20, 29, 32). It was also reported that weight increase of silk glands in the larvae allatectomized in the early IVth instar was larger than that of the control IVth instar larvae (4, 8).

3. Effect of JHA application on DNA synthesis in silk glands.

The amount of silk protein produced by larvae was found to be dependent on the RNA content in the posterior silk glands, and the RNA content was controlled by DNA content in the posterior silk glands under normal condition (19, 28).

In the normal larvae DNA accumulated in the posterior silk glands during the first half of the Vth instar and reached a plateau. When larvae were treated with JHA in the early Vth instar, the accumulation of DNA content in the posterior silk glands stopped, but soon resumed and finally DNA level exceeded the control. In larvae which reached about two weeks in the Vth instar due to JHA application, the DNA content increased nearly twice as much as the control (Fig. 1). A peak of DNA synthesis activity, a peak of thymidine kinase activity and a peak of DNA polymerase activity appeared in the early Vth instar in the untreated larvae (33, 34). In the larvae treated with JHA in this period of the Vth instar, these activities decreased quickly for a while, and the peak of each activity appeared again thereafter (20, 21, 23). However, DNA polymerase activity was not decreased by the treat-

2. Effet de l'application d'AHJ sur la croissance des glandes séricigènes.

Même lorsqu'une dose convenable d'AHJ est administrée au début du Vme stade, le taux de croissance des glandes séricigènes est légèrement ralenti et plus ou moins modifié selon la dose utilisée. Toutefois, la croissance redevient rapidement normale et en définitive, dépasse celle des témoins. Malgré une croissance plus faible des glandes séricigènes, il n'est pas possible d'observer un effet sur la croissance pondérale des vers (20, 29, 32). Il a été montré par ailleurs que la croissance pondérale chez les vers allatectomisés au début du IVme stade est supérieure à celle des témoins (4, 8).

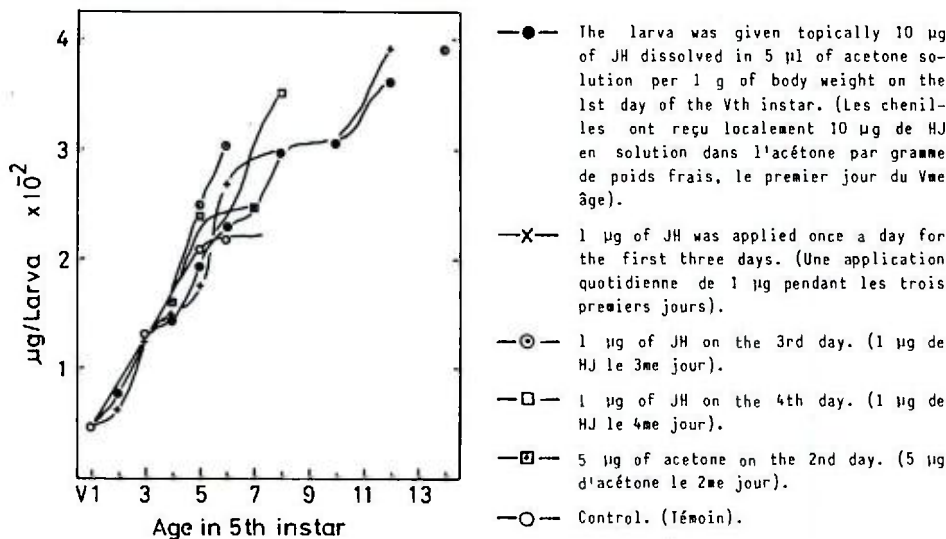
3. Effet de l'application d'AHJ sur la synthèse de DNA dans les glandes séricigènes.

Dans les conditions normales, la quantité de soie produite par les vers dépend de la teneur en RNA dans la partie postérieure des glandes séricigènes et la teneur en RNA est déterminée par la teneur en DNA dans la partie postérieure des glandes séricigènes (19, 28)

Chez les témoins, le DNA s'accumule dans la partie postérieure des glandes séricigènes au cours de la première moitié du Vme stade et atteint un plateau. Lorsque les vers sont traités par des AHJ au début du Vme stade, l'accumulation du DNA cesse, puis reprend bientôt pour dépasser finalement le niveau des témoins. Chez des vers ayant atteint le 14me jour du Vme stade en raison d'un traitement par des AHJ, le niveau du DNA s'accroît jusqu'à atteindre le double de celui des témoins (Fig. 1). Chez les vers non traités, l'activité de la thymidine kinase et celle de la DNA polymérase présentent un pic au début du Vme stade larvaire (33, 34). Chez les vers traités par des AHJ à cette période, ces activités diminuent rapidement durant un temps, puis un pic d'activité apparaît de nouveau (20, 21, 23). Toutefois, l'activité de la DNA polymérase n'est pas diminuée par le traitement. Lorsque

Fig. 1. Daily change in DNA content in the posterior silk gland of the Vth instar larva treated with JH-acetone solution. (Kurata, 1978)

Fig. 1. Evolution de la quantité de DNA dans la partie postérieure des glandes séricigènes des chenilles du Vme âge traitées avec une solution d'HJ dans l'acétone. (Kurata, 1978)



ment. When larvae were treated with JHA in the late Vth instar, the increase in DNA content, the induction of thymidine kinase activity and that of DNA polymerase activity could not be observed in the silk glands (21, 22, 28).

The increase in the DNA level in the treated larvae is considered to be due to an induction both in thymidine kinase and DNA polymerase activities, and the suppression of DNA synthesis observed after the treatment seems to be due to the inhibition of phosphorylation of DNA precursors, followed by the decrease in the activity of nucleotide phosphokinases, such as thymidine kinase.

le traitement par des AHJ est fait en fin de Vme stade, il n'y a pas dans les glandes séricigènes d'augmentation de la quantité de DNA, d'induction de l'activité de la thymidine kinase et de la DNA polymérase (21, 22, 28).

L'augmentation du niveau de DNA chez les vers traités semble due à l'induction de l'activité de la thymidine kinase et de la DNA polymérase, et l'arrêt de la synthèse de DNA observé après le traitement semble être dû à une inhibition de la phosphorylation des précurseurs du DNA, suivie par une diminution des nucléotides phosphokinases telles que la thymidine kinase.

4. Effect of JHA application on RNA synthesis in silk glands.

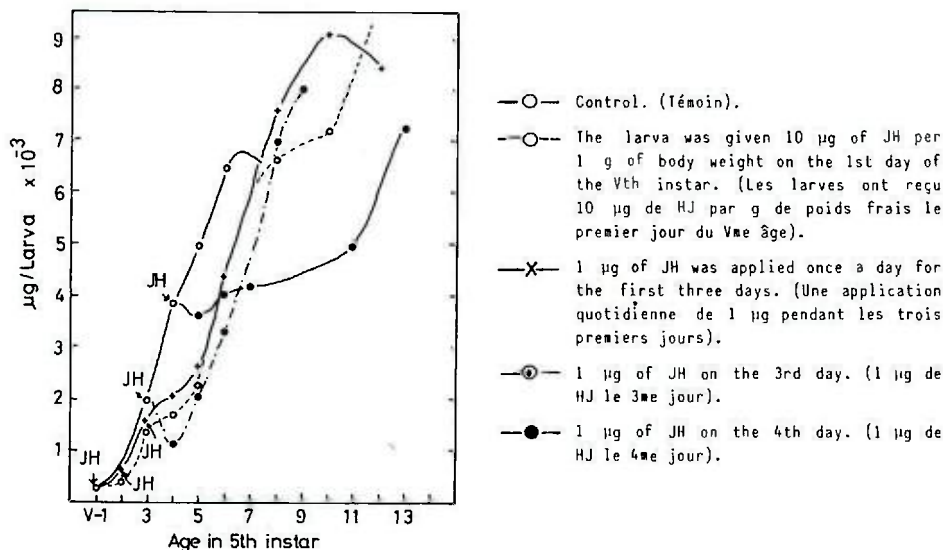
When the larvae were administered with JHA in the early Vth instar, the rate of RNA increase in posterior silk glands slowed down for a certain period, but the RNA content finally exceeded that of the control larvae (Fig. 2). However, when the larvae were administered in the late Vth instar, the RNA content did not increase. The synthesis of the three kinds of RNA species, m-RNA, r-RNA and s-RNA, was inhibited simultaneously for a certain period after JHA application (20, 22). JHA application at different times modified the ratio of the three kinds of RNA in the posterior silk glands when the RNA content was maximum. The ratio of s-RNA in the posterior silk glands of the larvae administered on the 1st day of the Vth instar has

4. Effet de l'application d'AHJ sur la synthèse de RNA dans les glandes séricigènes.

Lorsque les vers sont traités par des AHJ au début du Vme stade, le taux d'accroissement du RNA dans la partie postérieure des glandes séricigènes baisse pendant un certain temps, mais la teneur finale en RNA dépasse celle des témoins (Fig. 2). En revanche, lorsque les larves sont traitées en fin de Vme stade, la teneur en RNA ne s'accroît pas. La synthèse des trois espèces de RNA, m-RNA, r-RNA et s-RNA, est inhibée simultanément pendant un certain temps après l'application d'AHJ (20, 22). L'application d'AHJ à différents moments modifie le taux des trois espèces de RNA dans la partie postérieure des glandes séricigènes, lorsque la teneur en RNA est maximale. Le taux de s-RNA dans la partie posté-

Fig. 2. Daily change in RNA content in the posterior silk gland of the Vth instar larva treated with JH-acetone solution. (Kurata, 1980)

Fig. 2. Evolution de la quantité de RNA dans la partie postérieure des glandes séricigènes des chenilles du Vme âge traitées avec une solution d'HJ dans l'acétone. (Kurata, 1980)



increased twice as much as that of the control, but no increase was found when larvae were treated on the 3rd day (22). The increase in RNA content without the change in the ratio of RNA species seems to bring about the increase in cocoon production after the application of JHA.

5. Effect of JHA application on the silk protein synthesis.

The activity of silk protein synthesis increased conspicuously after the mid-Vth instar and reached the maximum level in the late Vth instar in the control larvae. When the larvae were administered with JHA in the first half of the Vth instar, the increase in the activity started at a delayed time, but the activity exceeded the control afterwards, and this higher activity was maintained (20, 22). In the larvae administered with JHA in the late Vth instar, the activity decreased rapidly after the treatment.

It seemed that the increase and continuation of the activity of silk protein synthesis after the administration of JHA in the early Vth instar were due to an increased dose of RNA in the silk glands.

6. Effect of JHA application on silk production.

While JHA application in the IIIrd instar or IVth instar resulted in a slight increase in the cocoon layer (30, 32), JHA application in the Vth instar was more effective. When the larvae were given JHA application in the early Vth instar, the larvae made larger cocoons than those made by larvae treated in the late Vth instar. Most effective effects were obtained in the application on the 3rd or 4th day of the Vth instar (5, 32). The effects varied more or less according to different silkworm races and rearing seasons. The effect was higher in the races of low silk productivity than those

rieure des glandes séricigènes des vers traités le 1er jour du Vme stade s'accroît jusqu'à atteindre le double de celui des témoins, mais cet accroissement ne s'observe pas chez les vers traités le 3me jour (22). L'accroissement de la teneur en RNA sans modification des taux des divers RNA semble être responsable de l'augmentation de la production de cocons consécutive à l'application d'AHJ.

5. Effet de l'application d'AHJ sur la synthèse de la soie.

Chez les témoins, la synthèse de la soie s'accroît de manière notable dans la deuxième moitié du Vme stade et atteint son maximum en fin de Vme stade. Lorsque les larves sont traitées par des AHJ dans la première moitié du Vme stade, l'augmentation d'activité en fin de Vme stade se produit plus tardivement que chez les témoins et cette activité accrue se maintient (20, 22). Chez les vers traités par des AHJ en fin de Vme stade, l'activité diminue rapidement après le traitement.

Il semble que l'accroissement et le maintien de l'activité de synthèse de la soie après l'administration d'AHJ au début du Vme stade sont dûs à une teneur accrue en RNA dans les glandes séricigènes.

6. Effet de l'application d'AHJ sur la production de soie.

Alors que l'application d'AHJ au cours des IIIme et IVme stades entraîne un faible accroissement de la coque soyeuse (30, 32), l'application au cours du Vme stade a des effets plus marqués. Lorsque les vers reçoivent des AHJ au début du Vme stade, ils produisent des cocons plus gros que ceux produits par les vers traités en fin de Vme stade. Les effets les plus importants sont obtenus quand le traitement est fait le 3me ou le 4me jour du Vme stade (5, 32). Les effets varient selon les races de vers à soie et les saisons d'élevage. Chez les races hautement productives, les effets

Table 2. Effect of JHA application on the increase in weight of silk layer in different silkworm races.

Tableau 2. Effet de l'application d'AJH sur l'augmentation de poids de la coque soyeuse chez différentes races de ver à soie.

Race / Race	Treatment / Traitement	Weight of cocoon / Poids du cocon	Weight of silk layer / Poids de la coque soyeuse	Rate of increase in silk layer / Accroissement de la coque soyeuse
Kohoku	Cont.	1.49 ± 0.14	0.164 ± 0.016	
		1.01 ± 0.33	0.154 ± 0.020	
	JHA*	2.01 ± 0.13	0.229 ± 0.040	140
		1.52 ± 0.14	0.224 ± 0.018	144
Matamukashi	Cont.	1.57 ± 0.14	0.164 ± 0.020	
		1.27 ± 0.14	0.176 ± 0.024	
	JHA*	1.98 ± 0.16	0.179 ± 0.021	109
		1.52 ± 0.16	0.179 ± 0.029	106
Giallo Ascoli	Cont.	1.50 ± 0.13	0.155 ± 0.015	
		1.21 ± 0.11	0.159 ± 0.023	
	JHA*	2.27 ± 0.15	0.271 ± 0.019	175
		1.72 ± 0.13	0.250 ± 0.022	157
610	Cont.	3.17 ± 0.26	0.697 ± 0.049	
		2.25 ± 0.14	0.617 ± 0.033	
	JHA*	3.17 ± 0.27	0.738 ± 0.036	106
		2.59 ± 0.22	0.693 ± 0.042	112
Nichii 140 X Shi 145	Cont.	2.79 ± 0.18	0.627 ± 0.038	
		2.01 ± 0.24	0.527 ± 0.097	
	JHA	2.89 ± 0.13	0.691 ± 0.049	110
		2.15 ± 0.12	0.573 ± 0.052	109
	JHA	3.16 ± 0.14	0.742 ± 0.051	118
		2.32 ± 0.14	0.661 ± 0.050	125
	Cont.	2.19 ± 0.09	0.413 ± 0.028	
		1.67 ± 0.05	0.378 ± 0.015	
Shi 124	JHA	2.93 ± 0.03	0.536 ± 0.026	123
		2.31 ± 0.05	0.492 ± 0.016	141
	JHA**	2.50 ± 0.07	0.496 ± 0.014	120
		1.90 ± 0.07	0.441 ± 0.004	117

Dose of JHA : 1 µg per g of body weight

* : larvae were given JHA at 48 hours following first meal of the Vth instar

** : Dose of JHA was 0.1 µg per g of body weight

Dose d'AJH : 1 µg par g de ver

* : l'application d'AJH est faite 48 heures après le premier repas du Vme stade

** : la dose d'AJH est de 0.1 µg par g de ver

Table 3. Effect of JHA on silk productivity.

Tableau 3. Effet d'AHJ sur la production de la soie.

Rearing season / Saison d'élevage	Application / Application			Number of larvae / Nombre de larves	Cocoon weight / Poids du cocon (g)	Cocoon shell weight / Poids de la coque (mg)	Article / Article
	Time* / Moment*	Dose / Dose	Way / Voie				
Spring / Printemps	60	10**	Topical	150	3.77	768	Kobari & Akai (1978)
	80	500**	/ locale	150	3.77	717	
	-	-	-	150	2.89	627	
Spring	48	500	Topical	2000	2.26	593	Kaneko & Ohkubo (1980)
	-	-	-	2000	2.16	550	
Summer / Eté	48	500	Topical	2000	2.26	559	
	-	-	-	2000	2.14	532	
Late autumn / Fin d'automne	48	500	Topical	2000	1.94	496	Muroga <i>et al.</i> (1975)
	-	-	-	2000	1.90	496	
Late autumn	61	0.8***	Oral /	6000	1.99	472	
	-	-	Orale	6000	1.80	411	

*: hours after first meal.

**: most effective dose among several doses at this application time.

***: 0.8 µg per larva.

*: heures après le premier repas.

**: dose la plus efficace parmi les différentes doses à ce moment d'application.

***: 0.8 µg par larve.

of high silk productivity (Table 2). In general, the rate of increase in silk production ranged from 5 to 15% by the application of JHA (9, 18, 27, 31, 32, 34) (Table 3), and was higher in the spring season than in other rearing seasons (12, 17, 24, 32).

In the larvae reared on an artificial diet, the weight of cocoon and of cocoon-shell also increased (10).

The amount of mulberry leaves ingested by the larvae applied with JHA was larger than that by the control (24, 36). However, there was virtually no difference in the coefficient of utilisation of ingested mulberry leaves into silk protein between the treated larvae and non-treated ones, namely 9.39 and 9.42% respectively (24).

The raw silk was somewhat longer and thicker than that of the control. The raw silk percentage was also somewhat higher than that of the control, but reelability percentage and neatness were somewhat lower (9, 12, 13, 14, 15, 17, 24, 31, 32, 35). Neither the alteration of the ratio of fibroin to sericin nor the alteration in the amino-acid composition of the fibroin was observed (8).

JHA application is considered to be economically profitable in sericulture, even in taking into account the additional expenses for purchasing JHA and for rearing larvae one more day (15).

Acknowledgement.

The author wishes to thank Dr T. Ito for his critical reading.

sont plus marqués que chez les races à faible production (Tableau 2). En général, l'application d'AHJ entraîne une augmentation de la production de soie allant de 5 à 15% (9, 18, 27, 31, 32, 34) (Tableau 3) et l'augmentation est plus importante au printemps que lors des autres saisons d'élevage (12, 17, 24, 32).

Chez les vers élevés sur aliment artificiel, le poids du cocon et de la coque soyeuse est également accru (10).

Les vers traités par des AHJ consomment davantage de feuilles de mûrier que les témoins (24, 36). Toutefois, il n'y a pratiquement pas de différence entre les coefficients d'utilisation digestive des feuilles de mûrier en soie des vers traités et des non traités : 9,39 et 9,42% respectivement (24).

Le fil de soie grège est plus long et de titre plus gros que celui des témoins. La richesse soyeuse est plus élevée que celle des témoins, mais le pourcentage de filabilité et la netteté sont légèrement inférieurs (9, 12, 13, 14, 15, 17, 24, 31, 32, 35). Il n'a pas été observé de modification de la proportion fibroïne-séricine, pas plus que de modification de la composition en amino-acides de la fibroïne (8).

L'utilisation des AHJ en sériciculture est considérée comme rentable même si on tient compte des dépenses supplémentaires correspondant à l'achat des AHJ et à la journée d'élevage en plus (15).

Remerciements.

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ANALYSE D'OUVRAGES

BOOK ANALYSIS

THE ROAD TO AN ARTIFICIAL DIET FOR THE SILKWORM.
Yasuji HAMAMURA, Editor.

LA ROUTE VERS L'ALIMENTATION ARTIFICIELLE DU VER A SOIE.
Yasuji HAMAMURA, Editeur.

This unique book - 295 pages written in Japanese - describes in detail (from beginning to end) the research to develop an artificial diet for the silkworm that Emeritus Professor, Yasuji Hamamura, Kyoto University of Industrial Arts and Textile Fibres, carried on with his collaborators during several decades. The book starts by explaining the very simple motive of the original research, 'Why does the silkworm only eat mulberry leaves?' (1935 - 1945). It goes on by mentioning that the research began by careful observation of the movements of the silkworm always under the keen eyes of the chemist, from which a conclusion was drawn after much trial and error (1945 - 1959), and that the research then developed inevitably towards the making of an artificial diet (1963 - 1973). Further, it gives the prospects for sericulture using the artificial diet (1975), all unique ideas of Dr Hamamura and his collaborators.

In the first part, Dr Hamamura begins by summarizing the research from the studies on the feeding mechanism of the silkworm to the perfection of an artificial diet. Then, he gives some up to date data.

Cet ouvrage unique en son genre, de 295 pages et en Japonais, décrit en détail depuis leur origine jusqu'à leur aboutissement, les recherches pour mettre au point un aliment artificiel destiné au ver à soie que le Dr Yasuji Hamamura, Professeur Emérite de l'Université des Arts Industriels et des Fibres Textiles de Kyoto a poursuivies avec ses collaborateurs durant plusieurs décennies. L'ouvrage commence par la présentation de la question très simple à l'origine des premiers travaux : "Pourquoi le ver à soie ne mange-t-il que des feuilles de mûrier?" (1935 - 1945). Il se poursuit par l'exposé des recherches ayant commencé par l'observation minutieuse des mouvements du ver à soie, sous le regard attentif du chimiste, à partir desquelles une conclusion a pu être tirée après de nombreux tâtonnements (1945 - 1959), et des recherches qui se sont orientées inévitablement vers la confection d'un aliment artificiel (1963 - 1973). Ensuite, les perspectives d'utilisation de l'aliment artificiel en sériciculture (1975), toutes les idées originales du Dr Hamamura et de ses collaborateurs sont présentées.

Dans la première partie, le Dr Hamamura commence par un résumé des travaux allant des recherches sur le mécanisme de prise de nourriture du ver à soie, à la réalisation d'une alimentation artificielle. Il présente ensuite quelques données récentes.

In the second part of the text, 4 co-workers have contributed to this work by various studies already mentioned in the first part, or by fundamental studies on the resistance of the silkworm to diseases, which was necessary for the successful rearing of silkworms on an artificial diet.

The first part can be summarized as follows. The feeding behaviour of the silkworm was found to involve 3 factors : attracting, biting and swallowing. Continuous eating occurs only when all the 3 factors are present, and eating is completed when all the 3 actions have been stimulated by chemical substances contained in the mulberry. With this working hypothesis, bioassay methods corresponding to each behaviour were devised, and each component concerned with the induction of eating was isolated from the mulberry. These components were citral (and a few other terpenes) as the attractant, β -sitosterol and iso-quercitrin (or morin, another flavon pigment) as the biting factors, cellulose as the swallowing factor and potassium phosphate (dibasic), sucrose, inositol and silica as supplementary factors. The working hypothesis was verified by preparing an agar-jelly diet which contained these chemical substances alone and by showing that the silkworm does eat this mixture just as it does the mulberry leaves. Then, an artificial diet containing these substances, soybean protein and vitamins, etc (1963) but without mulberry was prepared. During this process, several biting promoters and growth promoters were discovered, and they are mentioned in the text. The author goes on describing the applied research and gives details on a large scale model farm where silkworms are raised axenically (1972).

In the first chapter of the 2nd part, Dr Hayashiya compares the diffe-

Dans la deuxième partie de l'ouvrage, 4 co-auteurs ont contribué à cette entreprise par divers travaux déjà mentionnés dans la première partie, ou par des travaux fondamentaux sur la résistance du ver à soie aux maladies, élément indispensable à la réussite de tout élevage du ver à soie sur aliment artificiel.

La première partie peut se résumer de la façon suivante. Le comportement de prise de nourriture du ver à soie met en jeu 3 facteurs : attractif, de mastication et de déglutition. La prise de nourriture n'est continue que si ces trois facteurs sont présents et n'est réalisée que si les 3 séquences de comportement ont été stimulées par des substances présentes dans le mûrier. Partant de cette hypothèse de travail, des expériences correspondant à chaque comportement ont été imaginées et tous les composés jouant un rôle dans la prise de nourriture ont été isolés à partir du mûrier. Ces composés sont le citral (et quelques autres terpènes), pour les substances attractives, le β -sitostérol et l'iso-quercitrine (ou la morine, autre pigment flavonique) pour les facteurs de mastication, la cellulose : pour le facteur de déglutition, et le phosphate alcalin de potassium, le sucrose, l'inositol et la silice : pour les facteurs complémentaires. L'hypothèse de travail a été confirmée en préparant un aliment à base de gel d'agar contenant ces substances seules ou bien en montrant que le ver à soie consomme ce mélange comme les feuilles de mûrier. Ensuite, un aliment artificiel renfermant ces substances, de la protéine de soja, des vitamines, etc (1963) mais sans mûrier a été préparé. Plusieurs facteurs stimulant la mastication et la croissance qui ont été découverts au cours de ce travail sont signalés dans le texte. L'auteur poursuit ensuite par la présentation des recherches appliquées et décrit en détails une ferme modèle en grandeur nature où les vers à soie sont élevés en conditions axéniques (1972).

Dans le premier chapitre de la 2me partie, le Dr Hayashiya présente une

rence between the silkworms raised on an artificial diet and those raised on mulberry leaves, and shows that the silkworms raised on an artificial diet are less resistant to the oral infection of viruses (NPV). An anti-viral red fluorescent protein (RFP) was isolated from the digestive juice during the investigation on the anti-viral substances in the digestive juice of the silkworm raised on mulberry leaves. Studies on the biosynthesis of RFP in the digestive organs of the silkworm showed that the biosynthesis required the chloroplasts of green leaves in its process. The effective substance was isolated by careful fractionation of the chloroplasts, enabling the elucidation of the mechanism of RFP biosynthesis. The significance of the fact that fresh leaves are essential to the silkworm was then explained.

In the second chapter, M. Kato points out the problems met in the application of an artificial diet for the silkworm. He describes the molting behaviour of the silkworm reared on an artificial diet and the effect of light and food environments on the diapause of the silkworm.

In the third chapter, F. Matsubara describes the method of axenic silkworm rearing established by his group. The axenic rearing cabinet, the method of aseptic hatching of the eggs, the preparation of an artificial diet in axenic conditions and the tests to check the degree of sterility and so on, are shown with an up to date example.

In the fourth chapter, R. Kodama describes the bacterial diseases encountered and the ways to control them. The bacteria pathogenic to the silkworm are described. The author gives note of the particularly detailed studies made on *Streptococcus faecalis* - *Streptococcus faecium* intermediate E-5 and *Serratia piscatorum* E-15 which were isolated from diseased silkworm reared on an artificial diet. The studies on the growth of E-5 in the digestive

étude comparative des vers à soie élevés sur aliment artificiel et des vers à soie élevés sur mûrier et il montre que les vers élevés sur aliment artificiel sont moins résistants à une infection virale (NPV) par voie orale. Une protéine antivirale à fluorescence rouge (RFP) a été isolée à partir du suc digestif au cours des recherches sur les substances antivirales du suc digestif des vers à soie élevés sur feuilles de mûrier. Les études sur la biosynthèse de la RFP dans le tractus digestif du ver à soie ont montré que les chloroplastes des feuilles fraîches sont nécessaires à cette biosynthèse. La substance active a été isolée par fractionnement ménagé des chloroplastes, ce qui a permis la mise en évidence du mécanisme de biosynthèse de la RFP. La signification de la nécessité des chloroplastes des feuilles fraîches a pu être alors expliquée.

Dans le deuxième chapitre, M. Kato met l'accent sur les problèmes rencontrés dans la mise en pratique de l'alimentation artificielle du ver à soie. Il décrit le déroulement des mues du ver à soie élevé sur aliment artificiel et l'influence de la lumière et de l'alimentation sur la diapause du ver à soie.

Dans le troisième chapitre, F. Matsubara décrit les techniques d'élevage axénique du ver à soie mis au point par son équipe. L'enceinte d'élevage axénique, les techniques d'éclosion des oeufs en conditions axéniques, la préparation de l'aliment artificiel en conditions axéniques ainsi que les tests d'aseptie, etc..., sont présentés avec des exemples récents.

Dans le quatrième chapitre, R. Kodama décrit les maladies bactériennes rencontrées et les moyens de lutte disponibles. Les bactéries pathogènes pour le ver à soie sont décrites. L'auteur présente les études particulièrement détaillées sur *Streptococcus faecalis* - *Streptococcus faecium* intermédiaire E-5 et *Serratia piscatorum* E-15 qui ont été isolées à partir de vers à soie malades élevés sur aliment artificiel. Les études sur la croissance

juices, which is accompanied by a decrease in the pH of the digestive juices, and on the proliferation of E-15 in the body cavity, and the mechanism of the pathogenesis of bacterial diseases in the silkworm reared on an artificial diet, are discussed, with reference to the two groups of bacterial infection distinguished during this study. The author goes on discussing the measures to prevent bacterial diseases.

In the fifth chapter, F. Matsubara describes the induction of viral diseases. The silkworm reared under natural conditions is often attacked by viral diseases, and viral diseases are particularly induced in the Vth instar silkworms kept at a low temperature (5°C, 24 hr). However, no viral diseases were found to be produced in silkworms raised on an artificial diet under aseptic conditions, and viral diseases were not induced by low temperatures. The studies on the induction mechanism of viral diseases that originated from these findings are described in detail and are completed by a discussion on the resistance of the aseptic silkworm and natural silkworm to NPV infection.

In the sixth chapter, K. Hayashiya describes the cocoon and silk obtained from the silkworm raised on an artificial diet. Amino acid composition of fibroin and sericin of the silkworm raised on an artificial diet are similar to those of the silkworm reared on mulberry leaves as shown by amino acid analysis. It is mentioned that earlier studies in which cocoons contained a large amount of sericin, showed that the ratio of the fibroin content to sericin content varies according to the diet. The reelability of raw silk from cocoons, and the results of the tests on raw silk obtained from the cocoons of the silkworm reared on an artificial diet are discussed. It is clearly stated that the cocoons of these silkworms are durable enough to be used commercially.

de E-5 dans le suc digestif, qui s'accompagne d'une baisse du pH du suc digestif, et sur la prolifération de E-15 dans la cavité corporelle, ainsi que sur la pathogénie des maladies bactériennes chez le ver à soie élevé sur aliment artificiel, sont discutées en faisant référence aux deux groupes d'infection bactérienne distingués au cours de cette étude. L'auteur termine par une discussion sur les mesures de prévention des maladies bactériennes.

Dans le cinquième chapitre, F. Matsubara décrit l'induction des maladies virales. Le ver à soie élevé en conditions normales est souvent victime de maladies virales et les maladies virales se manifestent particulièrement chez les chenilles du Vme âge maintenues à basse température (5°C, 24 h.). Toutefois, les maladies virales n'apparaissent pas chez les vers à soie élevés sur aliment artificiel en conditions axéniques et les maladies virales ne sont pas induites par les basses températures. Les études sur la mécanique d'induction des maladies virales, dont ces résultats sont à l'origine, sont décrites en détail et sont complétées par une discussion sur la résistance à l'infection virale (grasserie) des vers à soie élevés en conditions axéniques et en conditions normales.

Dans le sixième chapitre, K. Hayashiya présente les cocons et la soie provenant de vers à soie élevés sur aliment artificiel. L'analyse des acides aminés montre que la fibroïne et la sérécine produits par les vers à soie élevés sur aliment artificiel présentent une composition en amino-acides qui est semblable à celle des vers élevés sur feuilles de mûrier. Il est mentionné que des études antérieures, au cours desquelles des cocons à teneur élevée en sérécine avaient été obtenus, ont montré que le rapport fibroïne/sérécine varie en fonction de l'aliment. La filabilité des cocons et les résultats des essais sur la soie grège provenant de cocons produits par des vers à soie élevés sur aliment artificiel sont discutés. Il est clairement établi que les cocons produits par ces vers à soie présentent une durabilité suffisante pour une utilisation commerciale.

The last pages of the book contain a report of a retrospective discussion made by the authors. In this section, the necessity of good ideas in research, the problems confronted during the study, the difficulties encountered throughout the study, and future prospects for using the artificial diet in sericulture were among the matters discussed.

At the end of the 2 parts and 6 chapters, there is a comprehensive bibliography. A supplement has been added to the book which gives the list of 308 papers related to the rearing of silkworms on an artificial diet reported by many researchers between 1958 and 1974.

Les dernières pages de l'ouvrage présentent une discussion à caractère historique entre les auteurs. A cet égard, la nécessité d'idées heuristiques dans la recherche, les problèmes auxquels il a fallu faire face au cours des études, les difficultés rencontrées durant le travail et les perspectives d'utilisation de l'alimentation artificielle dans le domaine séricicole ont été au centre du débat.

A la fin des deux parties et six chapitres, une bibliographie exhaustive est fournie. Un supplément présentant une liste de 308 articles concernant l'élevage des vers à soie sur alimentation artificielle publiés par divers chercheurs entre 1958 et 1974, est adjoint à l'ouvrage.

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REVUE SIGNALÉTIQUE

DESCRIPTIVE REVIEWS

LIST OF LANGUAGE SYMBOLS USED

(Bg) Bulgare
Bulgarian

(C) Chinois
Chinese

(D) Allemand
German

(E) Anglais
English

(F) Français
French

(J) Japonais
Japanese

(K) Coréen
Korean

(Pl) Polonais
Polish

(Pt) Portugais
Portuguese

(R) Russe
Russian

(Ro) Roumain
Rumanian

(S) Espagnol
Spanish

The corresponding small letters are used for indicating the language of the summary.

Les lettres minuscules correspondantes sont utilisées pour indiquer la langue du résumé.

GENERAL SERICULTURE

SERICICULTURE GENERALE

MUROFUSHI S., INA K.

Agr. Biol. Chem., 1981, 45, p.1501. Note

Survey of feeding stimulants for the sea bream present in the dried pupae of silkworms. (Etude des produits stimulants la prise de nourriture chez la brème de mer, présents dans les chrysalides séchées de ver à soie).

MULBERRY

MURIER

CHARTTERJEE G.E., BURMAN J.K., NAGCHAUDHURI A.K.

IRCS Medical Science : Biochemistry, 1981, 9, p.714.

Anti inflammatory activity of *Morus indica*. (Activité anti-inflammatoire de *Morus indica*).

IWATA E.

Bull. Sericul. Exp. Sta., 1981, 28(3), p.297-398. (J,j,e)

Studies on the growth of the regenerated shoot after intermediate-pruning and its application to cultivation of mulberry trees. (Etudes sur la croissance des nouvelles tiges après une taille intermédiaire et son application à la culture du mûrier).

Up to this time as mulberry harvesting method the leaf picking that the leaf blade is taken away from its shoot has widely been adopted. In the last few years, however, the shoot pruning method began to propagate as one of the labour-saving techniques due to a shortage of labour and the enlarged scale of silkworm rearing. In the case of shoot pruning, only the leaf blade is needed as feed for silkworm, therefore, it makes no serious sense except to cut down the manpower. It is thought, however, that the shoot pruning gives not a little effect on the physiological activity and the vigor of mulberry trees depending on the stage and method of pruning. As the matter of fact, although the shoot pruning at summer-autumn rearing stage, in which mulberry trees grow well, has frequently been discussed, the relation between pruning and the growth of regenerated shoot after that remains more or less unclarified. Furthermore, the experiment was carried out to (1) study the appearance / disappearance of endogenous growth substances during the growing process of mulberry trees, especially, in the leaves remaining after intermediate pruning in summer-autumn stage and (2) to clarify their impact on the sprouting of axillary buds.

The purpose of this study is to clarify the effect of shoot pruning at the growing stage of mulberry trees on the growth of regenerated shoot and to set up the rationalized technical system for shoot harvesting of mulberry trees therefore, the author proceeded with the studies from a standpoint of applied cultivation, the results of which are as follows.

1. The effect of shoot pruning at the growing stage of mulberry trees.

When the shoots were pruned by the middle of July with the spring pruning mulberry, and by the first part of August with the summer pruning one, many shoots regenerated and their growth was fairly well, but the pruning after the respective times resulted in the decreased number of shoots and retarded shoot growth. The growth of the regenerated shoots after intermediated pruning of the shoots is closely related to the growing stage at the time of pruning and the degree of cutting, therefore, should shoots be pruned deep at the latter stage of the growth, it was difficult to have sprouts grow. Thus, it was recognized that the turning point of regrowth is in the process of shoot growing, which ranges from 70 to 80 % of the final shoot length at the end of autumn.

Furthermore, it was clarified that the growing stage of shoot could be shown by development of the external morphology of the shoots ; and effects of pinching and green shoot cut on the lateral bud sprout and growth of the regenerated shoot were followed up.

The growing stages of mulberry trees are classified to the first (initial), middle (high-time), and latter stages viewing from the process of lignification (showing the color of shoot stem changed from green to grey). That is, at the first stage the base of green shoot starts to be woody, which then indicates a trend of surrounding all over the shoot stem ; at the following middle stage, the partial lignification develops extremely well on the green shoot besides the shoot grows vigorously ; and at the final latter stage partial development of lignification declined as the growth of shoot slow down. The stage of growth nearly 70 % of the final shoot length would correspond to the middle stage as mentioned above, and partial development of lignification nearly reached the peak.

2. Relation between the growing stages and the regrowth of mulberry trees.

The elongation of mulberry trees is one of the indexes to know degrees of the growth. Since an individual consists of the respective organs such as branch, leaf, root, stump and others, all the processes are to be clarified throughout the growth of these organs. Thus, growth of each organ was studied by means of grasping changes of dry matter in weight as the final product of assimilation. At the first growing stage of mulberry trees, the dry matter of the leaf as the assimilatory organ increased hastily, and at the same time those of the branch and root increased from the latter half of this stage. In proportion as the growth of the trees declined toward autumn, the dry matter of the branch and root increased rapidly. It was the stage of 70 to 80 % elongation in relation to the final length of the shoot that the growth of the organs centering around the leaf turned to branch and root. Moreover, it was an interesting fact that this elongation stage was the turning point of regrowth.

After the grown mulberry trees are pruned, budding situation of the lateral buds will be summarized into the following two points depending on the stage of growth in mulberry trees to be pruned. Firstly, until the stage when shoots grow more and more, the lateral buds sprout easily only with slight pruning at shoot tops. Secondly, with the stage of vigo-

rous growth as momentum, the lateral buds sprout less in the case of shoot topping, therefore, that could be sprouted again as the result of so-called "rejuvenation" by stimulation with deep pruning. The stage of vigorous growth secondly mentioned above agrees with the turning point in growth of the organs. It might be thought that an operation such as deep pruning keeps up physiological activity of mulberry trees at the time when its activity changes. The stage of vigorous growth was seen approximately on the 20th of July in the spring pruning of mulberry trees and on the 10th of August in the summer pruning of them in the San-In district. Up to the stage of vigorous growth, the number of days from pruning to sprout as well as growth of the regenerated shoots were influenced by meteorological conditions, especially the atmospheric temperature, while at the stage of vigorous growth onwards, the time of sprouting was prolonged with the progress of growth, besides growth of the regenerated shoots gradually declined.

3. Influence of the shoot pruning on the dry matter production and growth of the regenerated shoots.

Increase of the dry matter of each organ differed markedly under the conditions whether the lateral buds were removed from the shoot or not when the trees were pruned up to the stage of vigorous growth. That is, when the lateral buds were sprouted, not only the regenerated shoot grew vigorously, but also the dry matter of leaf, stem, old and new roots of the young trees increased. On the other hand, the dry matter of the old and new roots was found only a little but that of remained shoot increased in the case when the lateral buds were removed, especially development of the new root declined in the case of deep pruning. Marked difference was not found between the lateral buds sprouted or grown and the dry matter in weight of each organ when the trees was pruned at the stage exceeding the vigorous growth of the shoot because of the remained organs increased. The dry matter of underground parts (root) increased when the lateral buds were sprouted, thus it can be said that the regenerated shoots play an important role to increase the dry matter of underground parts in addition to the growth of themselves.

Furthermore, as the result of pruning upon dividing the growth stages into three groups, regrowth was vigorous and the dry matter of the parts above the ground (leaf, stem and stump) and that of root as well increased comparatively when pruned up to the stage of vigorous growth and the regrowth declined and the storage organs such as stem and roots increased when pruned at the stage of low growth. The whole dry matter of the individuals in those periods as stated above showed no great difference compared with the intact, but upon pruning at the stage of vigorous growth, the regrowth was not so vigorous, the dry matter of leaf did not increase and also the whole dry matter was less than the intact. It seems that this stage coincide with the turning point from the growth centered to the assimilatory organ to that of the storage organ, thus the dry matter is not increased because of pruning at the time when temperature is high and the material of trees consumed severely.

Thus, the characteristic results shown in the regrowth and increase of the dry matter in each organ throughout the stages of growth or pruning should give a fundamental knowledge to improve shoot harvesting method.

4. Physiological action of the remained leaf after shoot pruning

It is obvious in the general crops, mulberry trees and so on, that to remove the apical bud or leaf gives an influence on the remained leaf. After pruning, the color of remained leaf turns darker with the lapse

of time. This phenomenon is resulted from an increase of chlorophyll content in the remained leaf, and also it was recognized that the leaf weight per area increased, which made the leaf thicker. Thus, variations of the remained leaf after pruning would be caused to heighten the physiological activity with the growth regulating substances.

The inorganic components contained in the comparatively young leaf are divided into two groups by the rate of components and their distribution. The first group consists of nitrogen, phosphorus and potassium. The rate of their contents in the leaf were high at the stage of vigorous growth, which however reduced at the stage of slow growth, and also deteriorated with the progress of the leaf age. The second group consists of magnesium and calcium. The rate of their contents varied only slightly at the growth stage of mulberry trees. Magnesium gradually decreased while calcium increased according to the progress of leaf age. On the contrary, in the remained leaf after pruning, the rate of the components in the first group was higher and that in the second group was much higher compared with the intact, but the rate of the components in the remained leaf was different a little compared with the intact when mulberry shoots were pruned at the stage of slow growth.

The following two points can be indicated from the above mentioned facts. Firstly, the remained leaf was physiologically "rejuvenated" by accumulation of the inorganic components, and secondly, increase of nitrogen, phosphorus and potassium that are most closely concerned with photosynthesis, seemed to heighten the photosynthesizability. At the same time it can be said that increase of magnesium which is one of the components of chlorophyll was closely related to increase of chlorophyll as well as photosynthesizability in the remained leaf. It was an apparent difference compared with the young leaf that magnesium and calcium increased in the remained leaf. Therefore, increase of the inorganic components would be considered as one of the causes to heighten the physiological activity of the remained leaf. Such physiological activity of the remained leaf plays an important role onto sprouting of lateral buds and growth of the regenerated shoots. On the other hand, physiological activity of the leaf gradually declined and at the same time the rate of the inorganic components in the remained leaf also reduced when the growth slowed down.

5. The endogenous growth substances in the mulberry plants during the growing process and remained leaf after intermediate-pruning of them

After basal cutting in June, the shoots were grown rapidly, and their best time of growth was observed in the period from middle of July to early in August. Then, the growth declined gradually and almost came to its last stage in end of September or early October. So far as intermediate-pruning concerned, sprouting of axillary buds and regenerative growth of mulberry trees were rapid and active if it has been done on and before 1st August, while rather passive by the pruning on 21st of August. These results showed that the turning point of regeneration growth seems to be around August 10th.

At the best time of growth of mulberry trees, the relative amount of auxin-like substances was high in the shoot top, while less in the medium part of the shoot. However, its decrease occurred in the shoot top at the cease of the growth. The leaves of the medium part of the shoot showed the decrease of inhibitory substances after their increase till August 21st while the shoot top contained minimum amount on 1st of August, then their amount increase. On the 6th day after intermediate-

pruning which fell between August 1st and August 21st auxin-like substances were less in the remaining leaves compared with the ones of the leaf order on the non-treated shoots, thereafter the said substances increased meaning no effect of cutting. The amount of inhibitory substances in the remaining leaves was slightly less than that in the intact leaves in the period from August 1st to August 21st. It was also suggested that there might be some relationship between sprouting of axillary buds and the inhibitory substances in the remaining leaves.

6. Development of obtained results against shoot harvesting method in the summer-autumn rearing stage

To identify the results so far obtained in cultivation of the mulberry trees, an intermediate-pruning was applied three times to mulberry trees of summer pruning, that is, the first on the 7th, the second on the 12th and the third on the 17th August respectively. The yield of shoots increased when the more number of shoots were pruned in the stump at the later stage. On the contrary, the yield tended to reduce at the late autumn stage because the growth of regenerated shoots slowed down due to a lack of water in the field in the second half of August, and the less number of regenerated shoots was found pruning at the late stage especially growth of the regenerated shoots declined at the third time when all shoots were pruned in a stump. The less yield of shoot was found in the spring rearing time next year when intermediate-pruning was carried last August for the second time and the yield in the whole year was less too. It is worthy to notice that intermediate-pruning at the stage of vigorous growth in the previous year gives an influence on the yield next year.

Cultivation of mulberry trees requires as the crop desirable field maintenance to activate their growth and heighten the production, and in view of sericultural farm management-harvesting, it demands the labour saving and efficient harvesting of the shoot as the assimilation organ as well as the better yield. The harmony between those as stated above is an important subject due to vitality of the trees maintained and the stable yield for many years. The shoot harvesting at the summer-autumn rearing stage that involves many problems would be improved as follows based on the results obtained through this study.

It is recommendable to accelerate regrowth by pruning at an early stage when the regenerated shoots are harvested after an intermediate-pruning, and to prune the shoots at the later stage when an abundant yield by single pruning is expected. Actually, silkworm in the early autumn is fed with the mulberry trees of spring pruning so as to supplement shortage of mulberry shoots with the summer pruning, and silkworm in the late autumn is fed with mulberry trees of summer pruning. Thus, it is necessary to promote the establishment of the custom to harvest mulberry trees of summer pruning twice for spring and late autumn rearings to maintain the vitality of tree and intentional harvesting.

JAISWAL V.S., KUMAR A.

Zeitschrift für Pflanzenphysiologie, 1981, 102, p.299.

Activity and isozymes of peroxidase in *Morus nigra* L. during differentiation. (Activités et isozymes de la peroxydase de *Morus nigra* L. au cours de la différenciation.

Variation in peroxidase activity and in its isozymes were analysed at the time of sex differentiation in male and female plants of *Morus nigra* L. Activity was more of less the same in vegetative apical meristems of both sexes but female reproductive structures had relatively

higher activity. Male reproductive structures had one new peroxidase isozyme.

MATHUR R.N.

Indian Forest Bulletin (India), 1980, 273(6), (E)

Biology of the mulberry defoliator *Glyphodes pyloalis* (Wlk) Lepidoptera : Pyralidae. (Biologie du ravageur du mûrier *Glyphodes pyloalis* (Wlk) Lepidoptère : Pyralidae).

Glyphodes pyloalis, a serious pest of mulberries (*Morus alba* and *M. indica*), was first noticed in Punjab, Pakistan in 1928. The young larva feeds upon the epidermis on the under surface of the leaf. The life history and habits are described. *Glyphodes* is parasitized by *Apanteles* sp., *Cedria paradoxa*, *Chelonus* sp., *Hemiteles* sp., *Ichneumonidae* sp., *Microgaster* spp., *Microbacon* sp., *Cremastus* sp., *Trophocampa* sp., *Xanthopimpla* sp., Chalcidoid spp. and *Callicera* sp. Predacious enemies include a carabid beetle, larvae of *Parena nigrolineata*, *Chlaenius rayotus* and *Calleida splendidula*, thread worms, *Hexameris* sp., Eumenid wasps and a species of spider. As the insect passes the greater part of its larval stage within folded leaves on the soil or ploughing to destroy the hibernating larvae. An emulsion of kerosene or soap solution mixed with pyrethrum of BHC is applied before the larvae roll the leaves.

From Abstracts on Tropical Agriculture (N° 35247)

NIKI T., SAKAI A.

Plant & cell Physiology, 1981, 22, p.171. (E,e)

Ultrastructural changes related to frost hardiness in the cortical parenchyma cells from mulberry twigs. (Modifications ultrastructurales en relation avec le durcissement par le froid des cellules du parenchyme cortical des rameaux de mûrier).

Ultrastructural changes in the cortical parenchyma cells of mulberry (*Morus bombycz* Koidz. cv. 'Gorogi') twigs were related closely to the seasonal cycle of frost hardiness. Changes in hardiness from summer to winter and vice versa took place particularly in the plasmamembrane.

During stages that result in a rapid increase in hardiness, the sequence of cytological changes for the replacement of the plasmamembrane was marked invaginations of the plasmamembrane; pinching off into vesicles in the peripheral cytoplasm; engulfment of these vesicles into vacuoles; generation of numerous microvesicles by the Golgi apparatus; the appearance of the microvesicles with the plasmamembrane. Similar cytological changes that are associated with increased hardiness occur during artificial hardening at 0°C for 5 to 20 days in both the autumn and spring. In the midwinter cells, however, the plasmamembrane has a fairly smooth structure. Thus, the highly folded structure of the plasmamembrane is not always characteristic of extremely hardy cells. Ultrastructural changes associated with hardiness are discussed in terms of membrane renewal.

NOMURA T., FUKAI T.

Planta Medica, 1981, 42, p.79.

Constituents of the cultivated mulberry tree. 7) Isolation of 3 new Isoprenoid-Flavanones, Kuwanon D, E, and F from root-bark of *Morus alba*. (Les constituants des mûriers cultivés. 7) Isolement de 3 nouveaux Isoprenoïde-flavanones, les Kuwanone D, E et F à partir de l'écorce des racines de *Morus Alba*).

NOMURA T., FUKAI T.

Planta Medica, 1981, 42, p.197.

Mulberrofuran-B, a new Isoprenoid-2-arylbenzofuran from the root bark of the cultivated mulberry tree. (Mulberrofuran-B, un nouvel Isoprenoïde-2-arylbenzofuran de l'écorce de la racine du mûrier cultivé).

OGURE M.

J. Sericult. Sci. Japan, 1981, 50(3), p.213-214. (short rep.)

Development of white sorosis following temporary grafting to paper mulberry (*Broussonetia kazinoki* SIEB.) in mulberry. (Développement de soroses blanches chez le mûrier après une greffe temporaire sur *Broussonetia kazinoki* SIEB.).

OGURTZOV K.S., VLASOVA N.A.

Genetika, 1981, 17, p.645.

Cytogenetical studies of *Morus alba*. (Etude cytogénétique de *Morus alba*).

OKABE T.

J.A.R.Q., 1981, 14(4), p.235-238. (E)

Development of mulberry shoot reapers. (Développement des machines à récolter les rameaux de mûrier).

SATOH M.

Bull. Sericul. Exp. Sta., 1981, 28(3) p.399-498. (J,j,e)

Studies on matter production in mulberry tree with special reference to change in physiological activity of leaves retained after harvest and their contribution to regrowth. (Etude sur la production de matière chez le mûrier. Relation avec les modifications de l'activité physiologique des feuilles laissées en place après la récolte et contribution de celles-ci à la repousse).

As mulberry trees are cultivated to harvest leaves for diet of silk-worms, the assimilatory organ is removed repeatedly in the growing season, in a way rarely done in other crops cultivation. Leaf harvest with stems is recently much prevailing with the dissemination of the shoot rearing throughout seasons. In mulberry cultivation the problems wait to be solved on how to get leaf yield as much as possible and, at the same time, on how to maintain tree vigor as juvenescent as possible.

This investigation was carried out in order to establish the bases of mulberry cultivation through the analysis of effects of removing the assimilatory organ and of retaining some leaves at the time of stem pruning upon the production, distribution and consumption of photosynthetic products.

Throughout the studies which consisted of 11 experiments, one-year-old cuttings or graftings were used after potting and pruning the previous year's stems mostly at the basal 5cm position. The sprouting buds at the bases were trimmed leaving one bud per plant, and the resultant current year's stems and the leaves on them were measured or treated for various experimental purposes. New shoots developed from the stems after the pruning of various intensity were also used.

The results obtained can be summarized as follows :

1 Apparent photosynthetic rate of leaves showed different values according to the growth stages of plants, leaf position on stem and varieties tested. For the growth stage, plants shortly after planting

showed comparatively high rate, while the rate showed a tendency to decrease with the lapse of time after planting. For the leaf position on stem, young leaves on stem tip showed low rate, and sometimes, negative rate leaves evolving carbon dioxide even under illumination. Photosynthetic rate became high in the 5th to 10th leaves from the stem tip, showed a maximum value in the just matured leaf and leaves adjacent to it and then decreased gradually with increasing age of leaves. Varietal difference was observed regarding the maximum rate and the rate shift with leaf age. The maximum rate in this experiment was about $26 \text{ mg CO}_2 \cdot \text{dm}^{-2} \cdot \text{hr}^{-1}$, which is nearly equal to the maxima obtained in other deciduous woody plants.

2 Translocation of photosynthetic products which was assimilated by a leaf on the middle position on a stem to other organs was highly active immediately after assimilation and almost completed in 4 days after assimilation. The upper leaves on a stem distributed more photosynthetic products to leaves and less to a stump and roots than lower leaves did. On the contrary, lower leaves distributed much photosynthetic products to a stump and roots. Middle leaves on a stem showed downward as well as upward translocation and distributed much photosynthetic products to a stem. It was recognized in mulberry trees that leaves share the destination of photosynthetic products with varying positions on a stem.

3 Regrowth ensues following pruning at the basal part of stems in the growing season. Newly developed shoots sharp growth about 15 days after the pruning. The dry weight of storage organs such as a stump and roots decreased shortly after the pruning, showed a minimum 10 to 20 days after the pruning and then turned to increase. The content of soluble sugars and starch in storage organs decreased 10 to 20 days after the pruning and then turned to recovery. The decrease in soluble sugars was about 30 % of the initial value, while that in starch amounted to about 80 %.

The translocation of carbon-labeled photosynthetic products that was assimilated and reserved in a stump and roots before the stem pruning to new shoots was investigated in the process of regrowth, and the rate of reserve substances in new shoots on dry weight basis was also measured. It was recognized that leaves being at the basal part of new shoots, that is, those developed shortly after the pruning gave much high rate of reserve substances. The rate of reserve substances in new shoots was approximately 100 %, 60 %, 30 % and 12 % on the 10th, 16th, 23rd and 34th day after the pruning, respectively. These results suggest that regrowth becomes to be supported mostly by the photosynthetic activity of new shoots about 20 days after the pruning.

4 Regrowth after stem pruning was markedly accelerated through retaining 4 leaves on the basal part of stem at the time of pruning. Basal leaves retained were also effective in alleviating the decrease of dry weight and reserve carbohydrates in storage organs such as a stump and roots. Amylase activity in storage organs increased immediately after the pruning and showed 1.5 to 2 times as high as the initial for the period 5 to 20 days after the pruning. The increase in the activity was less when basal leaves were retained than when removed.

Stems with about 37 leaves were pruned in the middle and the leaves just below the pruned position were assimilated with carbon-labeled carbon dioxide. Labeled photosynthetic products were distributed predominantly to the new shoots being in vigorous development 10 to 15 days after the pruning, while the distribution of the products to the stem, stump and root was remarkably decreased, and the leaves, showed slight decrease in the distribution. The results will show that the photosyn-

thetic activity of the leaves retained on the stems at the time of the pruning plays an important role in the acceleration of regrowth.

5 The effect of age of the retained leaves on regrowth was examined by means of the defoliation treatment in which leaves on various parts of the stems were retained to make each part nearly the same leaf area and other leaves were removed, and then the stems were pruned above the respective parts. The cumulative dry weight increment of new shoots was little different among these parts for 20 days after the treatment and became different after then ; the increment was highest in the part with youngest leaves and smallest in the part with oldest or 2nd oldest ones. In storage organs such as a stem, a stump and roots, however, the increment was higher in the parts with young leaves than in the parts with old leaves.

In addition, the effect of area of the retained leaves on regrowth was examined by the defoliation in which no leaf was retained and various numbers of leaves were retained making the average leaf age of each stem to be almost the same. The increment in new shoots was very poor when no leaf was retained, while, in case in which the leaves were retained, irrespective of the number of them, the increment was twice or more times higher than the wholly defoliated. The increment in storage organs such as a stem, a stump and roots increased almost proportionally to the increase in area of the retained leaves. As to the retained leaves, the increment proved to be negligibly small. Though the increment on the basis of plant became large with area of the retained leaves, the increment was not much accelerated by the increase in area of the retained leaves. The cumulative dry weight increment thus examined was closely related to the distribution of photosynthetic products to organs ; when the leaf area was extremely lessened by means of defoliation, the products were predominantly distributed to new shoots, while the distribution to storage organs was diminished.

6 From the experimental evidences, as described above, it is suggested that the function of the leaves retained after harvest in mulberry fields is directly to accelerate the regrowth through distributing photosynthetic products mainly to new shoots and indirectly, to reduce the consumption of reserve substances in storage organs, to avoid the interruption of mineral nutrients and water absorption through roots and to avoid the interruption of biosynthesis of substances in roots.

7 Comparison was made regarding photosynthetic activity between the stems in which tips were pinched and, in addition, leaves were alternately removed and the stems in which tips were pinched without any defoliation. The retained leaves in the alternately defoliated stems showed increased photosynthetic rate compared with the corresponding leaves of the non defoliated and reached to 1.6 times the activity of the latter 10 days after the treatment. Afterwards, the rate in the alternately defoliated turned to decrease and came to almost the same level as that of the non defoliated on the 30th day. In addition, after the treatment, the alternately defoliated stems showed vigorous regrowth of new shoots, increase in net assimilation rate and high rate of enlargement of leaf area including new shoots, compared with the non defoliated. The difference in net assimilation rate between the alternately defoliated and the non defoliated came to be hardly recognized after leaf area became nearly identical.

Properties of the retained leaves were compared among treatments in which stems of different lengths were left by pruning at different positions. Photosynthetic rate, areal weight and nitrogen content of the

retained leaves became high in proportion to decrease in the number of the retained leaves. Photosynthetic rate thus increased, however, gradually decreased with the regrowth of new shoots.

8 The leaves retained in the stems were examined as to physiological and anatomical changes with the progress of aging for 40 days, using 3 kinds of stems : stems pruned at the middle part, stems pruned at the middle and axillary buds disbudded, and stems unpruned. The leaves retained in the unpruned stems were characterized by gradual decrease in photosynthetic rate, in contrast to those in the pruned and disbudded in which the rate was not significantly changed and came to more than double of the former leaves 40 days after the treatments. Little difference was recognized in stomatal resistance to carbon dioxide diffusion between the leaves in the unpruned and those in the pruned and disbudded, while mesophyll resistance differed distinctly between them, with the former leaves showing increase and with the latter being almost unchanged. Contents of starch and growth inhibitors such as abscisic acid and phaseic acid were lower in the leaves in the pruned and disbudded than those in the unpruned, while chlorophyll content and cytokinin-like substances content measured on the 13th day were higher in the former than in the latter. In addition, the leaves in the pruned and disbudded were featured by the increase in leaf thickness and in length of palisade and spongy parenchymal cells. For the leaves in the pruned, but not disbudded stems, the changes as described above were approximately between the unpruned ones and the pruned and disbudded ones.

9 It is conjectured from the above-mentioned results that rejuvenescence of leaves retained after stem pruning and / or defoliation, as expressed by the enhancement of their physiological activity, is attributed to cytokinin which has most probably its origin in roots, accumulates in the retained leaves and promotes chloroplast multiplication as well as protein and chlorophyll synthesis in the leaves. A temporary decrease in the content of growth inhibitors of the leaves retained after stem pruning is also conjectured to enhance physiological activity of them.

10 In order to maintain high leaf yield for successive years in mulberry trees, one of perennial tree crops, in which leaves are harvested for silkworm raising usually twice or more times in a year, it is considered necessary not to make a vacancy in matter production by complete removal of the assimilatory organs. To retain leaves at the time of harvest, even if little in amount, is effective in promoting regrowth after harvest and accumulation of reserve substances in storage organs. Based on the findings regarding compensatory activity of the retained leaves, optimal extent of leaf harvest in practice was discussed.

SIKDAR A.K., KRISHNASWAMI S.

Indian J. Agron., 1980, 25, p.382-386. (E,e)

Control of weeds in irrigated mulberry gardens. (Lutte contre les adventices dans les mûraies irriguées).

YAHIRO M., HIGASHI H.

Jap. J. Trop. Agric., 1981, 25(2), p.59-62.

Chilling requirements in the termination of dormancy in mulberry winter buds. (Besoins en froid des bourgeons d'hiver du mûrier pour l'achèvement de leur dormance).

In 1978 and 1979, some experiments were carried out as to the number of chilling hours (chilling requirements) necessary for the termination of dormancy in mulberry winter buds, using Shukakuichi and Ichinose (varieties of the type of comparatively cold region) and Wasemidori and Atsubamidori (varieties of the type of warm region).

In both $5\pm 1^{\circ}\text{C}$ and $7\pm 1^{\circ}\text{C}$, chilling requirement was noted to be about 40 days (960 hours) in Shukakuichi and Ichinose, and about 10 days (240 hours) in Wasemidori and Atsubamidori.

YAMASHITA T.

J. Sericult. Sci. Japan, 1981, 50(4), p. 251-258. (J,j,e).

Formation of ^{14}C -asparagine from ^{14}C -precursor in mulberry leaves. (Formation de ^{14}C -asparagine dans les feuilles de mûrier à partir d'un précurseur marqué au ^{14}C .)

Since a remarkable accumulation of asparagine in the young leaves of mulberry has been observed, the formation of ^{14}C -asparagine from ^{14}C -labeled substrates in young leaves was examined in comparison with that in the mature leaves. ^{14}C -aspartic acid and ^{14}C -succinic acid expected as active precursors for asparagine biosynthesis, and ^{14}C -sucrose as respiratory substrates were fed respectively to the disks of young or mature leaves of mulberry.

Although ^{14}C -succinic acid was actively converted to ^{14}C -asparagine, no significant amount of ^{14}C -asparagine was formed from ^{14}C -aspartic acid in two hours of feeding period. The rate of formation of ^{14}C -asparagine from ^{14}C -succinic acid in the mature leaves was slightly higher than that in the young leaves. Amino acids other than asparagine acquired ^{14}C from ^{14}C -labeled substrates were mainly aspartic acid, glutamic acid, alanine and γ -amino butyric acid in both of the leaves.

Intending to accelerate the formation of asparagine in the leaves, ammonium ion was supplied to culturing solution as only source of nitrogen and plants were grown for two weeks in that solution before ^{14}C -labeled substrates feeding experiments. Supplying of ammonium ion brought about enhanced accumulation of asparagine in the young leaves, and caused remarkable formation of ^{14}C -asparagine from ^{14}C -aspartic acid in both of the leaves. However, the rate of ^{14}C -asparagine formation from ^{14}C -aspartic acid in the young leaves did not exceed that in the mature leaves.

ABADJIEVA R.

Animal Science, 1980, 17(7), p.118-120. (Bg,bg,e)

Study on the content of reducing sugars in the haemolymph of some silkworm lines. (Etude sur la teneur en sucres réducteurs dans l'hémolymph de quelques lignées de ver à soie).

Beginning on the seventh day of the fifth age cycle, the kind and the content of reducing sugars (glucose and fructose) in the haemolymph of silkworms belonging to three different lines are studied.

Fructose has not been established in the haemolymph of silkworms.

The content of glucose varies from 48.45 mg % (in line n° 773 to 43.B5 and 42.90 mg % (in lines n° 13 and 6 respectively).

It is also established, that in all three lines the content of glucose correlates positively with the rate of viability (i.e. the ratio between number of silkworms left after the third age cycle and number of silkworms that actually have cocooned) and with the weight of single cocoon.

BAI A.R.K., SHADAKSHARASWAMY M., MADDI P.P.

Entomon, 1980, 5(4), p.345-348. (E), (Brief communication)

Changes in acetylcholinesterase and butyrylcholinesterase activity in the nervous system during moulting in the silkworm *Bombyx mori* L. (Modification de l'activité de l'acétylcholinestérase et de la butyrylcholinestérase dans le système nerveux au cours de la mue chez le ver à soie *Bombyx mori* L.).

CALVEZ B.

J. Insect Physiol., 1981, 27, p.233-239. (E,e)

Progress of the developmental programme during the last larval instar of *Bombyx mori* : relationships with food intake, ecdysteroids and juvenile hormone. (Déroulement du programme de développement au cours du Vme âge chez le ver à soie *Bombyx mori* : relation avec la prise de nourriture, les ecdyotéroïdes et l'hormone juvénile).

The progress of developmental programme in the epidermal cells of last instar larvae of *Bombyx mori* was determined by ecdysteroid injections in normal and in JH-treated larvae. To clarify the importance of food intake in the control of development, starved animals were also used.

The instar begins with a period during which the larval programme is expressed : this occurs in the presence of 20-hydroxyecdysone. Epidermal cells can thereafter secrete pupal cuticle after ecdysteroid injection although the larval programme is normally still present. During the last period only pupal characters can be expressed either in normal or in 20-hydroxyecdysone-injected larvae.

These different developmental phases are not correlated with obligatory and facultative feeding periods.

Transition from the first to the second phases is correlated with the absence of JH effects on pupal genes. JH applications during the second period, however, prevent the expression of pupal characters after 20-hydroxyecdysone injection. Thus, during this period, the pupal programme is not stabilized. Cellular reprogramming itself occurs at the onset of the last developmental period and is probably under the control of ecdysteroids.

CHAVANCY G., MARBAIX G., HUEZ G., CLEUTER Y.
Biochimie, 1981, 63(7), p.611-618. (E,e,f)

Effect of tRNA pool balance on rate and uniformity of elongation during translation of fibroin mRNA in a reticulocyte cell-free system. (Effet de la composition de la population de tRNA sur la vitesse et l'uniformité de l'élongation au cours de la traduction du mRNA de la fibroïne dans un système acellulaire de réticulocyte).

Unsuccessful attempts to synthesize complete fibroin chains *in vitro* were previously made in heterologous cell-free system (3). In the present work, we succeeded to obtain complete translation of purified fibroin mRNA in a rabbit reticulocyte lysate. Whilst this work was being completed (1), similar results were published by Lizardi *et al.* (4).

The synthesis of full-sized molecules of fibroin (M.W. 360,000) was achieved by adding tRNA from the posterior silk gland to the cell-free system. With tRNA from other sources, both the translation rate and the amount of complete fibroin chains dropped. This effect of tRNA is situated at the elongation level.

Analysis of cell-free synthesized products by polyacrylamide gel electrophoresis shows that smaller discrete polypeptides are accumulated after 120 minutes of incubation. These polypeptides correspond to growing fibroin chains. This pattern of translation products suggests that elongation might decelerate at specific sites of the fibroin mRNA.

These results shows that a tRNA pool adjusted to mRNA codon frequency is required to obtain the maximal average elongation rate. A stochastic model based on random acceptance of tRNA at

Des tentatives infructueuses pour obtenir des chaînes complètes de fibroïnes par la traduction *in vitro* du mRNA purifié ont été réalisées précédemment (3). Les résultats que nous présentons ici montrent que nous avons obtenu la traduction complète du mRNA de la fibroïne dans un lysat de réticulocyte. Au moment où ce travail touchait à sa fin, des résultats analogues ont été publiés par Lizardi *et al.* (4).

La synthèse de molécules entières de fibroïne (P.M. : 360.000) est obtenue en ajoutant dans le système acellulaire des tRNA de la partie postérieure de la glande séricigène. Avec d'autres populations de tRNA, la vitesse de traduction et la quantité de fibroïne entière sont plus faibles. Cet effet des tRNA se situe au niveau de l'élongation des chaînes protéiques.

L'analyse des produits de traduction par électrophorèse sur gel de polyacrylamide montre que des polypeptides plus petits que la fibroïne apparaissent sous forme de bandes discrètes sont accumulés après 2 heures d'incubation. Ce résultat suggère que l'allongement des chaînes protéiques est ralenti à des endroits particuliers du mRNA de la fibroïne.

Nos résultats montrent donc qu'une population de tRNA quantitativement ajustée à la fréquence des codons du mRNA est nécessaire pour obtenir la plus grande vitesse d'allongement. Un

the ribosomal A site for the codon-anticodon recognition process can explain the occurrence of the unfinished discrete fibroin polypeptides during *in vitro* translation.

modèle stochastique pour la reconnaissance codon-anticodon peut expliquer ce résultat. Il permet également d'expliquer l'apparition de ralentissements de l'allongement au cours de la synthèse *in vitro* de la fibroïne.

DOIRA H., KIHARA H., CHIKUSHI H., UMEZU R.

J. Sericult. Sci. Japan, 1981, 50(2), p.154-157. (J,j,e)

Genetical studies on the 'maternal brown of Tsujita' mutation in *Bombyx mori*. (Etudes génétiques de la mutation "maternal brown of Tsujita" de *Bombyx mori*).

Linkage analysis of the maternal brown of Tsujita (symbol *b-t*) gene was performed. It was shown that the *b-t* gene was linked with chocolate (*ch*) which had been known to be located at 9.6 position on the thirteenth linkage group. A three-point experiment involving *b-t*, *ch* and *cf* was made in order to determine map position of the *b-t* gene. The recombination value between *b-t* and *ch* was 5.70 %, *ch-cf* 10.66 %, and *b-t-cf* 15.53 %. Taking correction factor into account, the locus of *b-t* was calculated to be 6.04 units away to the left of *ch*. Hence the *b-t* gene is localized at 3.6 on the thirteenth linkage group.

DOIRA H., SAKATE S., KIHARA H., TAMURA T.

J. Sericult. Sci. Japan, 1981, 50(3), p.185-189. (J,j,e)

Genetical studies of the 'mottled translucent of Var' mutations in *Bombyx mori*. (Etude génétique de la mutation "transparent marbré du Var" du ver à soie *Bombyx mori*).

The recessive mutant "mottled translucent of Var" (symbol *ov*) was found as a spontaneous phenomenon in a European race, Var. The *ov* gene was shown to be linked with brown-4 (*b-4*) mapped at 21.9 position of the twentieth linkage group. Another mottled translucent mutation was isolated from a hybrid stock of m60, in which two different translucent genes, *os* and *oc*, are already known to be co-existed. Mating experiment revealed that the mottled translucent gene of m60 stock was an allele of *ov* and the gene received the symbol *ov*. The locus of *ov* gene was determined to be 15.2 position of the twentieth linkage group through a three-point experiment involving *Df-t*, *b-4* and *ov*.

HIRAO T., YAMAOKA K.

J. Sericult. Sci. Japan, 1981, 50(4), p. 335-342. (J,j,e).

Analysis of feeding behaviour pattern in the silkworm, *Bombyx mori* - Short circuit type actograph. (Analyse du comportement alimentaire du ver à soie, *Bombyx mori* - Un actographe à circuit court).

An electrical actograph was designed and fabricated to record the feeding behaviour. The low voltage direct current was supplied to the larva and the diet through electrodes : a plus electrode was implanted into the caudal horn of the larva and another minus electrode was connected to the diet. When the larva bit off a piece of the diet, the resistance of the larval body and that of the diet were connected in series through the contact resistance between the mouthpart and the diet. The change of the electrical potential between two electrodes was picked up and amplified to induce into the recorder. By this apparatus the action of the feeding behaviour of the larvae between 2nd and 5th instar was

recorded satisfactory, irrespective of the type of the diet ; mulberry leaves or artificial diets. The recording was able to carry out continuously for the respective instar period. The electrical shocks by passing the direct current through the larval body could be minimized to have little effects on an amount of food intake and on growth of the larva. In addition to the feeding signals, a clearly distinguishable type of signals was picked up by this apparatus. This type of signals appeared to be related to the action of the rectum muscular system.

HOU R.F., CHEN R.S.

Appl. Entomol. Zool., 1981, 16(2), p.169.

The blue-green alga, *Spirulina platensis* as a protein source for artificial rearing of *Bombyx mori* (Lepidoptera : Bombycidae). (L'algue bleue-verte *Spirulina platensis*, source de protéine pour l'alimentation artificielle de *Bombyx mori* (Lepidoptera : Bombycidae).

HUKUHARA T., MIDORIKAWA M., ITO H.

J. Sericult. Sci. Japan, 1981, 50(4), p. 301-305. (J,j,e).

Purification of a cytoplasmic-polyhedrosis virus from silkworm feces. (Purification d'un virus de la polyédrose cytoplasmique à partir d'excreta de ver à soie.

Groups of fifth-instar larvae were administered an artificial diet which had been contaminated with polyhedra of a cytoplasmic-polyhedrosis virus. After feeding for two or three days on this diet, the larvae were transferred to uncontaminated diet and their feces were daily collected. The feces (1 g) were macerated in 10 ml of 0.05-0.1 M sodium pyrophosphate to detach the absorbing virus and incorporated into an aqueous two-phase separation system consisting of 5 ml of 20 % (w/w) dextran (MW 200,000-300,000) and 2 ml of 40 % (w/w) polyethylene glycol 6000. The detached virus entered the upper phase, while the larger particles constituting the feces entered the lower phase. The upper phase was transferred to another vial and 1/100 volume of 20 % (w/w) dextran sulfate 500 (MW 500,000) and 1/10 volume of 3 M NaCl were added. In this biphasic system the virus was concentrated in the lower dextran sulfate-rich phase. Serial dilutions of the macerated feces and the purified preparation were perorally administered to newly-hatched larvae in order to determine their IC_{50} as expressed by dry weight per unit volume. The IC of the starting material was 158 times as great as that of the purified preparation. This result indicated that most (157/158) of the non-viral fecal material was eliminated by the purification procedure. Feces collected on different days were compared in their infectivity by bioassays of the preparation purified from them. The feces defecated during the period when the larvae were fed virus-contaminated diet were highly infective and presumed to contain ingested polyhedra and virions liberated from them. The feces collected 1-2 days after the larvae were transferred to uncontaminated diet showed very low infectivity. However, the infectivity began to increase in 4 or 5 days following the peroral administration of polyhedra and reached a very high level on the last day of the fifth instar. The feces were presumed to contain the virus which had multiplied in the epithelial cells of the larval midgut.

HUKUHARA T., MIDORIKAWA M.

J. Sericult. Sci. Japan, 1981, 50(4), p. 345-346. (J) Short rep.

Assessment of the occurrence of the cytoplasmic polyhedrosis in silkworm populations reared on an artificial diet. (Dépistage des polyédroses cytoplasmiques dans les populations de vers à soie élevés sur aliment artificiel).

HUKUHARA T., SAKATE S., SATO Y.

J. Insect Physiol., 1981, 27, p.469. (E,e)

Rhythmic contractile movements of the larval midgut of the silkworm *Bombyx mori* (Mouvements de contraction rythmiques du tube digestif de chenille du ver à soie *Bombyx mori*).

The midgut of intact larvae of *Bombyx mori* exhibited active contractile movements. Contraction waves were generated rhythmically at several regions of the midgut. The waves passed in both oral and aboral directions from their sites of origin. Midgut movements were depressed during moulting. The midgut continued to move normally when tetrodotoxin was injected into the larval haemocoel at doses sufficient to paralyze somatic muscle. Ligation of larvae paralyzed with tetrodotoxin behind the second or third body segment resulted in the abolition of the contraction waves in the midgut portion anterior to the ligature. A ligature applied behind other body segments did not hamper midgut motor activity irrespective of whether or not an abdominal ganglion had been extirpated. The frequency of contraction and the rate of food transport in the midgut were increased when larvae were administered serotonin or when their body temperature was raised.

IIZUKA T., FAUST R.M., TRAVERS R.S.

J. Fac. Agr. Hokkaido Univ., 1980, 60(2), p143-151. (E,e)

Comparative profiles of extrachromosomal DNA in single and multiple crystalliferous strains of *Bacillus thuringiensis* variety *Kurstaki*. (Profils comparatifs des DNA de souches mono- ou polycristallifères de *Bacillus thuringiensis* variété *Kurstaki*).

Extrachromosomal DNA from single and multiple crystalliferous strains of *Bacillus thuringiensis* var. *kurstaki* (serotyp 3a, 3b) were consistently isolated using a procedure which optimizes lysis of the normally lysozyme resistant cells. The results obtained can be summarized as follows :

1. A variety of large and small extrachromosomal DNA elements were readily visualized with agarose gel electrophoresis that generally included nine between 0.69 and <9.0 megadaltons (Mdal) in size, three between 0.9 and < 50 Mdal, two between 50 and 200 Mdal, and two that were larger than 200 Mdal.

2. The HD-1 strain contained as many as 16 extrachromosomal DNA elements while only 15 were isolated from the HD-73 and the multicrystalliferous strains.

3. Only one major difference between the multicrystalliferous and the two single crystalliferous strains that could be noted was the absence of an 18.62 Mdal DNA element in the single crystalliferous strains, although a number of other differences in the extrachromosomal DNA profiles was also noted among all three strains which makes it futile to attempt to correlate the production of parasporal crystals with any particular extrachromosomal DNA element(s).

4. Although strains of the same serotype have a number of extrachromosomal DNA elements in common, the data demonstrated that there can be differences in extrachromosomal DNA patterns between strains of the same serotype.

IIZUKA T., FAUST R.M., TRAVERS R.S.

J. Sericult. Sci. Japan, 1981, 50(2), p.120-133. (E,e,j)

Isolation and partial characterization of extrachromosomal DNA from serotypes

of *Bacillus thuringiensis* pathogenic to Lepidopteran and Dipteran larvae by Agarose gel electrophoresis. (Isolement et caractérisation partielle d'un DNA extrachromosomique à partir de sérotypes de *Bacillus thuringiensis* pathogènes pour des larves de Lépidoptères et de Diptères par électrophorèse sur gel d'agarose).

Extrachromosomal DNA molecules of 24 different *B. thuringiensis* strains were consistently isolated using a procedure which optimizes lysis of the normally lysozymes resistant vegetative cells. The results obtained can be summarized as follows :

1. Twenty-four strains of *B. thuringiensis* contained extrachromosomal DNA molecules of various sizes that were readily visualized with agarose gel electrophoresis and that ranged from 200 to 1 megadaltons (Mdal), depending on the strain.

2. A determination of the numbers of extrachromosomal DNA molecules based on agarose gel profiles revealed that there were 1 for *sotto* and *thompsoni*, 2 for *subtoxicus*, *entomocidus*, *ostrinae* and *darmstadiensis*, 3 for *dendrolimus* and *indiana*, 5 for *galleriae*, 6 for *canadensis*, *morrissoni*, and *israelensis*, 7 for *wuhanensis*, 8 for *kenyae*, *tolworthi*, and *pakistani*, 9 for *thuringiensis* (BA 068) and *dakota*, 10 for *toumanoffi*, 11 for *thuringiensis* Berliner, 13 for *alesti* and *aizawai* (juroi), 14 for *kyushuensis*, and 16 for *kurstaki* (HD-1). Such abundance and variety of extrachromosomal DNA elements is a rare phenomenon among bacterial species.

3. In serologically identical varieties (*thuringiensis* Berliner and *thuringiensis* BA 068, serotype 1 ; *sotto* and *dendrolimus*, serotype 4a, 4b ; *subtoxicus* and *entomocidus*, serotype 6), only serotype 6 strains show similar extrachromosomal DNA profiles and while a number of strains of *B. thuringiensis* have some extrachromosomal DNA elements in common, distinct differences can be observed in the DNA profiles between serotypes and even among strains of the same serotype.

IMANISHI S., YOSHITAKE N.

J. Sericult. Sci. Japan, 1981, 50(2), p.88-93. (J,j,e)

Deterioration in food value of the artificial diet for the silkworm, *Bombyx mori*, by the lighting. (Détérioration de la valeur nutritionnelle de l'aliment artificiel pour le ver à soie, *Bombyx mori*, par la lumière).

It has been known that the silkworm reared on artificial diet exposed to the light was undergrown. In the present paper, a deleterious factor for the silkworm development and growth which was produced in the diet after exposure to the light, was investigated. The results obtained were as follows.

1. Deterioration in food value by lighting was recognized more clearly in the diet containing mulberry leaf powder than in the semi synthetic diet.

2. The diet containing mulberry leaf powder exposed to the light showed almost similar food value to that containing the powder reserved in the dark.

3. The diet omitted soybean oil showed no deterioration in food value by lighting.

4. The diet containing the light-oxidized soybean oil was poor in food value.

5. The diet containing the crude lipids which had been extracted from the diet exposed to the light was low in food value.

6. Hydroperoxide value of the crude lipids extracted from the diet was increased proportionally to the light intensity and the exposure time applied to the diet.

From these results, it was concluded that the deterioration in diet value by lighting was due to the change of lipids in the diet containing mulberry leaf powder in the light into deleterious hydroperoxide for the silkworm growth.

INOKO H., KATSUKI M., WATANABE I.
Animal behaviour, 1981, 29, p.873.

Suppression of phototaxis in silkworm larvae. (Suppression de la phototaxie chez les chenilles de ver à soie).

INOUE H.
J. Sericult. Sci. Japan, 1981, 50(4), P. 311-319. (J,j,e).

Double infection of midgut epithelial cells with nuclear and cytoplasmic polyhedrosis virus. (Double infection des cellules de l'épithélium de l'intestin moyen avec des virus de la polyedrose nucléaire et cytoplasmique).

Double infection of a nuclear polyhedrosis virus (NPV) and a cytoplasmic polyhedrosis virus (CPV) were investigated histopathologically on the midgut in the silkworm, *Bombyx mori*.

Fifth-instar larvae were subjected to low temperature (5°C) for 24 hours after ecdysis and then administered with a mixed suspension of NPV and CPV, which formed a big CPV-inclusion body in the nucleus of columnar cell, and reared at 23°C. Double infection occurred in not a few columnar cells. Proteinaceous crystals of CPV and NPV were distinguishable by, (1) stainability to bromophenol blue after pretreatment with methanol and hot water, CPV-inclusion body was stained but not NPV-polyhedron, (2) size, and (3) crystal form. Both viruses were observed as being independent multiplication and fusion of two kinds of proteinaceous crystals was not occurred; however, lots of numbers of nucleocapsid of NPV attached to the surface of CPV-inclusion body, followed with incorporation of some of them into the inclusion body, and that was in contrast to NPV-polyhedron incorporating enveloped NPV and its empty envelopes.

ISOBE M., KONDO N., IMAI K., YAMASHITA O., GOTO T.
Agric. Biol. Chem., 1981, 45(3), p.687-692. (E,e)

Glucosyltyrosine in silkworm haemolymph as a transient metabolite of insects. (La glucosyltyrosine de de l'hémolymphe du ver à soie, métabolite fugace chez les insectes).

Trehalose, the major haemolymph sugar in the silkworm, is partly regulated in concentration by diapause hormone. During the course of our re-investigation on the developmental changes of sugars in polyvoltine silkworm pupae, a new sugar (Sugar-A) was found out at the late stage of pupal-adult development. The amount of Sugar-A was five times as much as that of trehalose at its maximum, but it disappeared almost completely with emergence. The structure of Sugar-A was determined as 8-glucosyl-O-tyrosine by 270 MHz PMR, FDMS and chemical methods. The physiological function of glucosyltyrosine is also discussed.

ITO T., INOKUCHI T.

J. Insect Physiol., 1981, 27, p.447. (E,e)

Nutritive effects of D-aminoacids on the silkworm *Bombyx mori*. (Effets nutritifs des D-amino acides chez le ver à soie *Bombyx mori*).

Nutritive effects of D-amino acids on the silkworm, *Bombyx mori*, were investigated by growth experiments using defined diets and also by analysis of free amino acids in the larval haemolymph. None of the D-forms of the usual ten essential amino acids could be utilized effectively, although D-methionine was utilized in lieu of the L-form only to a limited extent and D-histidine gave a position but smaller effect than D-methionine, D-Proline, its L-form being semi-essential for the silkworm, was not utilized. D-Leucine, and to a lesser extent D-alanine and D-serine, were found to be somewhat toxic. Comparison of free acid patterns in the haemolymph of the fifth-instar larvae, which fed on diets either lacking L-forms of histidine, methionine and leucine singly or including the D-forms singly in place of these L-forms, supported the results of the growth experiments.

IWANO H., ISHIHARA R.

J. Sericult. Sci. Japan, 1981, 50(4), p.276-281. (J,j,e)

Inhibitory effect of several chemicals against the hatch of *Nosema Bombycis* spores. (Effect inhibiteur de divers produits chimiques sur l'éclosion des spores de *Nosema Bombycis*).

Of nine kinds of chemicals tested, 0.001% solution of Hilite® (Potassium Dichloroisocyanurate) inhibited, immediately, after treatment, the hatch of *N. Bombycis* spores most effectively, followed by 0.1% of Benzenethonium Chloride, Cocktone® and One Stroke Embiron®. These chemicals hold their inhibitory effect on spores at room temperature, for 24 hours after preparation.

Feeding test of *N. Bombycis* spores with mulberry leaves showed spores treated with Hilite® lost their infectivity to the silkworm. Hilite® did not retard the growth of the silkworm larvae when fed with leaves at the concentration of 0.1%.

KAGEYAMA T., TAKAHASHI S.Y., OHOKA T., OHNISHI E.

Develop. Growth Differ., 1980, 22, p.859. (E,e)

Polyol accumulation in *in vitro* system of *Bombyx* eggs. (Accumulation de polyols dans les systèmes *in vitro* d'oeufs de ver à soie *Bombyx*).

KAGEYAMA T., TAKAHASHI S.Y., TAKAHASHI K.

J. Biochem. (Tokyo), 1981, 90, p.665.

Occurrence of thiol proteinases in the eggs of the silkworm, *Bombyx mori*. (Présence de thiol-protéinases dans les oeufs du ver à soie *Bombyx mori*).

KAI H., KATO J., NIINO T., KAWAI T.

J. Sericult. Sci. Japan, 1981, 50(2), p.109-114. (J,j,e)

Three esterase A members in relation to diapause development in *Bombyx* eggs. (Relation entre trois estérases A et la mise en place de la diapause dans les oeufs de *Bombyx*).

An increase of esterase A (Ease A) during chilling of diapause eggs

may be a kind of activity that occurs during the diapause stage in preparation for resumption of morphogenesis or diapause development. The present work describes the further separation of the Ease A by an iso-electric focusing (I.E.F) and, from consideration of the separated members, gives an indication of the diapause development in *Bombyx* eggs.

The esterase A obtained by starch-gel electrophoresis was separated into five members (Ease A1-5) by the IEF. Three of them, Ease A2, A3 and A4, exhibited appreciable changes in the activities during chilling; such changes were not observed in unchilled diapause eggs. The activities of Ease A2-4 increased after 25 days of chilling with a steep rise and reached the maximum after 30 days of chilling. Then the activity decreased sharply, and after 40 days of chilling to almost the same activity as before the chilling. The establishment of hatchability by chilling was achieved after the Ease A2-4 activity had reached the maximum level.

These results suggest that Ease A2-4 might be responsible for the increase of Ease A activity during chilling.

KAI H., KAWAI T.

J. Insect. Physiol., 1981, 27, p. 623-627. (E,e).

Diapause hormone in *Bombyx* eggs and adult ovaries. (L'hormone de diapause dans les oeufs et les ovaires des adultes de *Bombyx*).

An extraction method using Triton-X-100 was successful in yielding active extracts of diapause hormone both in adult ovaries and laid eggs, as well as from mature unladen eggs. The extracts induced normal diapause eggs which underwent diapause. The extracts also exhibited activity when injected into pupae with the suboesophageal ganglion removed. The percentage of diapause eggs laid was dependent upon the amount of extract administered. The activity occurred exclusively in diapause ovaries or eggs and was not found significantly in non-diapause ovaries or eggs. By partition between butanol and water, the hormonal activity was recovered in butanol. Sephadex-LH-20 chromatography located the activity in the same fraction as that of diapause hormone.

The data suggest that diapause eggs and ovaries contain the diapause hormone in a bound form.

KATO M.

J. Sericult. Sci. Japan, 1981, 50(4), p. 343-344. (J) short rep.

Efficiency count of silkworm eggs by colony analyzer. (Comptage satisfaisant des oeufs de ver à soie par un analyseur de colonies).

KATO S.

J. Sericult. Sci. Japan, 1981, 50(2), p.77-82. (J,j)

On a protease dissolving the peritrophic membrane of the silkworm *Bombyx mori*, obtained from culture medium of *Aeromonas* sp. (Une protéase dissolvant la membrane péritrophique du ver à soie *Bombyx mori*, obtenue à partir d'un milieu de culture d'*Aeromonas* sp.).

KATO Y., NAKAYAMA S., TAKEUCHI T.

J. Sericult. Sci. Japan, 1981, 50(4), p. 347-348. (J) Short rep.

Existence of glycoprotein in haemolymph albumin fraction of the silkworm, *Bombyx*

mori. (Existence d'une glycoprotéine dans la fraction albuminique de l'hémolymphe du ver à soie, *Bombyx mori*).

KATSUNO S., TAMAZAWA S.

Appl. Entomol. Zool., 1981, 16(1), p.48.

Histological observations of the ovary in the Vth instar larva of triploid silkworm, *Bombyx mori* L. (Observation histologique des ovaires des chenilles du Vme âge de vers à soie triploïdes, *Bombyx mori* L.).

KAWAMURA N., NAKADA T.

Jpn. J. Genet., 1981, 56, p.249-256. (E,e)

Studies on the increase in egg size in tetraploid silkworms induced from a normal and a giant-egg strains. (Etude de l'augmentation de la taille de l'oeuf chez des vers à soie tétraploïdes provenant d'une souche normale et d'une souche à oeufs géants).

Deposition of large size eggs by tetraploid females of the silkworm has been reported by many investigators, while no detailed analyses have been carried out on the cause of the increase in egg size due to chromosome doubling. In this insect, a sex-linked gene called "Giant egg (*Ge*)" is known, and the diploid females with *Ge*-gene lay remarkably large size eggs.

In the present study, tetraploid females of F_1 hybrids which do or do not carry *Ge*-gene were induced by applying a low-temperature treatment, and the effect of the chromosome doubling was compared to that of the doubling of *Ge*-gene on egg size. Eggs of the tetraploid females for both hybrids showed a remarkable increase in size, although the increment was relatively small in the females with the double *Ge*-gene dose. Furthermore, especially large eggs laid by some of the *Ge*-progeny were all unfertilized. The results suggested the possibility of a limitation of egg size increase in the silkworm.

KIM S.E., SHIKATA M., KAI H.

J. Sericult. Sci. Japan, 1981, 50(2), p.94-100. (J,j,e)

Egg-shell lipids in relation to water evaporation and diapause in the silkworm, *Bombyx mori*. (Les lipides chez le ver à soie *Bombyx mori*, en relation avec l'évaporation d'eau et la diapause).

Lipids of egg-shell and egg-content were analysed from a point of view of water evaporation through the egg-shell and the silkworm diapause.

1. In diapause eggs the lipid concentration in egg-content was about 70mg per g eggs throughout from 2 hr to 40 days after oviposition. On the other hand, that in developing eggs decreased after oviposition until hatching, especially in the latter half of the development ; that is, from 57 to 20mg and from 68 to 32mg in the non-diapause and HCl-treated eggs, respectively. The lipid concentration in egg-shell did not change significantly during the same period as mentioned above ; that is, 0.77~1.03mg, 0.49-0.60mg and 0.63-0.87mg per g eggs in diapause, non-diapause and HCl-treated eggs, respectively.

2. The lipid composition of egg-contents was not so complicated. The major one was triglyceride and minor ones were sterol ester, wax ester, free fatty acid, free sterol, diglyceride and phospholipid. On the con-

trary, that of egg-shell was more complex and composed of the major components of hydrocarbon, unidentified X1 and X2, and long chain alcohol in addition to those of egg-content.

3. Among these components, hydrocarbon, X1 and X2 concentrations in egg-shell showed different patterns between diapause, non-diapause and HCl-treated eggs. The X2 concentration in diapause egg-shell increased abruptly shortly after the oviposition and reached the maximum level, about 40 μg per g eggs, 6 days after oviposition, which was maintained for at least 70 days after oviposition. This, however, was not the case for non-diapause or HCl-treated eggs, in which no appreciable change was observed throughout the embryonic development, exhibiting the value of about 10 μg per g eggs.

4. The evaporation rate of water from diapause eggs was lower than that of non-diapause eggs shortly after the oviposition, and decreased according to the time lapse after oviposition. Thus, hydrocarbon, X1 and X2 in egg-shell seem to be related to diapause nature and, in addition, might be concerned with water evaporation.

KIMURA S.

J. Sericult. Sci. Japan, 1981, 50(2), p.101-108. (E,e,j)

The occurrence of chitinase in the alimentary canal of the silkworm, *Bombyx mori*. (La chitinase dans le tube digestif du ver à soie, *Bombyx mori*).

Development of chitinolytic enzymes in the alimentary canal of *Bombyx mori* during the larval-pupal transformation was investigated. Chitinase activity was undetectable in the midgut epithelium and gut contents before the termination of spinning, rapidly appeared at pupation. The value for gut contents was 28-fold higher than that of tissue. Activities decreased thereafter. Chitinase including β -N-acetylglucosaminidase decreased with a U-shaped pattern in gut tissue, whereas gut contents showed 20-fold greater activity from the end of spinning to pupation. α -Mannosidase and β -galactosidase did not resemble to chitinase and chitinase in developmental pattern. The evidence suggests that chitinolytic enzymes in the gut epithelium transfer to lumen when activated. Gel filtration revealed that the chitinase may not be a lysozyme-like enzyme. The characteristic changes in amino sugar levels in the lumen coincided with chitinolytic activity.

KLUNOVA S.M., ALTSYBEEVA T.I., FILIPPOVICH Y.B.

Biochemistry (U.S.S.R.), 1980, 45, p.1553

Metabolism of ^{14}C Labeled soluble proteins of *Bombyx mori* at the concluding stage of larval development. (Métabolisme des protéines solubles de *Bombyx mori* marquées au ^{14}C au cours de la phase finale du développement larvaire).

KOBAYASHI M., KAWASE S.

Journal of Invertebrate Pathol., 1981, 38, p.4-11. (E,e)

Quantitative analysis of the metabolism in the isolated pupal abdomens of the silkworm, *Bombyx mori*, infected with nuclear polyedrosis virus. (Analyse quantitative du métabolisme dans les abdomens isolés des chrysalides du ver à soie *Bombyx mori*, infectés par le virus de la polyédrose nucléaire).

The rate of oxygen uptake and the amount of several main cell constituents were determined in NPV-infected and uninfected isolated pupal ab-

domens of the silkworm *Bombyx mori*. The oxygen uptake in uninfected isolated abdomens increases for the first 2 days due to the effect of water injection, but thereafter it remains almost unchanged at a relatively low level. When isolated abdomens are infected with an NPV, the oxygen uptake increases markedly from 3 days postinfection onward, being about three times that of uninfected isolated abdomens at late stages of infection. The amounts of cell constituents analyzed in the present study change little in uninfected isolated abdomens throughout the experiment. Infection of NPV leads to a marked accumulation of both DNA and RNA, and a loss of glycogen. The amount of protein, lipid, and sugar are scarcely affected by NPV infection. These results indicate that the activity of metabolism in uninfected isolated abdomens is not only low but also stable, and that infection of NPV results in an activation of host cell metabolism. It is considered that such isolated pupal abdomens provide an excellent opportunity to analyze both the process of NPV replication and the alteration of host cell metabolism resulting from NPV infection.

KOBAYASHI T.

J. Agr. Chem. Soc. Japan, 1981, 55(2), p.137.

Organ culture of posterior silk glands of the silkworm. Examination of culture systems detectable for hormonal effects. (Culture d'organes du sécréteur de la glande séricigène du ver à soie. Etude de systèmes de cultures permettant de détecter les effets des hormones).

KOZLOV E.A., LEVITINA T.L., GUSAK OVANDER M.N., SEREBRYANY S.B.

Bioorganicheskaya Khimiya, 1981, 7, p.1008.

Composition of aminoacid sequences of inclusion body proteins of nuclear polyhedrosis viruses of *Bombyx mori*, *Porthetria dispar* and *Galleria mellonella*. (Séquence des acides aminés des protéines du corps des virus de la polyédrose de *Bombyx mori*, *Porthetria dispar* et *Galleria mellonella*).

KURODA S., SUMIOKA H., YOSHITAKE N.

J. Sericult. Sci. Japan, 1981, 50(3), p.175-179. (J,j,e)

Statistical analysis of growth curve of the silkworm, *Bombyx mori*, under restricted feeding by the index. (Analyse statistique de la courbe de croissance du ver à soie, *Bombyx mori*, sous alimenté).

The present study was undertaken to investigate statistically the the growth curve of the 5th instar silkworm larvae under a restricted feeding based on the body weight. An amount of mulberry leaves supplied was determined by multiplying body weight by indexes from 0.1 to 0.8, and this mulberry feeding was done twice a day. The logistic growth functions were fitted to the growth curves of each silkworm under a restricted feeding by the feed index. The estimated growth parameters (logarithm value of asymptotic weight, constant and rate) were computed for each feed index.

The logistic parameters on all indexes fitted roughly the observed growth curves. In these parameters especially the rates (K) at which a logarithmic function of weight changes lineally per unit of time were found to be proportional to the feed indexes. The index difference in the rate parameter was highly significant ($P < 0.01$). Also, there was a significant difference in the rate parameter ($P < 0.01$) between the races used. The rate of F_1 hybrid was higher than those of the parents. Therefore, the regime by the index feeding method is effectual to change the rate of the growth curve in the silkworm larvae.

LAVERSEAU L., LAHARGUE J., SURLEVE - BAZEILLE J.E.

Int. J. Insect Morphol. Embryol., 1981, 10(3), p.235-246. (E,e)

Ultrastructure of the 'organe rameux' of the silkworm *Bombyx mori* L. (Lepidoptera Bombycidae). (Ultrastructure de "l'organe rameux" du ver à soie *Bombyx mori* L. (Lepidoptera Bombycidae)).

The relatively unknown 'organe rameux' of *Bombyx mori* is a rather large organ, but its anatomical position and fragility made it inaccessible for classical surgical experiments. We have made a microscopic study, especially at the ultrastructural level. The main features described in this study are a basal lamina, a cortical zone with deep infoldings occluded by diaphragms, pinocytotic vesicles, tubular elements related to a class of vacuoles, and a central zone containing 2 other types of vacuoles. These observations support the homology with the nephrocytes. The name 'giant nephrocytes' is therefore proposed for this organ, the term solely implying a structural similarity.

MANCHEV M.

Animal Science, 1980, 17(8), p.104-109. (Bg,bg,e)

Tolerance of silkworm (*Bombyx mori* L.) against the insecticides sevin, votexit and BJ-58. (Tolérance du ver à soie (*Bombyx mori* L.) aux insecticides sevin, votexit et BJ-58).

The tolerance of silkworms against the insecticides sevin (0.3 %, 0.2 % and 0.1 %), votexit (0.15 %, 0.10 % and 0.05 %) and BJ-58 (0.07 %, 0.10 %, 0.15 %, 0.20 %, 0.30 % and 0.40 % water solutions) produced by FEB in the GDR, is tested.

It is established that silkworms of all ages die when they are fed on mulberry leaves besprinkled with sevin solutions of tested concentrations until the 15th day after the sprinkling. After 24 hours the besprinkled leaves are no more poisonous.

Votexit is poisonous for silkworm of I, II, III and IV growth cycles during a period of 8 days. Silkworms of Vth growth cycle are more susceptible, they die even on the 8th day, begin to creep and to draw out their silk on the 10th and 11th day after a single feeding with besprinkled mulberry leaves. On the 15th day, after a single feeding, they do not react; but after fourfold simultaneous feedings on such food, a small percentage of them die, the greater part showing signs of nervousness, drawing out their silk over the bedding.

BI-58, in doses of 0.07 % to 0.20 % is not toxic to silkworms, but a 0.30 % or 0.40 % solution delays their development and leads to production of thin-walled cocoons.

Tested preparations do not induce spontaneous nuclear polyhedral disease.

MANCHEV M., YANCHEV I.

Animal Science, 1980, 17(8), p.110-115. (Bg,bg,e)

Testing the protective effect of baculostatin on silkworms (*Bombyx mori* L.) infected with *B. Bombycis*. (Evaluation des effets protecteurs de la baculostatine sur des vers à soie (*Bombyx mori* L.) infectés par *B. Bombycis*).

The protective effect of the biguanide derivative Baculostatin, applied per os with the food of silkworms in their Vth growth cycle and

infected with *Baculovirus bombycis* in doses of 2.10^2 , 2.10^3 and 2.10^4 polyhedrons per ml of the medium, is tested. This effect is also tested pathohistologically against the spontaneous form of this disease, utilizing a provoking factor low temperature for a period of 20 h, the silkworms being fed immediately after the stress effect has ended.

It is established that baculostatin does not lower the mortality rate from polyhedral disease, both from its induced, as well as infectious form. It does not clearly reduce the lethal period.

The conclusion is drawn that baculostatin does not act directly upon the virus or on the virus replication, and consequently does not have virusostatic action.

MATSUBARA F., OHNISHI M., MATSUMOTO T., HAYASHIYA K.

J. Sericult. Sci. Japan, 1981, 50(4), 259-265. (J,j,e).

Studies on the application of rearing of the silkworm with aseptic method to sericulture. I. Groping for proper stage to transfer the larvae fed on artificial diet from aseptic to natural rearings from the view point of the resistivity to virus infection. (Etudes de l'application à la sericiculture de l'élevage du ver à soie en conditions axéniques. I. Recherche du moment favorable pour le transfert des chenilles élevées sur aliment artificiel des conditions axéniques à des conditions normales du point de vue de la résistance aux infections virales.

This report is concerning to grope the proper stage to switch over the artificial diet to mulberry leaves during larval raising period from the view point of susceptibility of the larvae to virus. About 200 thousands of silkworm larvae were reared on artificial diet in the bioclean room. Four groups of larvae were set and reared on artificial diet under aseptic state, during 1) 1st stage only, 2) 1st and 2nd stages, 3) 1st to 3rd stages, 4) 1st to 4th stages, respectively, and then reared naturally on mulberry leaves to final stage. Susceptibilities to virus infection were tested by means of A) cold treatment at 5°C for inclusion, B) oral administration, and C) subcutaneous injection of NPV, respectively.

Occurrence of the disease in the aseptic larvae fed on an artificial diet during early developmental stages, from the group 2) to the group 4), was lower than that in the larvae fed on mulberry for whole stages. In case of A), each larval group reared on artificial diet from the 1st to the 2nd, to the 3rd, or to the 4th instars showed lower induction rate in the order than the larvae reared naturally on mulberry leaves. In the case B) and C), however, the susceptibilities to NPV administrated increased in the decreasing order of raising period on mulberry leaves.

It was concluded from these data that the stage to transfer the larvae fed aseptically on artificial diet to natural state should be the 3rd or 4th instar.

MATSUBARA F., OHNISHI M., MATSUMOTO T., HAYASHIYA K.

J. Sericult. Sci. Japan, 1981, 50(4), p. 266-270.

Studies on the application of aseptic rearing method of silkworm to sericulture. II. Effect of multiple rearing on the susceptibility of virus infection of the silkworm larvae fed on artificial diet for younger stages. (Etudes de l'application à la sériciculture de l'élevage du ver à soie en conditions axéniques. II. Effet des élevages multiples sur la sensibilité aux infections virales des chenilles élevées sur aliment artificiel durant les premiers âges).

Susceptibilities to virus infection of the silkworm larvae which had

been reared aseptically on an artificial diet for younger stages and then transferred to rear on the mulberry leaves were examined. This investigation was carried out six rearing times a year.

1) Virus susceptibilities of the larvae to oral administration and subcutaneous injection with a nuclear polyhedrosis virus (NPV) did not vary through rearing seasons of a year.

2) The occurrence of disease by administration of a cytoplasmic polyhedrosis virus (CPV) was low.

3) The larvae which had been fed on artificial diet in the bioclean room for younger stages grew normally after they were transferred to the mulberry leaf feeding without any effect of seasonal variation in the quality of mulberry leaves.

MATSUZAKI K., FUNABASHI H.

Biochem. Biophys. Res. Commun., 1981, 100, p.1272-1277. (E,e)

Isoaccepting tRNAs of posterior silk gland of mutant *Bombyx mori*. (tRNA isoaccepteurs de la partie postérieure de la glande séricigène d'un mutant de *Bombyx mori*).

The amino acid acceptor activities and the electrophoretic patterns of tRNAs from the normal posterior silk gland producing fibroin and from the posterior silk gland of mutant (symbolized as Nd-s) which secretes little fibroin were compared. The tRNA from the normal silk gland incorporated much (^{14}C) glycine and (^{14}C) alanine, and less (^{14}C) leucine and (^{14}C) lysine, which reflects the amino acid composition of fibroin. However, this was not observed with the silk gland tRNA of the Nd-s mutant of the silkworm. In the case of two-dimensional electrophoresis of the silk gland tRNA of the Nd-s mutant, fewer isoacceptors were recognized compared with tRNA from the normal silk gland, especially regarding isoacceptors of glycyl-, and alanyl-tRNAs.

MAZDA T., TSUTSUE M., SAKATE S., DOIRA H.

Japan J. Genet., 1981, 56, p.19.

Studies on the genetical and biochemical properties of the kiuki mutant of the silkworm *Bombyx mori*. (Etude des caractéristiques génétiques et biochimiques du mutant kiuki du ver à soie *Bombyx mori*).

MIZUTANI J., KOIKE S., IIZUKA T.

J. Chem. Soc. Japan, 1981, 5, p.645-651. (J,j,e)

A defense mechanism against the pathogenic bacteria in the digestive tract of silkworm larvae. (Un mécanisme de défense contre les bactéries pathogènes dans le tube digestif des larves de ver à soie).

One of the serious diseases of silkworm larvae reared on the artificial diets without antibiotics is the bacterial disease caused by abnormal multiplication of the intestinal bacteria, especially *Streptococcus* spp. However, the larvae fed on mulberry leaves under sanitary conditions are not practically attacked by the bacterial disease. This fact leads to an idea that the antibacterial substances derived from mulberry leaves must control the growth of the pathogenic bacteria in the midguts of larvae.

The authors have found that the digestive juice of the larvae contains 3,4-dihydroxycinnamic acid (Caffeic acid, CA), and that the concentration of CA is varied with starvation time. The concentrations, 460 and 222 ppm

of CA in the juices starved for 1 and 2 h, respectively, were found to be enough to exhibit the antibacterial activity. It has been clarified that CA is liberated from the reaction of chlorogenic acid (ChA) in mulberry leaves with an enzyme of the digestive juice *in vitro*. The authors found ChA in about 0.35 % of dry weight of the leaves by GLC or about 0.5 % by TLC. In the culture medium of pH 10.0 CA showed remarkable inhibitory action at the level of 500 ppm against *S. faecalis*, while at pH 7.0, the same concentration was not effective in depressing the bacterial growth. It has been suggested that CA is converted into a real antibacterial substance, caffeoquinone, by base catalyzed oxidation in alkaline medium (pH 10.0). Synergistic actions between CA and ChA or CA and p-2,3-diaminopropionic acid (DAPA) are discussed.

MORI M.

J. Sericult. Sci. Japan, 1981, 50(4), p. 320-328. (J,j,e).

Toxic substance in the leaves of fig, *Ficus carica* L., against larvae of the silkworm, *Bombyx mori*. (Une substance extraite des feuilles de figuier, *Ficus carica* L., toxique pour les chenilles de *Bombyx mori*).

Psoralen was isolated and identified in the leaves of fig, *Ficus carica* L., as a toxic substance against larvae of the silkworm, *Bombyx mori*. Larval growth was strongly retarded by feeding the artificial diet containing 1.0 mg/g dry diet of this compound. When the fifth-instar larvae were injected with 200 g of psoralen per individual, all the test animals died in a day. In addition to the toxic effect, this chemical exhibited the feeding inhibitory effect against the silkworm at the concentration of 0.3 mg/g dry diet.

MORISAKI M., YING B., IKEKAWA N.

Experientia, 1981, 37, p.336. (E,e)

Identification of both fucosterol and isofucosterol in the silkworm *Bombyx mori*. (Identification du fucostérol et de l'isofucostérol chez le ver à soie *Bombyx mori*).

NISHIMURA M., SANO Y.

Appl. Entomol. Zool., 1981, 16(2), p.79-87.

Studies on the neurosecretory cells in the silkworm *Bombyx mori* (Lepidoptera Bombycidae). 3. Ultrastructural differences of neurosecretory cells of brains of male and female pupae. (Etude des cellules neurosécrétrices du ver à soie *Bombyx mori* (Lepidoptera Bombycidae). 3. Différences dans l'ultrastructure des cellules neurosécrétrices du cerveau des chrysalides mâles et femelles).

The ultrastructure of neurosecretory cells in the pars intercerebralis were investigated in female and male pupae of the silkworm, *Bombyx mori*. The neurosecretory cells were classified into three types : type I, II and III, as in larvae. Only in type I cells of male pupae showed ultrastructure of the cytoplasmic change drastically from that observed in larvae. Type I cells in females were quite similar to those in larvae. Some type I cells in males 3 and 6 days after pupation showed degenerated structures, as if their neurosecretory functions were ceased. Cytoplasmic matrix decreased remarkably and neurosecretory granules decreased in their number, size and electron density. The cisternae of rER were considerably enlarged. In addition, the glial cell perikarya and glial processes which surround type I cells degraded or disappeared, resulting

in the exposure of type I cells to the hemocoel. Cells of type II and type III of both sexes, however, showed no alteration in structure. On the other hand, type I cells in females exhibited characteristics of active neurosecreting cells in both 3 and 6 day pupae and showed no degenerated structural alterations. The probability that type I cells of female pupae are involved in the production of the gonadotropic hormone is discussed in detail.

OKAZAKI T., YAMASHITA O.

J. Sericult. Sci. Japan, 1981, 50(3), p.190-196. (J,j,e)

Changes in glucose and fructose contents during embryonic development of the silkworm, *Bombyx mori*. (Evolution de la teneur en glucose et en fructose au cours du développement embryonnaire du ver à soie, *Bombyx mori*).

It is conceived that storage forms of the carbohydrates change according to the developmental stages of the eggs. To see the metabolic correlations between the reserved and intermediary forms, sugars were analyzed quantitatively by a gas chromatography during the embryonic development of silkworms.

Glucose, fructose, inositol and ribose as well as trehalose were clearly found in the eggs and showed a different changing pattern during the embryonic development each other. In both non-diapause and diapause types of eggs glucose became to be higher on the later stages when trehalose disappeared and inositol content rose gradually in the course of embryonic development. While fructose clearly increased at the early phase just after the termination of diapause when sorbitol was utilized abruptly. A low but significant level of ribose was observed throughout the embryonic life.

From these results the intermediary metabolism of carbohydrates was discussed with regard to embryonic development of silkworms.

ONGARELLI M.G., SILVA D.M., GATTI DE ALMEIDA I.M.

Turrialba, 1980, 30(4), p.421-426. (Pt,pt,e)

Dimensions of particles of the nuclear polyhedrosis virus (NPV) from *Anticarsia gemmatilis* Hübner to *Bombyx mori* L. (Dimensions des particules de virus de la polyédrose nucléaire (VNP) d'*Anticarsia gemmatilis* Hübner à *Bombyx mori* L.).

PEACOCK A.J.

Comp. Biochem. Physiol., 1981, 69, p.133-136. (E,e)

Distribution of $(Na^+ + K^+)$ -ATPase activity in the mid and hind-guts of adult *Glossina morsitans* and *Sarcophaga nodosa* and the hind-gut of *Bombyx mori* larvae. (Répartition de l'activité de la $(Na^+ + K^+)$ -ATPase dans l'intestin moyen et postérieur de *Glossina morsitans* et de *Sarcophaga nodosa* et dans l'intestin postérieur des chenilles de *Bombyx mori*).

1. The distribution of, a ouabain sensitive, Mg^{2+} dependent, $(Na^+ + K^+)$ activated ATPase has been determined in the mid- and hind-guts of adult *Glossina morsitans* and *Sarcophaga nodosa* and in the hind-gut of *Bombyx mori* larvae.

2. In *G. morsitans*, $(Na^+ + K^+)$ -ATPase activity was highest in the anterior mid-gut, lowest in the posterior region of this organ and was intermediate in the hind-gut.

3. In the *S. nodosa*, $(Na^+ + K^+)$ -ATPase activity was low in the mid-gut and ileum but high in the rectum.

4. In *B. mori*, $(Na^+ + K^+)$ -ATPase activity could not be demonstrated in either the ileum or rectum. The significance of these findings is discussed.

PETKOV M.

Animal Science, 1981, 18(1), p.87. (Bg,bg,e)

Utilization of mulberry leaves by some hybrid silkworms. (Utilisation des feuilles de mûrier par des vers à soie hybrides).

The study is carried out at the Sericulture Experiment Station in Vratsa with some hybrid silkworms approved for distribution in specific regions.

It is established, that as regards yield of cocoons and silk cover, the J-124 x C-122 and Hessa-2 x Hessa-1 hybrid silkworms are most productive. These hybrid silkworms use least quantity of mulberry leaves per kg of cocoons and silk cover while Super-2 x Super-1 and Super-1 x 157-K hybrid silkworms - greatest quantity.

Hybrid silkworms J-124 x C-122 and Hessa-2 x Hessa-1 are on the first place as regards yield of cocoons and silk cover and hybrid silkworms Hessa-1 x Hessa-2 and Hessa-2 x Hessa-1, Vratsa-1 x Vratsa-2 - as regards yield obtained from 1 kg mulberry leaves actually eaten. Least quantity of cocoons and silk cover from 1 kg actually eaten mulberry leaves is obtained from Super-2 x Super-1 and Super-1 x 157-K hybrid silkworms.

RAMAKRISHNAN V., DSOUZA S.F.

Experientia, 1981, 37, p.800.

Localization of sucrase activity in the cocoon of *Bombyx mori*. (Localisation de l'activité de la sucrase dans le cocon de *Bombyx mori*).

Enzymes capable of hydrolyzing sucrose, trehalose, lactose and cellobiose were detected in the cocoon of *Bombyx mori*. Sucrase activity was found to be highest and was present only in the outermost layer of the cocoon.

SACCHI V.F., CATTANEO G., CARPENTIERI M., GIORDANA B.

J. Insect Physiol., 1981, 27(3), p.211-214. (E,e)

L-Phenylalanine active transport in the midgut of *Bombyx mori* larva. (Transport actif de la L-Phénylalanine dans l'intestin moyen des chenilles de *Bombyx mori*).

L-phenylalanine and α -aminoisobutyric acid are actively transported from the lumen to the haemolymph in the isolated midgut of *Bombyx mori* larva. Kinetics of L-phenylalanine fluxes as a function of concentration have been studied. The influx shows a convex relationship to the amino-acid concentration, while the outflux bears a linear relationship within the range of concentrations considered. The net flux shows a saturation kinetic, is sodium independent and is inhibited by DNP and anoxia. L-phenylalanine pools obtained by luminal or haemolymph loading are similar and no intracellular accumulation of the aminoacid takes place. Conversely the amount of α -aminoisobutyric acid entering the cells through the basolateral membrane exceeds that of luminal origin and it reaches an intracellular concentration twofold higher than that of the bathing medium.

SAKAMOTO E., HORIE Y.

J. Sericult. Sci. Japan, 1981, 50(3), p.197-205. (E,e,j)

Polyol phosphate dehydrogenase in the hemolymph of the silkworm, *Bombyx mori*.
(La polyol-phosphate-déshydrogénase dans l'hémolymph du ver à soie *Bombyx mori*).

In the present experiment, the polyol phosphate dehydrogenase of the hemolymph of the silkworm larvae was purified 240 fold and the enzymatic properties were determined. Furthermore; the change in enzyme activity in hemolymph was determined during larval-pupal development.

The optimal pH for the enzyme was 7.0 and the enzyme required NADPH as a cofactor specifically. The polyol phosphate dehydrogenase catalyzed reduction of G-6-P, F-6-P and R-5-P, and oxidation of S-6-P.

The Km values of this enzyme for G-6-P, S-6-P and NADP were 1.0×10^{-2} M, 1.1×10^{-1} M and 1.1×10^{-5} M, respectively. The enzyme was activated by Ca^{++} and Mn^{++} , but inhibited by Mg^{++} .

Molecular weight of this enzyme was about 30,000. The enzyme activity was increased in the latter half of the 5th instar and then decreased quickly during spinning and pupal stages. The metabolic significance of polyol phosphate dehydrogenase was briefly discussed in connection with S-6-P level in hemolymph.

SASAKI S., NAKAJIMA E., FUJII-KURIYAMA Y., TASHIRO Y.

J. Cell Science, 1981, 50, p.19 (E,e)

Intracellular transport and secretion of fibroin in the posterior silk gland of the silkworm *Bombyx mori*. (Transport intracellulaire et sécrétion de la fibroïne dans la partie postérieure de la glande séricigène du ver à soie *Bombyx mori*).

Intracellular transport and secretion of fibroin in the posterior silk gland cells of the silkworm, *Bombyx mori*, were investigated in relation to the radial microtubule and circular microtubule-microfilament systems of the cells.

The silk glands were pulse-labelled for 3 min with [^3H] glycine *in vitro* and then chased in media containing excess cold glycine and in some cases antimitotic reagents (colchicine or vinblastine) or cytochalasin (B or D), and the flow of the label in the glands was investigated by radioautography. It was revealed that the label initially located over the rough endoplasmic reticulum subsequently moves to the Golgi bodies to be condensed there. The secretory granules of fibroin or fibroin globules thus formed are transported via the radial microtubule system to the apical cytoplasm to be secreted there under some regulation by the circular microtubule-microfilament system. In the presence of colchicine or vinblastine, the secretion of fibroin was suppressed and marked accumulation of fibroin globules in the Golgi regions was observed, while in the presence of cytochalasin B or D the secretion was accelerated and extensive invagination of the luminal surface, which was probably due to the serial exocytosis of fibroin globules, was observed. These results suggest that the radial microtubule system and the circular microtubule-microfilament system are responsible for intracellular transport of fibroin globules from Golgi bodies to the apical cytoplasm and secretion by exocytosis at the luminal surface, respectively.

SATO R., KOBAYASHI M., WATANABE H., FUJIWARA T.

J. Sericult. Sci. Japan, 1981, 50(3), p.180-184. (J,j,e)

Serological discrimination of several kinds of microsporidian spores isolated

from the silkworm *Bombyx mori*, by an indirect fluorescent antibody technique. (Discrimination sérologique de plusieurs types de spores de microsporidies isolées du ver à soie, *Bombyx mori*, à l'aide d'une technique utilisant un anticorps à fluorescence indirecte).

Nosema bombycis and seven kinds of microsporidia isolated from the infected silkworm were used in the present study. These microsporidia were different in the pathogenicity, the target tissue, and the spore morphology. However, indirect fluorescent antibody tests of these microsporidian spores revealed that the four of them were serologically the same with *N. bombycis*, suggesting they belonged to the common species. On the contrary, the other three microsporidian spores reacted only with each homologous antiserum. These results indicated that the indirect fluorescent antibody test of spores seemed to be one of the most useful methods for species discrimination of microsporidia being infectious to the silkworm.

SATO Y., SUGIYAMA H.

J. Sericult. Sci. Japan, 1981, 50(4), p. 349-350. (J) Short rep.

Residue of Acephate (O,S-dimethyl-N-acetyl phosphoroamidethioate) on mulberry leaves and its effects on the silkworm, *Bombyx mori* L. (Résidus d'Acephate (O,S-diméthyl-N-acetyl phosphoroamidéthiodate) sur les feuilles de mûrier et leur effet sur le ver à soie, *Bombyx mori* L.).

SATO Y., SUGIYAMA H.

J. Sericult. Sci. Japan, 1981, 50(4), p. 351-352. (J) Short rep.

Residue of Propaphos (O,O-di-n-propyl O-4 methylthiophenyl phosphate) in potted mulberry tree treated with the granular formulation and its effect on the silkworm, *Bombyx mori* L. (Résidus de Propaphos (O,O-di-n-propyl O-4 méthylthiophenyl phosphate) sur des mûriers en pots traités avec des granulés et leur effet sur le ver à soie, *Bombyx mori* L.).

SEONG S.I.

Appl. Entomol. Zool., 1981, 16(2), p.138-148.

Changes of proteins and nucleic acids during metamorphosis in the midgut of the silkworm, *Bombyx mori* (Lepidoptera Bombycidae). (Evolution des protéines et des acides nucléiques de l'intestin moyen au cours de la métamorphose chez le ver à soie *Bombyx mori* (Lepidoptera Bombycidae)).

SHIBUKAWA A., AKAI H.

J. Sericult. Sci. Japan, 1981, 50(2), p.73-76. (J,J,e)

Effect of Manta on the silk production of a silkworm race producing heavy cocoon shells. (Effets du Manta sur la production de soie d'une race de ver à soie à forte production soyeuse).

We administrated Manta to determine its effects on silk production in a silkworm race characterized by heavy cocoon shells. In the control animals, the average cocoon shell weight of both female and male was 72.4 cg. However, in Manta-treated animals, the average weight rose to 84.1 cg. Several heavy cocoons exceeding 1 g appeared in treated females, and 90 cg in the case of the males. However, the ratio of cocoon shell weight exceeded 30 per cent in males. The ability of silk production

in *Bombyx* larvae was discussed from view points of the genetical characters and hormonal conditions.

SHIMIZU I., KITABATAKE S., KATO M.

J. Insect Physiol., 1981, 27, p.593-599. (E,e)

Effect of carotenoid deficiency on photosensitivities in the silkworm *Bombyx mori*. (Effets de la carence en caroténoïdes sur la photosensibilité du ver à soie *Bombyx mori*).

The silkworm, *Bombyx mori*, was reared aseptically on a synthetic diet with and without β -Carotene and the effects of carotenoid and vitamin A deficiency on photosensitivities in larval phototaxis, visual function and adult eclosion were studied.

β -Carotene or vitamin A acted as a growth-promoting factor in continuous darkness and under photoperiodic conditions. The deficiency of β -carotene decreased the larval phototactic response as growth proceeded. The offspring larvae from eggs laid by β -carotene-deficient moths also lost the phototactic response, but successive rearing with dietary β -carotene or vitamin A re-established the response. The deficiency of β -carotene caused the loss of the electric response by light stimuli in the ocelli of the fifth instar larvae and the compound eyes of adults moths. These results indicate that vitamin A is essential for visual function in the silkworm, as reported in other insects. The lack of carotenoid did not affect the development of the pupae or the specific time of eclosion which is regulated by a photoperiodic condition of pupal stage. This observation suggests that the carotenoid and its derivative are not involved in photoreception for the entrainment of the adult eclosion of the silkworm.

SREEKANTASWAMY H.S., SIDDALINGAIAH K.S.

Fette Seifen Anstrichm., 1981, 83(3), p.97-99. (E,e,d)

Sterols and fatty acids from the neutral lipids of desilked silkworm pupae (*Bombyx mori* L.). (Les stérols et les acides gras de la fraction lipidique neutre des chrysalides de ver à soie (*Bombyx mori* L.)).

SREEKANTASWAMY H.S., SIDDALINGAIAH K.S.

Fette Seifen Anstrichm., 1981, 83(7), p.279-281. (E,e,d)

Composition of glycolipids and phospholipids of desilked silkworm pupae oil (*Bombyx mori* L.). (Composition en glycolipides et phospholipides de l'huile de chrysalides de ver à soie (*Bombyx mori* L.)).

SUDO M., SHO Y., OKAJIMA T.

J. Sericult. Sci. Japan, 1981, 50(4), p. 306-310. (J,j,e).

The relation between the leaf quality at different leaf order and silkworm growth or cocoon quality. (2). (Relation entre la qualité des feuilles provenant de différents niveaux et la croissance des vers à soie ou la qualité du cocon).

The quality of mulberry leaves of different nitrogen nutrition was compared by rearing silkworm larva singly. The mulberry plants were cultivated under different conditions ; the one 45 kg the 15 kg of nitrogen/10a/year. The leaf was picked by each leaf order in the late autumn and supplied to individual silkworm.

1. There existed a linear regression equation with significant minus correlation between the leaf order and the silkworm body weight, the cocoon weight, or the cocoon shell weight.
2. There existed a significant minus correlation between the nitrogen content in the leaf and the leaf order.
3. A highly significant correlation was found between the nitrogen content in leaf and the silkworm body weight, the cocoon weight, or the cocoon shell weight.

SUN Y.K., WU A.Z., DAI R.M., SHEN X.R.
Scientia Sinica, 1981n 24, p.684.

Synthesis of structural proteins in a cell free system directed by silkworm cytoplasmic polyhedrosis virus messenger RNA synthesized *in vitro*. (Synthèse dans un système acellulaire des protéines de structure dirigée par un RNA messager du virus de la polyèdrose synthétisé *in vitro*).

The mRNA of the cytoplasmic polyhedrosis virus of the silkworm *Bombyx mori* is synthesized *in vitro* in milligram quantities in the presence of the virion associated RNA polymerase. The mRNA is isolated from the reaction mixture through a column of DEAE-Sephadex A-25 and is shown to consist of nine segments by 2.5 % polyacrylamide gel electrophoresis. The protein synthesis directed by this mRNA is investigated in a cell-free translation system prepared from wheat germ using tritium-labelled amino acids. The translation products show immuno-cross reactions with the antiserum to the cytoplasmic polyhedrosis virus of silkworm. These results demonstrate that the mRNA synthesized *in vitro* contains the messages of the genome of CPV (CPV = cytoplasmic polyhedrosis virus).

TAKAMIYA K., KOBARI Y., SHIBUKAWA A.
J. Sericult. Sci. Japan, 1981, 50(3), p.215-216. (J) (short rep.)

Rearing of the silkworm races of high productive cocoon shell on artificial diet. (Elevage de races de ver à soie à haute production de soie sur aliment artificiel).

TAKESHITA H., KURATA K., SHIGEMATSU H.
J. Sericult. Sci. Japan, 1981, 50(4), p. 329-334. (J,j,e).

Quantitative change of nucleic acids in the posterior silk gland caused by reduction of diet for the silkworm, *Bombyx mori*. (Evolution quantitative des acides nucléiques dans la partie postérieure des glandes séricigènes consécutive à une réduction de l'alimentation chez le ver à soie, *Bombyx mori*).

The silkworm larvae were fed on mulberry leaves during the first 3.5 days of the fifth instar, then and after that time they had a forced starvation ; or they were allowed to feed for only 6 hours per day throughout their fifth instar life. They were then subjected to a determination of the growth and nucleic acids of the posterior silk gland.

The larvae with reduced diet could grow up to be about a half size in the body and in the posterior silk gland. Larvae under forced starvation stopped growing just after cut of feeding. Liquid silk expressed as the dry matter of the anterior and middle silk gland was accumulated far less in the experimental than in the control worms.

Reduction of diet had little effect on the replication of DNA, but complete cut of feeding after the fourth day caused a degradation of DNA. RNA was accumulated in the larvae with reduced diet by almost 70 % of the control. Starvation led to a decrease of RNA accumulation soon

after the cut of feeding.

The quality of cocoons produced by the fasted worms were inferior, and also, the efficiency of RNA for silk production of them was calculated approximately half of the control.

TANAKA S.

J. Sericult. Sci. Japan, 1981, 50(2), p.115-119. (J,j)

Spread of a nuclear polyhedrosis in silkworm rearing on an artificial diet (continued). (Propagation d'une polyèdrose nucléaire dans un élevage de ver à soie sur aliment artificiel (suite)).

TOJO S., KIGUCHI K., KIMURA S.

J. Insect Physiol., 1981, 27, p.491. (E,e)

Hormonal control of storage protein synthesis and uptake by the fat body in the silkworm *Bombyx mori*. (Contrôle hormonal de la synthèse et de l'assimilation de protéines de réserve par le corps adipeux chez le ver à soie *Bombyx mori*).

The female silkworm, *Bombyx mori*, rapidly accumulates two storage proteins, that are synthesized by the fat body, in the haemolymph during the feeding stage of the last-larval instar, and then sequesters them from the haemolymph into fat body during the larval-pupal transformation.

The rapid synthesis and uptake of storage proteins by the fat body are shown to be induced by allatectomy in the early-penultimate larval instar. A juvenile hormone analogue, methoprene, is highly effective in inhibiting the allatectomy-induced synthesis, and, in a higher dosage, further blocks the uptake. Allatectomy in the late-penultimate larval instar shortly before moulting does not enhance the storage protein synthesis, but causes the uptake to occur two days earlier in the last-larval instar. Injection of 20-hydroxyecdysone is not stimulatory for synthesis of the proteins, but is effective to induce their uptake. Starvation during the early last-larval instar completely blocks the synthesis.

From these results, it is suggested that storage protein synthesis is induced in the absence of juvenile hormone by some supplementary stimulus, possibly the supply of nutrient after feeding, and uptake is induced by ecdysteroids after a decline in the juvenile hormone level.

UCHIDA Y., HAYASHIYA K.

Japan. J. Appl. Entomol. Zool., 1981, 25(2), p.94-100. (J,e)

Biosynthesis of a red fluorescent protein (RFP) in the digestive juice of the silkworm larvae, *Bombyx mori* L. (Lepidoptera Bombycidae). Formation of a Chlorophyllide-a-Midgut Protein Complex. (Biosynthèse d'une protéine à fluorescence rouge (RFP) dans le suc digestif des chenilles de *Bombyx mori* L. (Lepidoptera Bombycidae). Formation d'un complexe chlorophyllide-a-protéine de l'intestin moyen).

WAGO H.

Dev. & Comp. Immunology, 1981, 5, p.217. (E,e)

The role of hemolymph in the initial cellular attachment to foreign cells by the hemocytes of the silkworm *Bombyx mori*. (Le rôle de l'hémolymphé dans la fixation cellulaire initiale des hémocytes du ver à soie *Bombyx mori* aux cellules étrangères).

WASHIDA S.

J. Sericult. Sci. Japan, 1981, 50(2), p.134-140. (J,j,e)

Photoperiodic control of young silkworm larvae reared on an artificial diet. I. Relationship between the light-dark rhythm and the molting time. (L'environnement lumineux des jeunes chenilles de vers à soie élevés sur aliment artificiel. I. Relation entre le rythme lumière-obscurité et le moment de la mue).

In the mass rearing of silkworm larvae on an artificial diet, molting occurs sometimes over 2 days, and the delayed growth gives some trouble in rearing. In order to get the uniform larval growth, photoperiodic control was tried in the rearing of this insect.

1. When the larvae were reared under a 12L : 12D photoperiod cycle, the larval apolysis and ecdysis occurred at the scotophase and the photophase. The rates of molting showed a single peak or two peaks according to the time when the scotophase began.

2. The molting initiation was shown to be determined by the scotophase before one cycle, but photoperiods had no appreciable effect on time of larval molting.

3. Feeding periods and diet compositions caused to change the induction time of molting depending on light-on and light-off cycle.

4. Considering these results, some discussions were made on the photoperiodic control in the mass rearing of silkworm larvae on the artificial diet.

WATANABE H., SHIMIZU T.

J. Sericult. Sci. Japan, 1981, 50(2), p.146-153. (J,j,e)

Factors concerned with the epizootics of nuclear polyhedrosis in the silkworm observed recently in sericultural farms. (Facteurs en relation avec une épizootie de polyhédrose nucléaire chez le ver à soie observée récemment dans les fermes séricicoles).

The epizootiological investigations on the occurrence of diseases in sericultural farms in recent years suggested that the nuclear polyhedrosis has become dominated to occur throughout several prefectures, especially in summer and fall rearing seasons. As factors concerned with epizootics of nuclear polyhedrosis, neither widespread of a high virulent nuclear-polyhedrosis virus (NPV) in sericultural farms, nor the rearing of silkworm strains with decreased resistance were recognized. On the other hand, incomplete disinfection that allows to remain some amount of viable viruses in the rearing house was frequently observed in the most of sericultural farms. Among silkworm viruses, NPV showed the highest viability under the natural condition within the rearing house. Accordingly, as far as incomplete disinfection of rearing house and instruments was carried out, it was highly possible that the recent epizootics of nuclear polyhedrosis much depends on the repeated infection with the NPV survived from disinfection and the increasing infestation of NPV during the multiple silkworm rearings.

XIE T.U., ZHANG G.Y., TSING Y.H., ZHANG Y.L.

Acta Entomol. Sinica, 1981, 24(3), p.336-337. (C) Scientific note

Silkworm ovarian monolayer cell culture and virus infection. (Culture cellulaire mono couche d'ovaire de ver à soie et infection virale).

YAMANOI F.

J. Sericult. Sci. Japan, 1981, 50(2), p.83-87. (J,j)

Effect of insecticides on the progeny in the silkworm, *Bombyx mori*. II. Effect of organophosphorus insecticides on the next generation. (Effet des insecticides sur la descendance chez le ver à soie, *Bombyx mori*. II. Effet des insecticides organophosphorés sur la génération suivante).

YAMANOI F.

J. Sericult. Sci. Japan, 1981, 50(4), p. 282-287. (J,j,e).

Effect of insecticides on progeny in the silkworm, *Bombyx mori*. III. Effect of the stage and the dose of application of organophosphorus insecticides on hatching. (Effet des insecticides sur la descendance chez le ver à soie *Bombyx mori*. III. Effet du stade et de la dose d'application des insecticides organophosphorés sur l'éclosion).

Organophosphorus insecticides, such as MPP, EPN, MEP and malathion, were administered to larvae of the silkworm and the effect on hatching or eggs laid by them was examined.

1. EPN or MPP was administered to the male and female groups of silkworm separately and found to reduce the hatchability abruptly only when administered to the female.

2. The application EPN or MPP at the end of the fifth larval instar (oral administration) and at the early pupal stage (injection) resulted and adverse effect on hatching.

3. The dose of the insecticides causing a 50% reduction of hatchability was 8.90 µg for EPN and 15.53 µg for MPP per larva, when administered at the end of the fifth instar. It was 1.58 µg per individual for MPP, when injected at early pupal stage.

4. MEP exerted an adverse effect only injected at pupal stage. No effect was recognized with malathion, even when applied at any developmental stages from larva to pupa.

YOSHIMURA Y.

J. Sericult. Sci. Japan, 1981, 50(3), p.206-212. (J,j)

Maternally conditioned mutant for the body color of newly hatched larva in the silkworm. (Un mutant à hérédité matrocline pour la coloration du corps des chenilles néonates chez le ver à soie).

FUJII A., ARIMOTO H., SAKABE H.

J. Sericult. Sci. Japan, 1981, 50(4), p. 271-275. (J,j,e).

Dyeing properties of wild silk yarns. I. Differences of dyeing properties with acid dyes. (Propriétés tinctoriales des filés de soies sauvages. I. Différence d'affinité tinctoriale vis à vis des colorants acides).

Dyeing properties of the spun yarns and fabrics of the wild silks (Chinese tusser and eri) with acid dyes (Orange II and Orange G) were compared with those of the mulberry silk by determining the isoelectric point (pI) of the yarn and color specificities of the fabrics.

1. The isoelectric points of three kinds of yarns, mulberry, Chinese tusser and eri silks, were 3.53, 3.36 and 3.74 respectively. The amount of dye absorbed by eri silk yarn, whose pI was in the alkaline side, was larger than those of the others. The absorbance was marked at a high pH (3.7) of the dyeing bath.

2. The pI of Chinese tusser spun yarn was in the most acidic side among three silks used. The amount of dye absorbed by this silk was very little at a high pH (3.7), but was larger than the amount of dye absorbed by mulberry silk spun yarn at a low pH (3.1). It was recognized that the amount of dyes absorbed by the silk related closely with pI of the silk.

3. The dominant wave length of three kinds of fabrics dyed with Orange G was around 581 nm, and there was little difference in the wave length among three kinds of fabrics. The lightness of chinese tusser silk fabric was low as compared with the others. This fact seemed to be caused by the undyed fabric itself, possessing a low lightness.

Les affinités tinctoriales des filés et des tissus de soies sauvages (tussah et eri chinois) vis à vis des colorants acides (Orangé II et Orangé G) ont été comparées avec celles des soies mûrier en déterminant le point isoélectrique (pI) du filé et la spécificité de couleur des tissus.

1. Les points isoélectriques des trois types de fils sont : 3,53 ; 3,36 et 3,74 pour le mûrier, le tussah de Chine et le éri respectivement. Le filé de soie éri dont le pI est du côté alcalin absorbe une plus grande quantité de colorant que les autres. L'absorption est forte pour une valeur élevée du pH (3,7) du bain colorant.

2. Le tussah chinois présente le pI le plus acide des trois soies testées. La quantité de colorant absorbée par cette soie est très faible à pH élevé (3,7), mais est plus importante que celle absorbée par le filé de schappe à pH faible (3,1). Il a été établi que la quantité de colorant absorbée par la soie était étroitement liée avec le pI de la soie.

3. La longueur d'onde principale des 3 types de tissus teints avec l'orangé G est aux environs de 581 nm et il y a peu de différence de longueur d'onde parmi les 3 types de tissus. Le brillant du tissu en tussah chinois est faible en comparaison de celle des autres tissus. Celui-ci semble être dû au tissu écru lui-même qui présente un faible brillant.

KAKO T.

J. Sericult. Sci. Japan, 1981, 50(3), p. 170-174. (J,j,e).

Change of performance of silk plain Habutae treated with detergent after repeating extension. (Modification des performances d'un habutae de soie uni traité avec des détergents après des extensions répétées).

Silk plain Habutae after repeating extension was treated with water, neutral detergent or commercial soap, and changes of its performance were investigated, and following results were obtained.

There was virtually little difference in the effect among three different treatment on the fabric performances, such as thickness, crease recovery, shrinkage, bending resistance and elongation. However, tensile strength was somewhat decreased by treatment of a 0.5 % neutral detergent or a soap solution ; thus, the tensile strength could be arranged in the order of the control (untreated), water treatment, neutral detergent treatment and soap treatment.

Un habutae de soie après des extensions répétées a été traité avec de l'eau, un détergent neutre ou du savon domestique, et les modifications de ses performances ont été étudiées. Les résultats suivants ont été obtenus.

Il n'y a pratiquement pas de différences entre les effets des trois traitements sur les performances des tissus telles que : l'épaisseur, la défroissabilité, le retrait, la résistance à la flexion et l'allongement. toutefois, la ténacité est quelque peu diminuée par un traitement avec un détergent neutre à 0,5 % ou une solution savonneuse ; on peut donc classer les valeurs de ténacité dans l'ordre suivant témoin (non traité), traitement à l'eau traitement avec un détergent neutre et traitement au savon.

KAWANA S.

Bull. Sericul. Exp. Sta., 1981, 28(3), p. 499-574. (J,j,e).

A new automatic cocoon filament end picking machine. (Une nouvelle machine à saisir le bout du fil du cocon).

Filature is the manufacture of raw silk through such processes as drying of fresh cocoons, storing, sorting and cooking of dried cocoons, groping and picking of cocoon filament ends, reeling, rereeling and packing of raw silk. End-groping and picking is the process to find and end of cocoon filament. We put several ends together to reel raw silk, therefore, the end-groping and picking process, which is a starting operation of silk production, is important. Nevertheless, the process is even now partly required manual labour, moreover wasting considerable raw silk. The author's study was the development study of a new automatic cocoon filament end picking machine, which has been done for the purpose of fully automating the end-groping and picking process and saving loss in the process.

La filature est la production de la soie grège par la mise en oeuvre des opérations telles que : le séchage des cocons frais, le stockage, le tri et la cuisson des cocons secs, le purgeage des cocons et la saisie du bout de la bave, le dévidage, le renvidage et l'emballage de la soie grège. Le purgeage du cocon et la saisie du bout de la bave sont des opérations visant à trouver le bout de la bave. Pour filer un fil de soie grège plusieurs baves sont nécessaires. Donc l'opération de purgeage et de saisie du bout qui est une opération initiale dans la production de la soie est importante. Néanmoins, cette opération est encore partiellement manuelle à l'heure actuelle, et de plus, gaspille beaucoup de soie. L'étude de l'auteur a porté sur l'étude du développement d'une nouvelle machine automatique à saisir le bout de la bave des cocons, qui a été réalisée en vue d'automatiser entièrement l'opération de purgeage du cocon et de saisie du bout et de limiter les déchets en cours d'opération.

In order to obtain the best method for groping and picking operation of cocoon filament ends, the problem was analysed and discussed from three different points of view : (1) the unit quantity of the cocoons being processed, (2) the processing method, and (3) the unit processing time.

The results obtained were as follows :

(1) The unit quantity of cocoons being processed.

The working efficiency of both groping and picking operations with a single cocoon was found better than that with a large quantity handled in a single operation.

(2) The processing method.

In both groping and picking operations, the cocoons to be processed were fed continuously toward the stationary groping brush and picking hook. In this manner, the working sequence was made continuous and simultaneously increased its efficiency.

(3) The unit processing time.

In both groping and picking operations, each working time should be performed within a fixed period which allows an optimum length of the filament to be picked, thereby preventing the cocoon from being floated during the operation.

The author proposed a new cocoon filament picking method in which the picking length was fixed at a certain value and was determined theoretically. Results of statistical analysis indicated that the optimal picking length lied between 2 to 3 meters. It was provided, however, that the filaments should be picked from each cocoon at exactly equal length, thereby substantial loss in raw silk could be prevented.

Results of an analysis study conducted by the author indicated that the filament-end groping and picking operations, which is still partly required manual labour, could be accomplished by mechanical means using a method proposed by the author. To test the feasibility of this method, the 1st and 2nd trial machines were fabricated successively and their performance was evaluated. From these trial

Afin de connaître la meilleure méthode pour réaliser le purgeage du cocon et la saisie du bout, le problème a été analysé et étudié de trois points de vue différents : 1) la quantité unitaire de cocons à traiter, 2) la méthode de traitement, 3) le temps d'opération unitaire.

Les résultats obtenus sont les suivants :

(1) La quantité unitaire de cocons à traiter.

Le rendement des deux opérations, purgeage du cocon et saisie du bout est inférieur avec un seul cocon que dans le cas d'une grande quantité traitée en une seule opération.

(2) La méthode de traitement.

Dans les deux opérations, purgeage du cocon et saisie du bout, les cocons à traiter alimentent de façon continue la brosse de purgeage et le crochet collecteur. Ainsi, la séquence de travail est continue et son rendement est accru.

(3) Le temps d'opération unitaire.

Au cours des deux opérations de purgeage du cocon et de saisie du bout, chaque opération doit être réalisée durant une période déterminée. Ceci permet de saisir une longueur optimale de bave et limite la mise en surface des cocons au cours de l'opération.

L'auteur propose une nouvelle méthode pour saisir la bave dans laquelle la longueur saisie est fixée à une valeur déterminée théoriquement. L'analyse statistique montre que la longueur optimale de bave saisie se situe entre 2 et 3 mètres. Il a été établi toutefois que la longueur saisie doit être exactement la même pour tous les cocons, ce qui permet d'éviter une perte de soie grège qui peut être importante.

Les résultats d'une étude analytique menée par l'auteur montre que l'opération de purgeage et de saisie du bout, qui nécessite toujours une intervention manuelle, peut être réalisée mécaniquement avec la méthode proposée par l'auteur. Pour tester la faisabilité de la méthode, un 1er puis un 2me prototypes ont été réalisés et leurs performances ont été mesurées. Les essais ont permis de montrer que l'opé-

tests, the author was able to confirm the feasibility of high performance and fully automated filament-end-groping and picking operation. For practical application, however, the device should be so designed that the filament could be picked at arbitrary length.

In line with previous efforts in developing a new filament-end picking machine, the 3rd trial machine was constructed which was a revised and improved form of the 2nd trial machine to meet the actual operating condition. Results of the test obtained so far revealed that the machine showed much better performance than that of the conventional machine. It has also shown that the machine could be incorporated easily in present running filature factories to replace the conventional ones.

For the purpose of confirming the practical performance of the 3rd trial machine, the 4th trial machine was constructed in the experimental factory of Filature Experiment Station, the Sericultural Experiment Station and the comparative performance tests, in which the new machine and the conventional machine were alternately operated, were carried out. From the tests, the author was able to confirm that the 4th trial machine did not need manual labour at all in operation and loss in raw silk was less than that of the conventional machine.

The new machine requires more room for installation as compared with conventional ones, but the mechanism is much simpler. Therefore, the production cost of the new model is estimated less expensive than that of the conventional ones, and also the maintenance will be much easier.

Considering the benefit of saving personnel expenses and increase in yield of raw silk due to a decrease in loss, the author concluded that application of the developed model to commercial practice could pay economically.

For practical use, however, the following two notices should be taken in designing.

ration de purgeage du cocon et de saisie du bout était réalisable avec un haut rendement et de façon entièrement automatique. Pour l'utilisation pratique, il convient toutefois de prévoir un dispositif permettant d'avoir une longueur saisie variable.

A la suite des premiers efforts de développement de cette nouvelle machine à saisir le bout de la bave du cocon, un troisième prototype a été construit, en révisant et en améliorant le deuxième prototype, afin de satisfaire aux conditions réelles d'utilisation. Les résultats des essais réalisés à ce jour ont montré que les performances de cette machine sont meilleures que celles de la machine conventionnelle. Ils ont également montré que cette machine pouvait être mise en place facilement dans les filatures actuellement en fonctionnement pour remplacer les machines conventionnelles.

Afin de confirmer les performances pratiques du 3^{me} prototype, un 4^{me} prototype a été construit dans l'atelier expérimental de la Station Expérimentale de Filature, Station Séricicole Expérimentale et des essais de performance comparatifs, mettant en oeuvre alternativement la nouvelle machine et la machine traditionnelle, ont été réalisés. Ces essais ont permis à l'auteur de confirmer que le 4^{me} prototype n'avait pas besoin d'intervention manuelle en cours de fonctionnement et que les pertes en soie grège étaient réduites par rapport aux machines conventionnelles.

La nouvelle machine occupe davantage de place que les machines conventionnelles, mais son mécanisme est plus simple. On peut donc prévoir que le coût de production du nouveau modèle sera inférieur à celui des matériels conventionnels et que sa maintenance sera plus facile.

En tenant compte de l'économie réalisée sur le personnel et de l'augmentation de la production de soie grège résultant d'une diminution de la quantité de déchets, l'auteur conclut que la mise en oeuvre de ce modèle dans la pratique est économiquement rentable.

Pour l'utilisation dans la pratique, il convient toutefois de prendre en compte les points suivants dans la conception :

- (1) Cooked cocoon tank and returned cocoon tank should be enlarged sufficiently.
 (2) Durability of machines should be improved.

1. Le réservoir de cocons cuits et le réservoir de cocons refusés doivent être suffisamment agrandis.
 2. La durabilité des matériels doit être améliorée.

MAGOSHI Y.

J. Sericult. Sci. Japan, 1981, 50(3), p. 161-169. (J,j,e).

Fraunhofer diffraction pattern of silk fabrics. VI. Effects of materials of fabrics. (Diagramme de diffraction de Fraunhofer des tissus de soie. VI. Influence de la matière première constituant les tissus).

The Fraunhofer diffraction pattern analysis has been investigated on the plain fabrics making from several materials by means of laser in order to numerize the structure of silk plain fabrics.

The results obtained are summarized as follows.

1. The filament yarn fabrics have 5 or 6 index of pattern and the spun fabrics have less than 3 in index of pattern. In these reason the surface (texture) of fabrics have more smooth and regular than one of the spun fabrics.

2. The index of pattern is influenced considerably the patches of weaving yarn that one of chief factors in weaving.

3. As this analysis is a relative method, it is necessary from pattern information to correct the opening ratio which have 5 models in plain fabrics. Two values are obtained, that is, one is opening ratio $[I_1]$ calculated from the amounts of weaving yarns, and another is opening ration $[II]$ computed from double Fraunhofer diffraction patterns.

4. Pattern characteristics could be calculated from the index of patterns adjusted by the opening ratio. These values are corresponded to the characteristics of fabric structure well.

5. Silk Habutae show unique pattern, but plain fabrics weaved by synthetic fibres are not shown those particular patterns.

TERASHIMA T.

J. Sericult. Sci. Japan, 1981, 50(2), p. 141-145. (J,j,e).

Compressional characteristics perpendicular to fiber axes of raw silk. (Caractéristiques de compression de la soie grège sollicitée perpendiculairement à l'axe des fibres).

The changes in thickness and elastic limit of the raw silk compressed laterally was investigated using the dry and wet threads sandwiched between two glass plates. The tread thickness t is related to the compressional load p by the equation $(p+c)(t-a) = b$, where a , b , and c are constant values depending on properties of threads.

The compressional strain increased as to converge to a certain value as the load was increased. When the dry and wet threads were compressed at the load below 10 and 3 g/cm, respectively, the recovery ratio exhibited 100 %, while over these loads the residual

Les variations de l'épaisseur et de la limite d'élasticité de la soie grège comprimée latéralement ont été étudiées à l'aide de fils secs ou humides pris en sandwich entre deux plaques de verre. L'épaisseur du fil t est liée à la charge compressive p par l'équation $(p+c)(t-a) = b$, où a , b et c sont des constantes dépendant des propriétés des fils.

La déformation due à la compression s'accroît jusqu'à une certaine valeur à mesure que la charge augmente. Lorsque les fils secs ou humides sont comprimés à des charges inférieures à 10 ou 3 g/cm, respectivement, le pourcentage de récupération atteint 100 %,

strain increased rapidly. From these results, the compressional elastic limit was considered to be at the load as indicated here.

alors qu'avec des charges supérieures la déformation résiduelle s'accroît rapidement. A partir de ces résultats, on peut considérer que la limite d'élasticité de compression se situe aux charges indiquées.

TSUCHIYA I., KYUMA H. MATSUMOTO Y.

J. Sericult. Sci. Japan, 1981, 50(4), p. 288-292. (J,j,e).

Mechanical properties of silk fabrics. II. On the luster of spun silk fabrics stretched repeatedly. (Propriétés mécaniques des tissus de soie. II. Le lustre des tissus de schappe ayant subi des extensions répétées).

It was recognized that the luster of spun silk fabrics stretched repeatedly varied according to the increase in the ratio of elongation. There occurred a peak in the mutual changes in the luster and the elongation of weft yarns. The peak observed in the repeated elongation by 2 % was considered to be caused by the rearrangement of fibers in the weft yarns. The decrease in luster of spun silk fabrics stretched repeatedly was seemed to be caused by the contract of the space between fibers in the yarns and the vary of the fabric density. It was also found that the twist-factor of the spun silk yarn (weft yarn) and the textile weaves influenced considerably on the luster of spun silk fabrics stretched repeatedly.

On a pu observer que le lustre des tissus de schappe ayant subi des extensions répétées varie en fonction du taux d'allongement. Il y a apparition d'un pic dans les modifications mutuelles du lustre et de l'allongement des fils de trame. Le pic observé pour un allongement répété de 2 % serait dû à un réarrangement des fibres dans les fils de trame. La diminution du lustre des tissus de schappe ayant subi des extensions répétées serait due à la contraction des espaces entre les fibres à l'intérieur des fils et à la variation de la densité du tissu. On a également trouvé que le facteur de torsion du fil de schappe (fil de trame) et les armures ont une influence importante sur le lustre des tissus de schappe ayant subi des extensions répétées.

TSUKADA M., BERTHOLON G.

Bull. Scient. ITF., 1981, 10, p. 141-154. (F,f,e).

Etude préliminaire des caractères physicochimiques de la séricine de la soie. (Preliminary study on physicochemical characters of silk sericine).

Many physicochemical characters of silk sericin are determined particularly the thermal behaviour and the variation of solubility in water. According to these characters, one hopes to obtain preliminary information about the structure and conformation on this protein. The experimental techniques used are the differential scanning calorimeter (DSC), thermomechanical analysis (TMA), evolved gas detection (EGA), & tangent measurement and solubility studies in water. One has proposed from these results a rough theory of thermal behaviour and structure of

Les caractères physicochimiques de la séricine de la soie et notamment le comportement thermique et l'évolution de la solubilité sont étudiés à partir de plusieurs techniques expérimentales, dans le but d'obtenir des résultats préliminaires pour une détermination de la structure et de la conformation de cette protéine. Les techniques expérimentales mises en oeuvre sont l'analyse thermique différentielle, l'analyse des produits volatils émis au cours de la dégradation, l'analyse thermomécanique, l'étude de la solubilité, en fonction de la tempéra-

silk sericin. The effect of degree of crystallinity and of the degree of solubility on the thermal behaviour are also detected.

ture et l'étude du module viscoélastique. Les auteurs proposent une ébauche de théorie concernant les relations entre le comportement thermique et la structure de la séricine de la soie et ils analysent, par rapport au comportement thermique, l'évolution du degré de solubilité et du taux de cristallinité.

TSUKADA M., BERTHOLON G.

J. Sericult. Sci. Japan, 1981, 50(3), p. 217-218. (J). Short rep.

Study on the thermal decomposition of disordered structure in the silk fibroin thread. (Etude de la décomposition thermique de la structure désordonnée du fil de fibroïne).

NON-MULBERRY SILKWORMS

SERICIGENES NON-MURIER

BEAULATON J.

C. R. Acad. Sc. Paris, 1978, 287, Série D, p.713-716. (F,f,e)

L'hémocytopoïèse chez le Ver à soie du Chêne *Antheraea pernyi* Guér. (Lépidoptère) : effets de l'ablation bilatérale des organes méso- et métathoraciques juxta-alaires sur l'évolution de l'hémogramme au cours du Vme âge larvaire. (Hemocytopoiesis in the oak silkworm *Antheraea pernyi* (Lepidoptera) : effects of bilateral removal of meso- and metathoracic peri-imaginal-wing organs on changes of hemogram during the fifth larval instar).

Removal of the hemocytopoietic meso- and metathoracic organs induces a dramatic decrease of the total hemocyte counts in comparison with those of controls. 144 hrs. after removal, only 39% of the hemocytes remain circulating at the spinning time. These experiments demonstrate that the peri-imaginal-wings organs are the major source of hemocytes.

L'ablation des organes hémocytopoïétiques méso- et métathoraciques provoque une importante réduction du nombre d'hémocytes circulants par rapport aux témoins. 144 h après l'opération, seulement 39% d'hémocytes restent en circulation. Ces expériences démontrent que les organes juxta-alaires ont un rôle majeur dans la production des hémocytes.

BEAULATON J.

C. R. Acad. Sc. Paris, 1980, 290, Série D, p.247-250. (F,f,e)

Effet de l'ablation des organes hémocytopoïétiques et de ligatures sur l'évolution de l'hémocytogramme différentiel chez *Antheraea pernyi* (Lépidoptère) au dernier âge larvaire. (Effect of removal of hemocytopoietic organs and ligations on changes of differential hemocytogram in *Antheraea pernyi* (Lepidoptera) in the last larval instar).

Removal of the hemocytopoietic meso- and metathoracic organs caused a substantial reduction of the total hemocyte counts (THC) but not a reduction of all hemocyte types. A dramatic decrease of the prohemocyte counts including intermediate forms between prohemocytes and plasmotocytes was found. Approximately 1/5 and 1/20 of the prohemocyte counts observed in controls were detected at the 4th and 8th days. The effects of ligation were investigated on the differential hemocytogram at two intervals.

L'ablation des organes hématopoïétiques méso- et métathoraciques provoque une nette réduction du nombre total d'hémocytes qui ne se répercute pas également sur les cinq types hémocytaires. Une réduction massive des numérations de prohématocytes et des formes intermédiaires avec les plasmocytes est mise en évidence. La proportion relative des prohématocytes observée au 4^{me} et au 8^{me} jours n'est plus que de 1/5 et 1/20 environ de celle des témoins. Les effets de la ligature sur l'hémocytogramme ont été examinés à deux périodes distinctes.

BEAULATON J.

C. R. Acad. Sc. Paris, 1980, 290, Série D, p.727-730. (F,f,e)

L'hématopoïèse chez les Lépidoptères. Etude des effets de ligatures et de la 20-hydroxyecdysone sur l'évolution de l'hémocytogramme en période prénymphale chez *Antheraea pernyi* Guér. (Hématopoïesis in Lepidoptera. Study on the effects of ligations and 20-hydroxyecdysone on changes of hemocytogram during pupal period in *Antheraea pernyi* Guer.)

Ligation of *Antheraea pernyi* larvae leading to half-pupae induced discrepancies between hemocytograms of anterior and posterior parts of the body. Two groups of ligatured larvae showed a significant increase of the total hemocyte counts (THC) in anterior part including one or two pairs of the hemocytopoietic organs. The effects of the hormonal treatment in the posterior part of half-pupae were investigated on the THC. The hormonal regulation of hemocytopoiesis is discussed in *Antheraea*.

La ligature des larves d'*Antheraea pernyi* en cours de filage donnant des demi-nymphes provoque une évolution différente de l'hémocytogramme dans les portions antérieures et postérieures du corps. Deux lots de larves montrent une augmentation significative du nombre total d'hémocytes dans la partie antérieure contenant une ou deux paires d'organes hématopoïétiques. Les effets du traitement hormonal dans la partie postérieure des demi-nymphes ont été examinés sur les numérations hémocytaires. La régulation hormonale de l'hématopoïèse chez *Antheraea* est discutée.

JONES C.W., KAFATOS F.C.

Mol. and Cellular Biology, 1981, 1, p.814-828.

Linkage and evolutionary diversification of developmentally regulated multigene families : tandem arrays of the 401/18 chorion gene pairs in silkworms *A. polyphemus*. (Liaison et diversification due à l'évolution des familles de gènes multiples régulées par le développement : disposition en tandem des paires des gènes du chorion 401/18 chez *A. polyphemus*).

KATULA K.S., GILBERT L.I., SHIDHARA S.

Molecular and Cellular Endocrinology, 1981, 22, p.315. (E,e)

DNA dependent RNA polymerase activity in silkworm wing epidermis after hormone treatment. (Activité d'un RNA polymérase dépendant du DNA dans l'épiderme alaire d'*A. polyphemus* après traitement hormonal).

DNA-dependent RNA polymerase activity of wing epidermal tissue from the silkworm, *Antheraea polyphemus*, has been studied after treatment of pupae with either molting hormone 20-hydroxyecdysone or 20-hydroxyecdysone and juvenile hormone. Enzyme activity has been measured both on endogenous template in isolated nuclei and on exogenous template after solubilization and correlated with transcriptional activity measured as the incorporation of [^3H] uridine into RNA. Within 4 h of either hormonal regimen, increases in nuclear transcriptional activity for enzymes I and II are observed. Maximal nuclear activity for both enzyme classes was observed at 26 h. Solubilized enzyme activity, on the other hand, increased continuously up to 144 h. The increase in enzyme activity at 26 h, and probably earlier, is dependent on both RNA and protein synthesis, indicating that the increase is not a consequence of the activation of inactive molecules, but requires the synthesis of either new enzyme molecules or effector molecules. Application of 20-hydroxyecdysone + juvenile hormone does not significantly affect nuclear RNA polymerase activity, rates of RNA synthesis or even RNA content during the first 26 h. However, JH causes significant diminution in the rise of solubilized activity observed with 20-hydroxyecdysone. This reduction is not a consequence of diminished protein content. Therefore, the number of active RNA polymerase molecules appears not to directly correspond to the rate of RNA synthesis.

KUMAR P.A., BANERJEE N.D., CHOUDHARY S.K., NARASIMHANNA M.N., SENGUPTA K.
Indian Silk, 1981, 19(12), p.11-17. (E)

A method for the isolation and preservation of fertile Tasar (*A. Mylitta*) eggs.
(Méthode de séparation et de conservation des oeufs fertiles du Tasar (*A. Mylitta*)).

LOCKSHIN R.A., BEAULATON J.
Tissue & Cell, 1979, 11(4), p.803-819. (E,e)

Programmed cell death. Electrophysiological and ultrastructural correlations in metamorphosing muscles of lepidopteran insects. (La mort programmée de la cellule. Corrélations électrophysiologiques et ultrastructurales dans les muscles en métamorphose d'insectes lépidoptères).

Individual spontaneously degenerating fibers of moths have been examined successively by electrophysiological and ultrastructural techniques. The correlations observed by this method have revealed two phases of lysis. The first lytic phase begins at or before the ecdysis of the moth. It is characterized by a probable but occult respiratory lesion, normal movement of the ions across the plasma membrane, and limited degradation of myofilaments and autophagy of mitochondria. There are nevertheless early degenerative changes in the Z-band and a slight swelling of the T system. The second lytic phase is introduced, at approximately 15 hr after ecdysis, by collapse of the tracheal airways. The collapse of the tracheae is followed within 2 or 3 hr by a drastic reduction of input resistance, depolarization of the fiber, and loss of contractility. The rate of proteolysis increases, and the remaining myofilaments lose all structural identity by the twentieth hour. During this period of rapid change, the electron density of the reticular portion of the dyads decreases before a compactive process increases their opacity. Neural elements degenerate secondarily. The early lytic phases are apparently non-lysosomal for the myofilaments, although organelles such as mitochondria, ribosomes, and glycogen are destroyed in autophagic vacuoles.

Elimination of oxygen and collapse of the resting potential, with the presumed equilibration of intracellular ionic content, provokes a rapid dissolution of the myofibril, with continued autophagic elimination of the organelles.

LOCKSHIN R.A., BEAULATON J.

Biologie Cellulaire, 1979, 36(1), p.37-42. (E,e)

Programmed cell death. Chloroquine limits resorption but does not delay its onset- an ultrastructural and Biochemical study. (La mort programmée de la cellule. La chloroquine limite la résorption mais ne retarde pas son démarrage. Etude ultrastructurale et biochimique).

The effect of chloroquine on the spontaneously degenerating muscles of metamorphosing moths has been studied. Chloroquine diphosphate injected into the insect provokes, in non-degenerating muscles, lesions similar to those seen in vertebrate muscles. In muscles which undergo spontaneous degeneration, extensive damage to the sarcoplasmic reticulum and transverse tubular system is noted, and acid phosphatase activity, known to have been present, is not detected cytochemically. Myofilaments disappear on schedule, but large amounts of protein are in vesicles which fill the cell before being lost over a period of 4 days. The vesicle membranes persist. *In vitro* assays of acid protease indicate the presence of the enzyme, and myosin ATPase diminishes relative to the amount of protein. The results suggest that the dissolution of the myofilaments is a step distinct from their complete proteolysis, and that chloroquine intervenes between these two events.

MORROW C.S., HUNSLEY J.R., LISZEWSKI M.K., MUNNS T.W.

Biochemistry, 1981, 20, p.2086-2091. (E,e)

Developmental changes in the methylation of silkworm follicular epithelial messenger ribonucleic acid. (Evolution au cours du développement de la méthylation de l'acide ribonucléique messager de l'épithélium folliculaire de *A. polyphemus*).

The methylation of silkworm follicular epithelial messenger ribonucleic acid (mRNA) was investigated at different stages of follicular development. Follicles from the late prechorionating and four chorionating stages were incubated in organ culture for 2 h with [*methyl*-³H] methionine. The resulting polysomal-derived, poly(A⁺) mRNAs were characterized with respect to both size and composition of methyl-³H-methylated constituents. As evaluated by sucrose density gradient centrifugation, prechorion mRNAs were heterogeneous in size (7-30S) in contrast to the relatively homogeneous chorion mRNAs which sediment within the 7-14S region of the gradient. Analysis of the methyl-³H-labeled products of mRNA digests (nuclease-P₁ or RNase T₂) via DEAE-cellulose and thin-layer chromatographic techniques revealed the following information. First, on the basis of nuclease-P₁ digestion, the predominating 5'-terminal cap structure in both prechorion (greater than 70 %) and chorion (greater than 90 %) mRNAs was m⁷G(5')ppp(5')A^m, with minimal amounts of m⁷GpppG^m and m⁷GpppC^m (prechorion) and m⁷Gpppm⁶A^m (chorion) also detected. Second, on the basis of RNase-T₂ digestion, the ratio of cap type 1 structures (m⁷GpppN^mpNp) to cap type 2 structures (m⁷GpppN^mpN^mpNp) was 1:1 and 7:1 for prechorion and chorion mRNAs, respectively. Additionally, whereas prechorion mRNAs possessed an average of two internal m⁶A residues per cap, chorion mRNAs were deficient in this or other internal methylated nucleosides, i.e., less than 0.1 m⁶A/mRNA. As measured

by the extent of incorporation of [^3H]methyl groups into 5'-terminal m⁷GpppN^m structures, the synthesis of poly(A⁺) mRNA progressively increased during follicular development, ultimately exceeding the pre-chorion value by 20-fold. Collectively, these results indicate that significant alterations in the methylation patterns of silkworm mRNA accompany transitions in the types and amounts of mRNA expressed during follicular development.

RASENICK M.M., BERRY S.J.

Insect Biochem., 1981, 11(4), p.387-395. (E,e)

Regulation of brain adenylate cyclase and the termination of silkworm diapause. (Régulation de l'adénylate cyclase cérébrale et l'achèvement de la diapause de *A. polyphemus*).

Factors which could account for increased levels of brain cycle AMP during the initiation of pupal-adult metamorphosis were examined in silkworms. Cycle nucleotide phosphodiesterase activity of whole brain homogenates was not depressed after the initiation of adult development. Adenylate cyclase activity was assayed in brain homogenates and in a partially purified membrane particle preparation. Parallel agonist and antagonist studies suggest that a substance with an active site resembling 5-hydroxytryptamine may be the natural activator of brain cyclase.

YAMADA M.

J. Sericult. Sci. Japan, 1981, 50(4), p. 293-300. (J,j,e).

Elemental analysis by means of X-ray on the cocoon layer of several wild silkworms. (Analyse élémentaire aux rayons X de la coque soyeuse de quelques vers à soie sauvages).

By means of energy dispersive X-ray analysis interfaced to scanning electron microscopy, inorganic elements in cocoon layer were investigated with several wild silkworms, *Antheraea yamamai*, *Antheraea pernyi*, *Philosamia cynthia ricini*, *Antheraea mylitta*, *Attacus atlas* and *Eriogyma pyretorum*. In addition, quantitative analysis of ash was also carried out on those cocoon layer. The main results obtained are summarized as follows

- 1) Estimation of ash in cocoon layer differed with the species of wild silkworm. The highest value for ash estimation were observed at *Antheraea yamamai*, but there were some differences between the place of cocoon production of this insect.

- 2) In the elemental analysis by X-ray, Ca and K element were detected as the major component in cocoon layer. Furthermore, S, Cl, Na, Mg or P element presented in mere trace amounts.

- 3) At plane-analysis of element, a great deal of Ca element was observed in micro-substance sticking on the filament, however Ca, S and K element were also scattered all over the surface of cocoon layer. This result suggests that these inorganic components of cocoon layer are present in the sericin.

MEETING ANNOUNCEMENT

ANNONCE DE REUNIONS

SMALL MEETING OF THE INTERNATIONAL SOCIETY FOR NON-MULBERRY SILKS

REUNION DE LA SOCIETE INTERNATIONALE DES SOIES NON MURIER

FIRST ANNOUNCEMENT

PREMIERE ANNONCE

Date : August 1982

Location : China, tentatively scheduled in Lu-ta (Dairen)

Duration : 2-3 days for general study reports, special lectures and deliberations; and 4-5 days for field studies of non-mulberry silks in China

Theme of the small meeting : study and utilization of non-mulberry silkworms, with regard to general study reports. There will be no limit of the study fields as far as they are concerned with non-mulberry silkworms and silks (including textile). Each report will not exceed 30 minutes.

Information can be obtained from the secretariat at the following address :

S. Sakate
The Silkworm Genetics Labo. of Sericultural Experiment Station.
Yatabe, Ibaraki 305, Japan

Date : août 1982

Lieu : Chine, probablement à Lu-ta (Dairen)

Durée : 2 à 3 jours pour les rapports généraux d'étude, les conférences et les délibérations; 4 à 5 jours pour l'étude sur le terrain des soies non-mûrier en Chine

Thème de la réunion : étude et utilisation des vers à soie non-mûrier pour ce qui concerne les rapports généraux d'étude. Les domaines d'étude ne sont pas limités dans la mesure où les études portent sur les vers à soie et les soies non-mûrier (textile compris). Les rapports ne doivent pas dépasser 30 minutes.

Les informations peuvent être obtenues auprès du secrétariat, à l'adresse suivante :

S. Sakate
The Silkworm Genetics Labo. of Sericultural Experiment Station.
Yatabe, Ibaraki 305, Japan

SATELLITE SYMPOSIUM
TO THE SPECIAL F.E.B.S. MEETING
ON CELL FUNCTION
AND DIFFERENTIATION

SYMPOSIUM SATELLITE
DES REUNIONS DE LA F.E.B.S.
SUR LA FONCTION
ET LA DIFFERENCIATION CELLULAIRE

SECOND ANNOUNCEMENT

DEUXIEME ANNONCE

Subject : THE SILKWORM, A MODEL SYSTEM
FOR DEVELOPMENT AND DIFFERENTIATION

Location : Athens or surrounding area.

Date : most probably on April 22nd and
23rd 1982.

Organisators :

Sujet : LE VER A SOIE, MODELE DE DEVE-
LOPPEMENT ET DE DIFFERENCIATION

Lieu : Athènes ou sa région.

Date : probablement les 22 et 23 avril
1982.

Organisateurs :

Jean-Pierre GAREL, Département de Biologie Générale,
Université Claude Bernard, Lyon I, 69622 Villeurbanne,
France. Tel. (7) 889.81.24 poste 33.72.

Fotis C. KAFATOS, Université d'Athènes, Département
de Biologie, Panepistimiopolis, Kouponia, Athènes,
Grèce. Harvard University, Biological Laboratories,
16 Divinity Ave, Cambridge, Massachussetts 02138,
U.S.A.

Hajime SHIGEMATSU, (Coordinateur pour le Japon) (*Coor-
dinator for Japan*), Sericultural Experiment Station,
Owashi 1-2, Yatabe, Tsukuba, Ibaraki 305, Japan.

PROGRAMME1st day : Gene structure and expression

- . Silk secretion
- . Oogenesis
- . Poster session
- . Round table discussion

2nd day : Hormones in developpement and differentiation

- . Action of hormones in *Bombyx mori* development
- . Physiological interactions during cell development
- . Poster session
- . Round table discussion

1er jour : Structure et expression des gènes

- . Sécrétion de la soie
- . Ovogenèse
- . Session poster
- . Table ronde

2me jour : Les hormones dans le dévelop-
pement et la différenciation

- . Action des hormones sur le dévelop-
pement de *Bombyx mori*
- . Interactions physiologiques au cours
du développement cellulaire
- . Session poster
- . Table ronde

Suite de la page 290.

The aims of this Society are the promotion of research and development in this field and the setting up of a permanent forum for international cooperation.

A draft of constitution has been drawn up and the following members have accepted to undertake the responsibilities of officials of our new Society.

Les buts de cette Société sont la promotion de la recherche et du développement dans ce secteur et la mise en place d'un forum permanent de coopération internationale.

Un projet de constitution a été rédigé et les membres dont les noms suivent ont accepté de prendre des responsabilités de direction au sein de la société.

President	: M. S. Jolly	(India)	Président
Vice President	: X. Yu	(China)	Vice Président
Secretary	: S. Sakate	(Japan)	Secrétaire
Treasurer	: K. Okui	(Japan)	Trésorier
Executive Members	: C. B. J. Rao	(UNIDO)	Membres actifs
	: H. Yamada	(Japan)	
	: M. Kato	(Japan)	
	: M. Iwamoto	(Japan)	

The address of the Secretariat is :

L'adresse du Secrétariat est :

The Silkworm Genetics Laboratory of
Sericultural Experiment Station
Yatabe, Ibaraki 305, Japan.

INTERNATIONAL JOURNAL OF ENTOMOLOGY

It is the name of the latest of the international periodicals concerning Entomology.

The first issue will come out in July 1982

For any information, please apply to :

C'est le nom que porte le dernier en date des périodiques internationaux consacrés à l'Entomologie.

La sortie du 1er numéro est prévue pour juillet 1982.

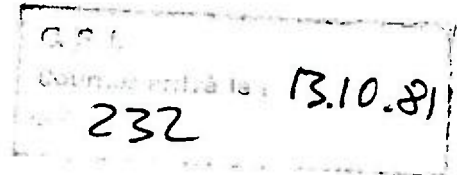
Pour tous renseignements vous pouvez vous adresser à :

Dr. U.V.K. Mohamed
Chief Editor of the
International Journal of Entomology
Entomology division
University of Calicut
KERALA 673 635
INDIA

ERRATUM

A mistake of pagination has been made in the issue n° 21 2-3 which should start on page 117 (instead of 1) and finish on page 272 (instead of 116).

Une erreur de pagination s'est glissée dans le n° 21 2-3 qui doit commencer à la page 117 (au lieu de 1) et se terminer à la page 272 (au lieu de 116).

**GROUPE DE ZOOLOGIE
ET PROTISTOLOGIE**UNIVERSITÉ DE CLERMONT-FERRAND II
COMPLEXE SCIENTIFIQUE DES CEZEAUXBoîte Postale 45 TÉL. (73) 92-22-26
63170 AUBIÈRE (France)au Dr H. Bouvier
Directeur de Sericologia
3, quai Chauveau
69009 LYON

Monsieur et Cher Collègue,

C'est avec beaucoup de retard que j'accuse réception de Sericologia que vous avez eu l'amabilité de me faire parvenir. Je me félicite de cette excellente initiative car cette revue permet d'assurer une liaison très utile entre les biologistes ayant pour modèle les vers à soie. La partie scientifique est d'un très bon niveau et se trouve complétée par la partie signalétique. Afin de compléter cette analyse bibliographique pour les séricigènes non-mûrier je me permets de vous adresser ci-joint quelques tirés à part assez récents portant sur ce matériel.

Pour le cas où la rédaction aurait besoin d'une bonne volonté supplémentaire, je prends la liberté de vous signaler que je suis prêt à collaborer à l'entreprise si vous le jugez utile.

D'autre part, je serais intéressé par le prêt de l'ouvrage " Study and ulization of non-mulberry silkworms " cité dans le dernier fascicule de Sericologia car je souhaiterais avoir connaissance de l'article de Kikuchi et coll. sur l'alimentation artificielle.

Avec mon bien cordial souvenir, je vous prie de croire, Monsieur et Cher Collègue, à mes sentiments les meilleurs.

Dr J. BEAULATON