III.7. Pebrine Inspection

The data of pebrine inspection at the Subcenter was as presented in Fig.3. The pebrine inspection of F_1 moths was performed with the Nagahara Type Moth Crusher and moths were crused one by one. (Fig. 3 see page 23).

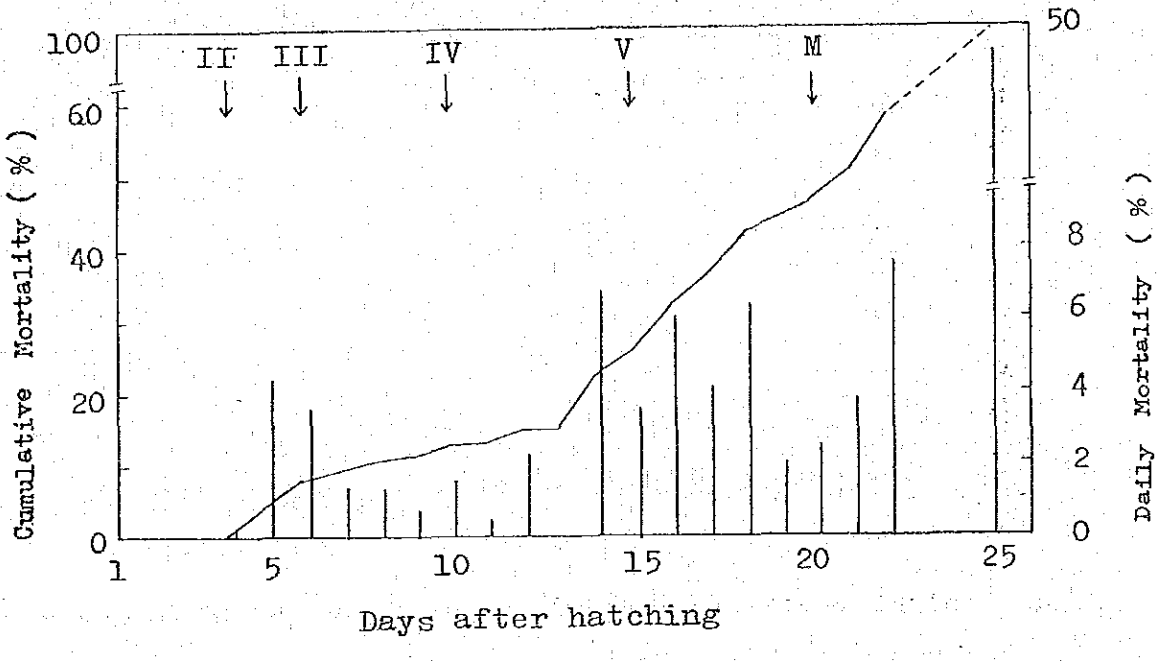


Fig. 2. Mortality of Silkworm Larvae Hatched from Eggs by Pebrine-Infected Female Moth.

It is said that the pebrine infection percent of F_1 moths derived from eggs imported from Japan was gradually decreased from 1974. But at the 5th silkworm rearing time for egg production in 1978, the infection percent was abnormally high, especially as to moths reared at the place of Wepte and Tanah BellangE. Usually, when the Project buy cocoons from farmers

for egg production, a group of 50 cocoons from one farmer is inspected for pebrine infection in advance, but this time the inspection was not done. After that time, the silkworm rearing for egg production was limited only in the Project. In 1979, the percentage of pebrine infection decreased to 0,01 - 0,30 %. At the 2nd silkworm rearing time in 1980, however, the pebrine infection increased again, upto 7,87%.

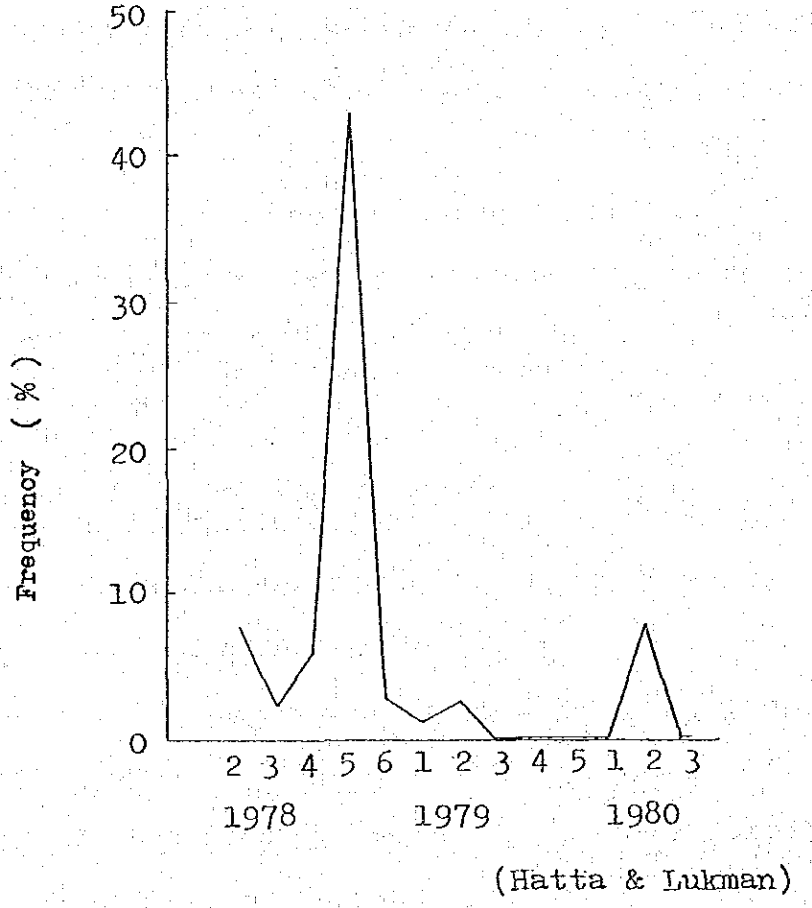


Fig. 3. Pebrine Inspection.

At this time at the Subcenter, some kinds of silkworm larvae from Java were reared for the purpose of breeding and these larvae were highly infected with pebrine, and it was seemed that the pebrine infection of larvae for egg production was caused with the contamination from such larvae.

III. 8. Discussion

In former times, the Project bought cocoons from farmers for egg production, but taking oppurtunity of the 5th egg production in 1978, only the silkworm larvae reared at the Project were supplied for egg production. This policy is hoped to be continued.

As to the pebrine inspection system of 50 cocoons from a farmer, one pebrine-infected cocoon was admitted upto that time, but originally speaking if one cocoon from 50 ones is infected with pebrine, the Project had better not to buy cocoons from its farmer.

The result of examination on the distribution of pebrine disease revealed that the pebrine disease already decreased in the farmer. About the 40% of F_2 larvae hatched from eggs raised by pebrine-infected female moth was able to grow upto the stage of mature larvae. This fact said adversely that if pebrine inspection technique is more improved and if the 1st and 2nd instar larvae is reared under the clean condition, pebrine disease is seemed not to be a serious problem. Thus, although the pebrine spore is still observed at the silkworm rearing place of farmers, the pebrine disease is seemed not to give a big damage to farmers of the cocoon production for

raw silk, and also it is no longer not a serious silkworm disease in the South Sulawesi. Sometimes, farmer said that almost all of the larvae died at the late stage of 5th instar with pebrine disease, but in many case it was caused by the nuclear polyhedrosis virus.

Nowadays, the silkworm eggs come from other districts such as Java and India besides Japan, but we scarecely have the information of pebrine inspection of these imported eggs except eggs from Japan. To get information about the condition of these eggs from other districts is one of the most important factor to keep the pebrine disease in the low situation in the South Sulawesi.

IV. DISTRIBUTION OF *Aspergillus* FUNGI

The *Aspergillus* disease is one of the most important disease in the South Sulawesi, and its distribution at the silkworm rearing places of farmers and its infectivity to the larvae were examined.

IV.1. Distribution of *Aspergillus* sp.

For the detection of *Aspergillus* sp., the stamp agar method (Kawakami et al, 1975) was adopted. A tube of Rose Bengal Agar medium was wiped with 70% alcohol and was cut with a knife, wiped with 70% alcohol in advance, as 5 mm thick after being stamped on to the place examined, followed with being placed in a petri dish. The growth of *Aspergillus* sp. was observed after the 3 days.

IV.1.1. Aspergillus sp. at the Rearing Place of the Project

The examination result was as presented in Table 14. - The silkworm rearing places of the Project was as a whole very dirty with Aspergillus sp. Aspergillus sp. was found especially at the floor. Also, Aspergillus sp. was much at the mulberry stock room, showing the possibility of transfer of Aspergillus sp. into the silkworm rearing room with mulberry leaves.

Table 14. Distribution of Aspergillus sp. in the Institution of the Project

Place	Floor	Wall	Ceiling	Leaf stock box	Rearing Stand
Soppeng :					
Silkworm rearing room 1	-	++	-		
" " " 2	+++	-			-
" " " 3	-	+			
Mulberry stock room	+++	++		+++	
Egg raising room	+++	++			
Pebrine inspection room	+++	+++			
W a j o :					
Silkworm rearing room	+	+	+		+
S i d r a p : (Massepe)					
Silkworm rearing room	++	+	-		+
Enrekang :					
Young silkworm rearing room	++	+	+		+
Grown silkworm rearing room	-	+++	++		++

- Grade : +++ > ++ > + > - (April - June, 1979).-

IV.1.2. Aspergillus sp. at the Rearing Place of the Farmer

The examination result was as presented in Table 15. -

Table 15. Distribution of Aspergillus sp. in the Farmer's Rearing Place

Place	Existence of Spore					
	Floor	Wall	Ceiling	Rearing stand	Cocoon frame	Mulberry stock place
Soppeng :						
Unit 4 Solie	++	++	++	+		
Farmer A	-	+	+	+	+	
Unit 8 KPAT Pissing	+	+	+	+++		+++
Farmer A	+	++			+	+
Unit CV Nurwena	-	+	++	-		+
Farmer A	-	+	+	+		
Farmer B	-		+++		-	+
W a j o :						
Unit Project						
Farmer A	-	+	+	+	+	+
Farmer B	+	+	++	++	+	++
Unit PT Kebun Ternak	+	++	+	+		
Farmer A	+	+		+		
Farmer B	++	+		+		
Farmer C	++	+		+		
Sidrap :						
Unit Abd. Latief	+	+++	++	++		
Farmer A	+	+	++	++	+++	
Farmer B	+		+	++	++	
Enrekang :						
Unit Sudu	+++	++	+	++		
Farmer A	-	+	+	-	++	
Farmer B	-	+	+	+		
Farmer C	+	+	+	+		
Unit Belajen	++	+	+	+		
Farmer A	+	+	+	+		
Farmer B	+	+	+	+		
Farmer C	+	+		-	+	

(June, 1979).-

-) Grade : +++ > ++ > + > -

The fact that the wall and ceiling was contaminated with Aspergillus sp. revealed that these places were very dirty. There observed many dead bodies of insects at the wall or ceiling. In general, the mature larvae is not resistant to Aspergillus infection, therefore the cocoon frame should be cleaned out.

IV.2. Infectivity of Aspergillus sp.

The infectivity of Aspergillus sp. was examined by the bioassay method. The Aspergillus strain used in the examination was separated by the stamp agar method at the Subcenter, and then it was cultivated on the Czapek's agar medium for one month. The F_2 larvae just after hatching or ecdysis was inoculated with Aspergillus spores by the dipping method. Then, the larvae were reared in the petri dish or plastic box. The observation result for 12 days was as presented in Fig.4. (See page 29). The F_2 larvae became more resistant to Aspergillus infection with the growth of larvae. All the larvae of 1st instar died within 4 days, when they were inoculated with high concentration of spores (1 : 1) but within 7 days with spores (1 : 500), whereas only 70% of 4th instar larvae died within 12 days with spores (1 : 1).

IV.3. D i s c u s s i o n

The Aspergillus sp. was, in short, separated at all silkworm rearing places in the South Sulawesi. This fact told that the silkworm larvae were reared under the dirty conditi-

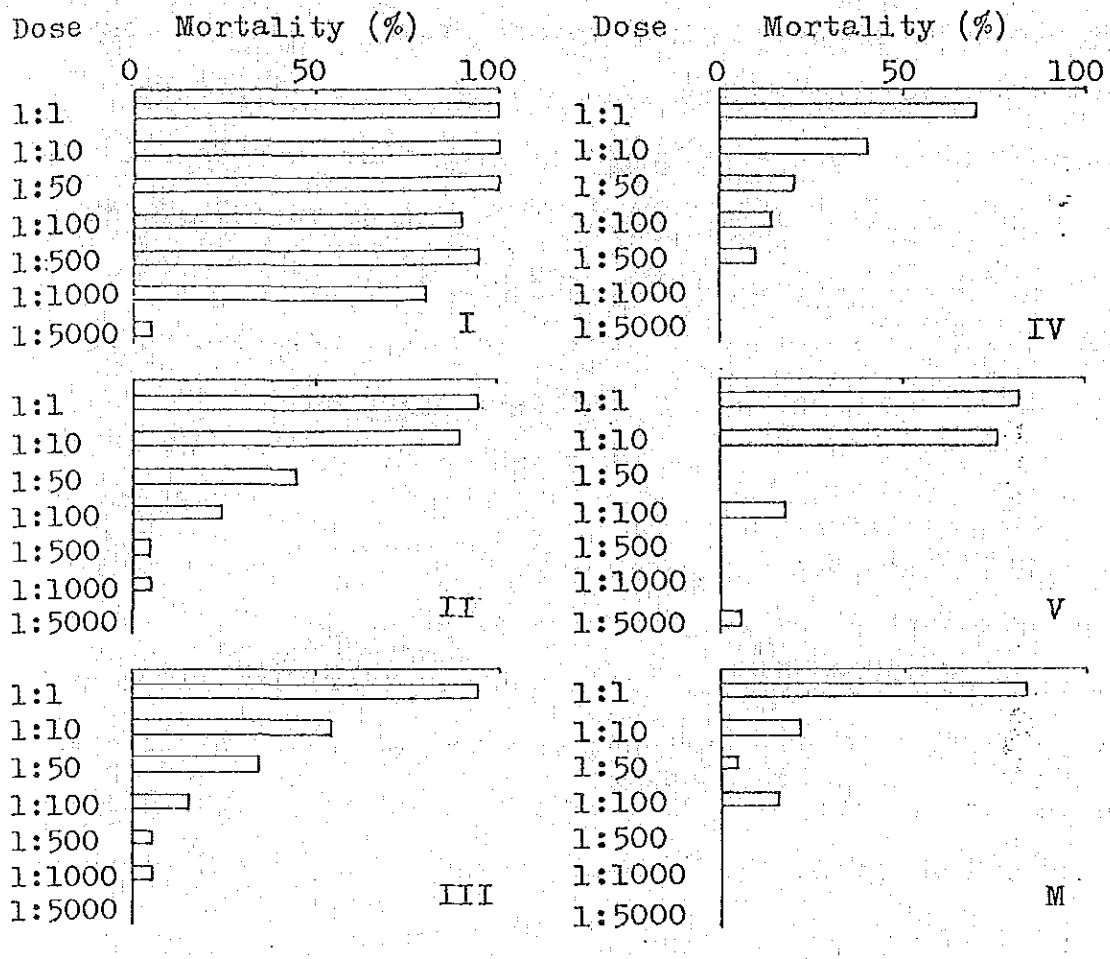


Fig.4. Infectivity of Aspergillus sp. to F_2 Larvae

I - V : 1st - 5th instar larvae

M : Mature larvae

The duplicated data were ajusted into one figure.

on. At the silkworm rearing places of farmers, Units and the Projects, we observed the spider net including inset dead bo-

dies, and also observed dirty cocoon frames madd from bamboo. These spots was thought as a source of Aspergillus fungi. As mentioned in the Capter II, Aspergillus fungi was one of the main cause of dead silkworm cocoon, and this fact suggested - that it was infected with Aspergillus sp. in the stage of grown silkworm or mature larvae. In short, the silkworm rearing place of farmers should be cleaned out and disinfected.

V. NATURE OF DISEASE

The several silkworm diseases, which were well-known - in Japan, were observed in the South Sulawesi. The silkworm - rearing is, at the present, performed under the non-disinfection condition, and sametimes a double infection of pathogens was observed. Herewith, the nature of diseases was described for the diagnosis of them.

V.1. Nuclear Polyhedrosis Virus Disease

The polyhedron of nuclear polyhedrosis virus (NPV) was hexagonal as presented in Fig.5 (page 31), when it was observed with a light microscope, but the polyhedron observed in the pupae or larval silkgland was cut at the edge. The diseased larva became swollen. The text book of insect pathology - said that the NPV-infected larvae moved actively in the rearing tray, but in usual the diseased larvae scarcely moved here. In the case of comparatively low temperature such as rain, however, a few larvae moved with a little active manner. The foot of diseased larvae was milky color. Sometimes the NPV-in

fected larvae showed pink color after the death, and it seemed to be caused with the bacteria, such as Serattia group. As

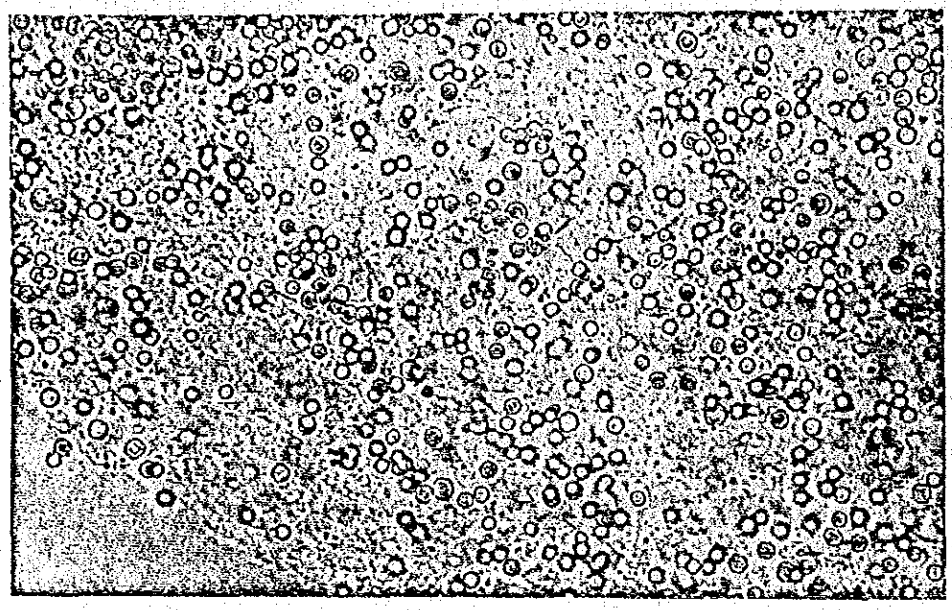


Fig. 5. Polyhedron of Nuclear Polyhedrosis Virus
(x 600)

to the pupae died with NPV in the cocoon, tissues were dissolved and only the skin remained there. If the dissolved tissue was smeared on a glass slide with a piece of match, polyhedron was able to be observed with a light microscope.

V.2. Cytoplasmic Polyhedrosis Virus Disease

The larvae infected with a cytoplasmic polyhedrosis virus (CPV) became sluggish and didnot eat mulberry leaves in the comparison with the healthy larvae. The midgat of these larvae was white color, when they were disected. When a part of such midgut tissue was observed with a light microscope ,

hexagonal polyhedra of CPV was found as presented in Fig.6. - In Japan, tetragonal polyhedra have been reported, but not yet in the South Sulawesi.

V.3. Pebrine Disease

The strain of pebrine spore separeated at the Subcenter was a typical Nosema bombycis (Fig.7 page 33). This work was performed in cooperation with MR. I. FUJIWARA, the Sericultural Experiment Station in Japan. The pebrine spore germinated within 10 seconds, when it was mixed with a larval digestive juise on a glass slide. The spore was frequently observed in the Malpighian tube, and there was small white - spots on the silk gland when it was infected. Sometimes, there

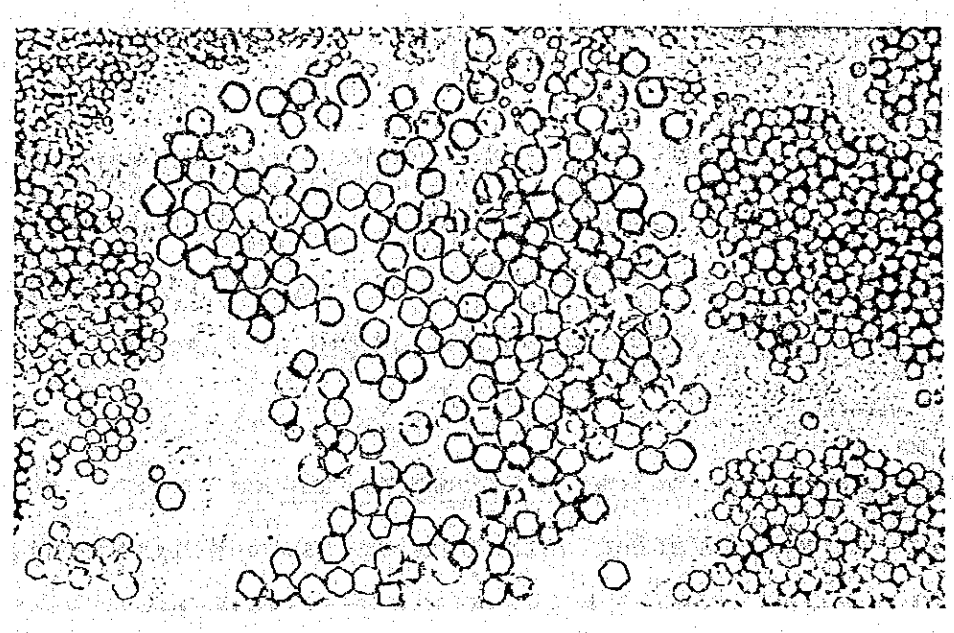


Fig. 6. Polyhedron of Cytoplasmic Polyhedrosis Virus (x 800)

observed very small larvae in the rearing tray of farmers, and in many case these larvae were infected with pebrine spores . The infected larvae became sluggish and sometimes their faeces were connected with each other (Fig. 8, page 34).

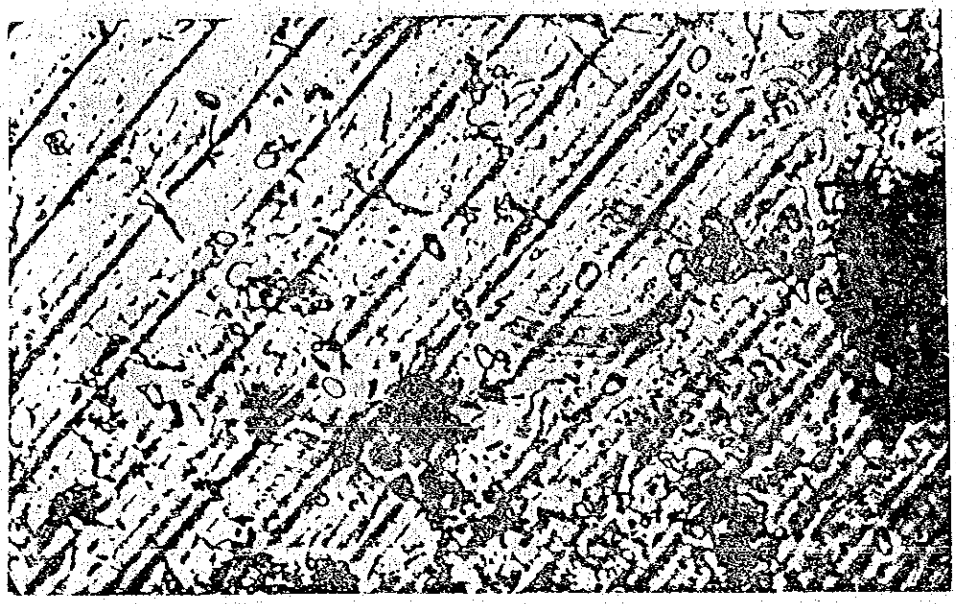


Fig. 7. Pebrine Spore.
(Scale showes a 10 μ distance)

V.4. Aspergillus Disease

From the dead silkworm larvae by the infection of Aspergillus sp. at the Subcenter (Fig. 9, page 34), two kind of Aspergillus strains were separated. One was Aspergillus flavus as presented in Fig 10 (page 35), and the other was Aspergillus tamari (ig. 11, page 35). This work was performed in cooperation with DR. K. KAWAKAMI, the Sericultural

Experiment Station in Japan. The color of Aspergillus fungi -

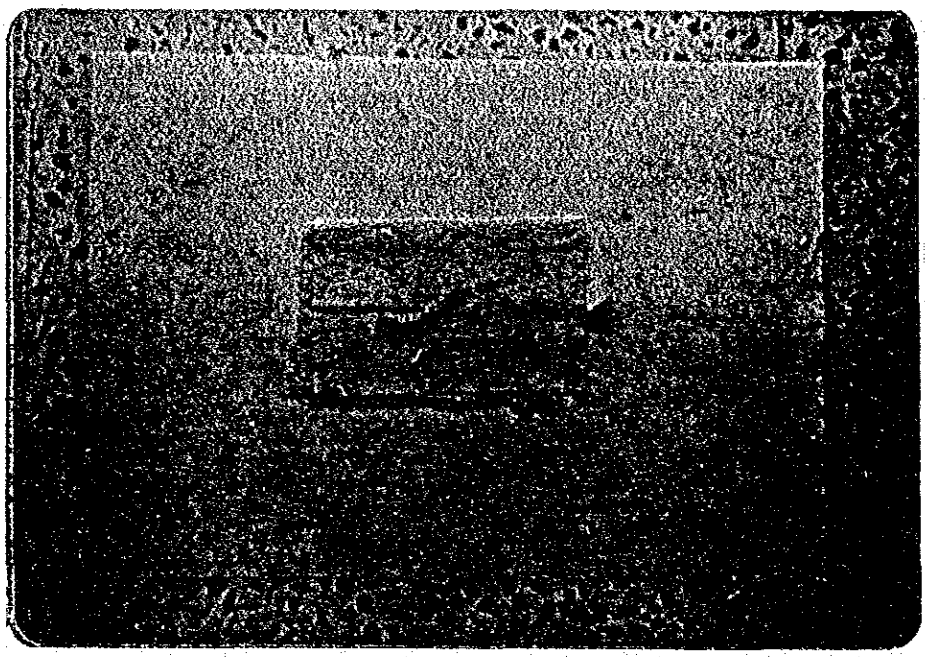


Fig. 8. Pebrine Infected Larva.

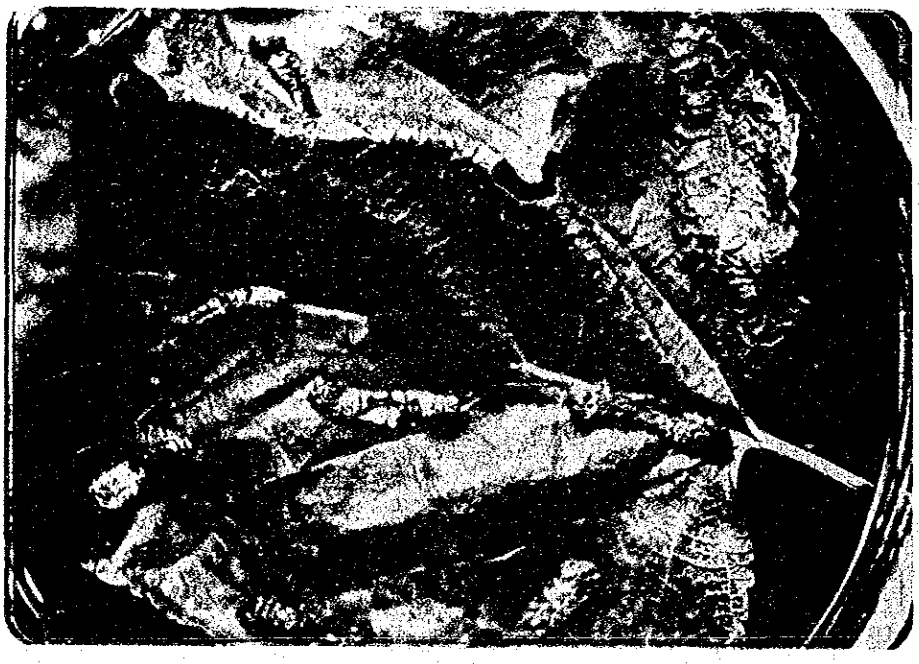
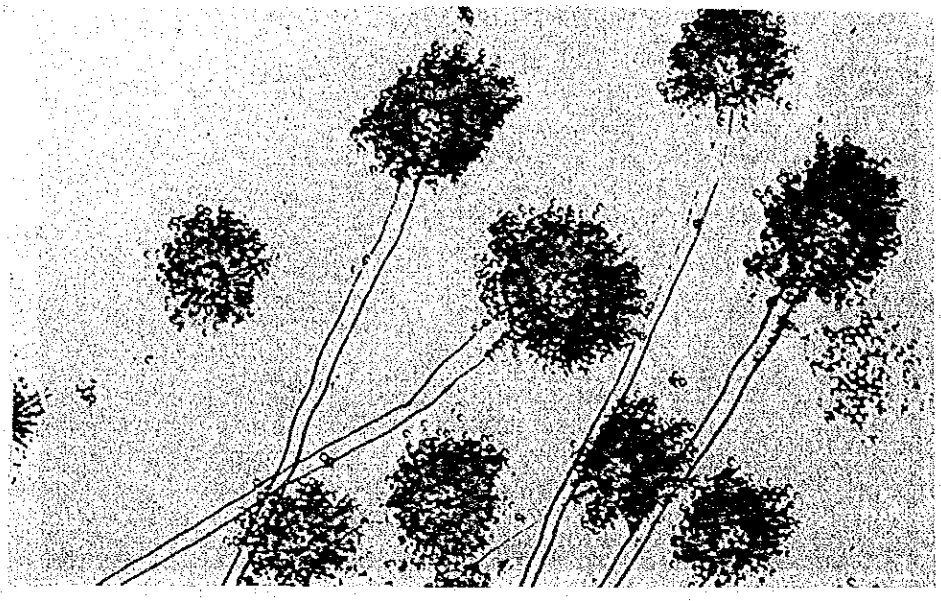


Fig. 9. Silkworm Larvae Died with Aspergillus Fungi.



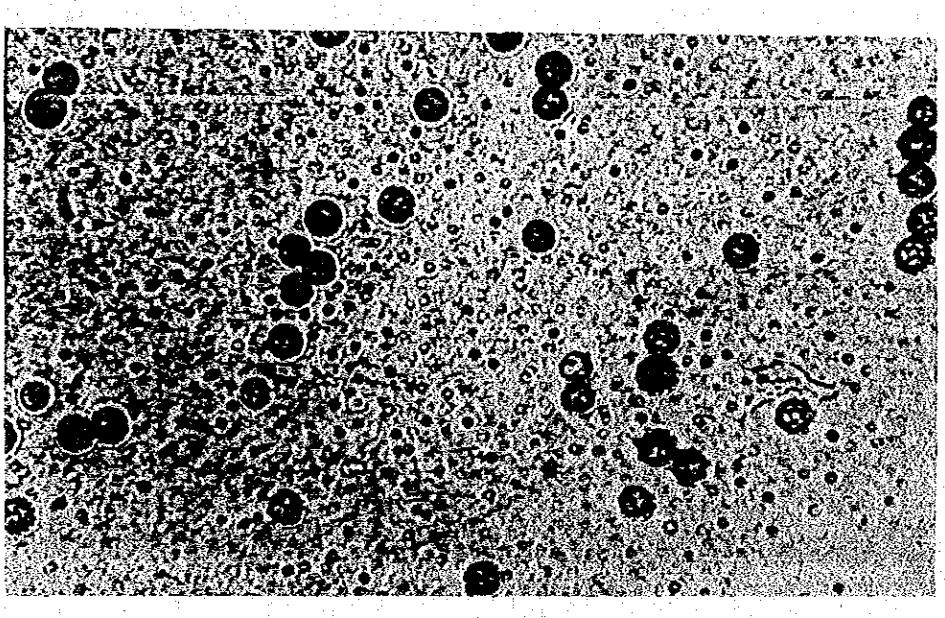
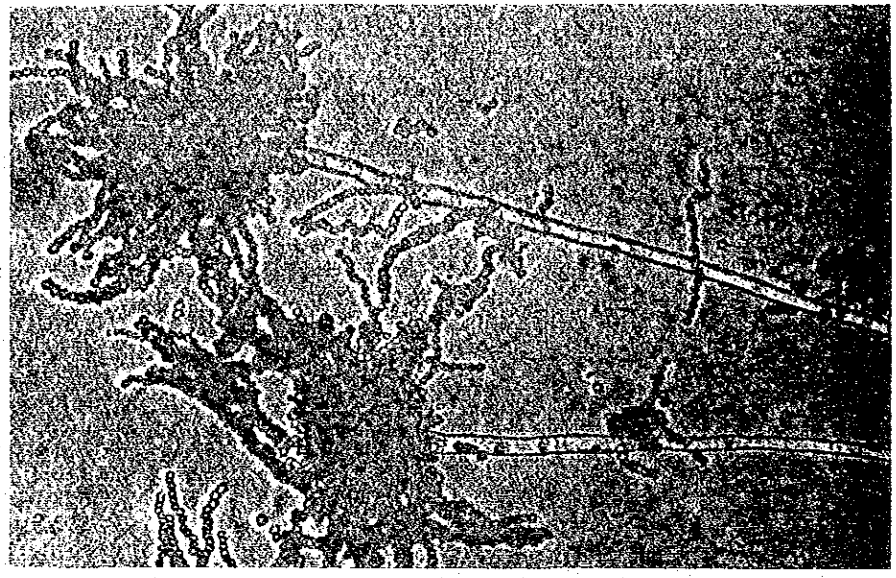


Fig. 10. Aspergillus flavus.

Above : Conical head.

Lower : Spore.



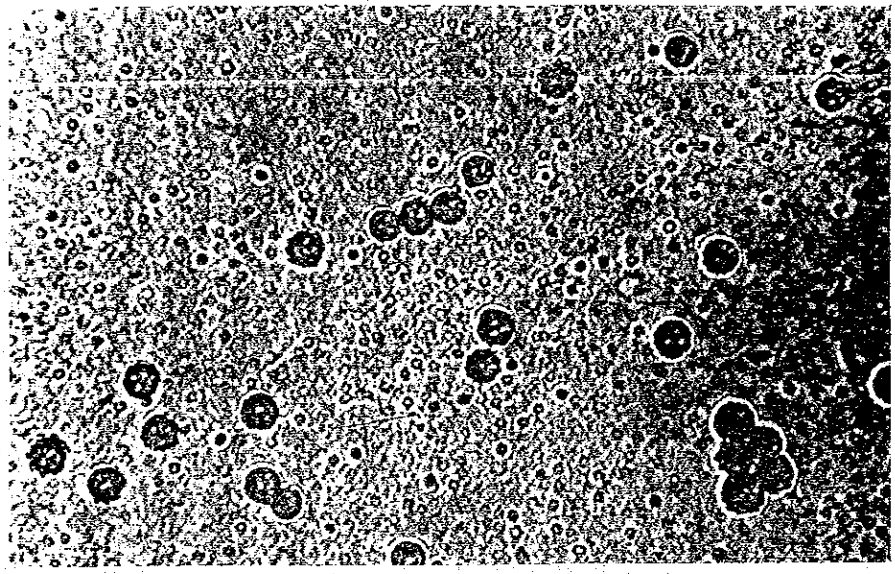


Fig. 11. Aspergillus tamari.

Above : Conical head

Lower : Spore.

was yellow-green at Czapek's agar plate, and Aspergillus flavus was seemed to be the most main pathogen. The infected larvae showen a difficulty in ecdysis, and also showed little body fluid.

V.5. Muscardine Disease

In general, the muscardine disease was quite a few in the South Sulawesi, but at the Sericulture Center at Bili-Bili the green muscardine disease appeared especially in the Wet Season, though the distinction with the black muscardine remained to be clarified. The dead body was covered with white fibers, but change its color as green within two days later.

V.6. Poisoning with an insecticide

The auther observed the poisoning of 5th instar larvae with "Sevin", a kind of insecticide. This insecticede was used for the prevention of attak by ant. The Sevin powder was dissolved with water and sprayed around the silkworm rearing place, and after that Sevin box was placed at the window, resulting into the scatter of powder by the wind. The poisoning larvae showed the symptoms such as, (1) vomitting the digesttive juice from the mouth, (2) putting out the silk fiber from the mouth, (3) waving its head, and (4) paralysis.

VI. TEST FOR CONTROL OF SILKWORM DISEASE

We already learned that the Aspergillus disease was one of the most important disease and the damage of silkworm by

NPV was increasing in tendency. The several tests performed here was mainly focused to the control of Aspergillus disease because of the limitation of research equipment and tools.

VI.1. Effect of Formalin Spray at the Subcenter

The disinfection effect of formalin was examined by the bioassay method at the Subcenter. Before and after the 3% formalin spray, the dust was collected from objective spots and inoculated to the newly hatched F_1 larvae. The result was as presented in Table 16. The one-time spray of 3% formalin showed the disinfection effect but not complete.

Table 16. Pathogenisity of the Dust Collected at the Subcenter

Place	Before disinfection		After disinfection	
	No. of healthy larvae	No. of dead larvae	No. of healthy larvae	No. of dead larvae
Rearing room (Old)	0	10	8	2
" (New)	9	1	10	0
Mulberry stock room	6	4	9	1
Research room (old)	9	1	9	1
Egg raising room	10	0	5	5
Pebrine inspection room	0	10	10	0
C o n t r o l	10	0		

(August, 1978).-

Then, the disinfection effect of formalin was examined to the Aspergillus fungi. After the finish of silkworm rearing, 3% formalin was sprayed, and then Aspergillus spore was detected with the stamp agar method. The result was as pre-

sented in Table 17. Even after the 1st spray of formalin, Aspergillus spores kept their activity at the places of floor, wall and rearing tray.

Table 17. Existence of Aspergillus Spore after Formalin Spray at the Subcenter

Place	Floor	Wall	Ceiling	Rearing stand	Rearing tray
Rearing room 1	-	++	-		
" " 2	+++	-		-	
" " 3	-	+			-
Mulberry stock room	+++	++			
Egg raising room	+++	++			++
Pebrine inspection room	+++	+++			

- Grade : +++ > ++ > + > - (April, 1979).-

VI.2. Inactivation Test of Aspergillus Spore

In order to develop a disinfection method for farmers, several chemicals were tested for the disinfection of Aspergillus spores. Aspergillus sp. used was obtained at the rearing room for young silkworm at the Project, Enrekang. After 3 days cultivation of Aspergillus sp. in the Czapek's agar medium, spore suspension of 1 : 1 was prepared with distilled water contains 5,000 times dilution of Tween 40. The one-loop dose of spore suspension was placed on a filter paper (5 mm in diameter), and then the filter paper was dippid in chemical solutions for suitable hours. After dipping, the filter paper was kept into the Czapek's solution for 8 days and the growth of Aspergillus sp. was observed. The result was as pre

sented in Table 18. The spore was completely inactivated with 3 % formalin and it was apparent that Aspergillus strain at Enrekang was not yet formalin resistant. Sodium Hypochlorite solution was very effective to the spore with its 0,004 % (effective dose). On the contrary, the bleaching powder was not effective, but it became clear that this bleaching powder had lost its effective during the stock in the laboratory. The similar test was performed on the Aspergillus sp. separated at the Subcenter, and the same result was obtained.

Table 18. Inactivation Test of Aspergillus Spore

Chemicals	Dipping time			
	30 min	1 hr	3 hr	5 hr
Formalin 5%	- - -	- - -	- - -	- - -
" 3%	- - -	- - -	- - -	- - -
Sodium hypochlorite				
0,4 %	- - -	- - -	- - -	- - -
0,04 %	- - -	- - -	- - -	- - -
0,004 %	- - -	- - -	- - -	- - -
Bleaching powder 200x	+++++++++	+++++++++	+++++++++	+++++++++
" " 500x	+++++++++	+++++++++	+++++++++	+++++++++
Control (Distilled Water)	+++++++++			

- Grade : +++ > ++ > + > - (September, 1979).
- Aspergillus sp. at Enrekang was used after 3 days cultivation at Czapek's agar medium.

VI. 3. Spray Test of Sodium Hypochlorite Solution

The disinfection effect of sodium hypochlorite to Aspergillus spore was examined at the Subcenter. Sodium hypochlor-

ite solution (SH) of 0,004% and 0,04% (effective dose) was sprayed in the same room. The spray volume was approximately 1 litre/m2. The result was as presented in Table 19.

Table 19. Spray Test of Sodium Hypochlorite Solution

Chemicals	Disinfection	Floor		Wall		Ceiling		Rearing stand	
SH 0,004 %	Before	++++	++++	+	+++	-	-	-	++
	After	+++		+++	+++	-	-	-	-
SH 0,04 %	Before	++++	++++	++	+++				
	After	++ a)		-	-				
Formalin 3%	Before	++	+++	+++	++	-	-	++	+++
	After	-	+	-	+	-	-	-	-

(January, 1980).-

- SH : Sodium Hypochlorite Solution, effective dose.

a) SH 0,04% was sprayed on SH 0,004% solution.

Sodium Hypochlorite Solution (SH) of 0,004% was not effective, but effective its 0,04% solution. SH of 0,04% showed only a little effective when it sprayed on the floor, but this might be the reason that when 0,004% SH was sprayed at the ceiling, it fell down on the floor, and then the solution 0,04% SH was sprayed, resulting into the dilution of 0,04% SH. The disinfection effect of 0,04% SH was not looked to disadvantage with 3% formalin, which was sprayed in another room at the same time.

By the way, if the surface of wall or places objected was painted with a lime or paint, it seemed to increase the disinfection effect, because the surface became flat. The

smell of SH was not painful to the person and SH 0,04% was not harmful to the ironwork. Thus, 0,04% SH solution is adoptable for the disinfection of farmer's silkworm rearing place.

VI.4. Feeding Test of Sodium Hypochlorite Solution

Sodium Hypochlorite Solution (SH) of 0,04% was smeared on the both side of mulberry leaf and was given to the newly hatched F_2 larvae. Then, the larvae were given SH- smeared leaves one time in a day, and reared till the larvae became 4th instar. The growth of larvae given SH was the same as that of control larvae. Thus, 0,04% SH solution was not harmful to the larval health.

VI. 5. Spray Test of Sodium Hypochlorite Solution on the Larval Surface

The possibility of Sodium hypochlorite solution (SH) as a disinfectant of larval body surface and rearing tray was examined. The silkworm F_2 larvae was used. SH was sprayed on the larval body surface with a hand sprayer. Every 2,000 larvae was reared in the same tray for 1st to 3rd instar, and then they was divided into a group of 200 larvae for the test. The experiment plan and result was as presented in Table 20 (page 43). The F_2 larvae used in this test was seemed not to be good, because "Okichijimi" larvae appeared for 2nd to 4th instar. When Test I-c (pafsol spray) and Test I-d (Lime powder spray) were thought as control, Tests of SH spray showed comparatively high percentage of healthy pupae as a whole. In addition, Test II-a in which SH was -

Table 20. Spray Test of Sodium Hypochlorite on Larvae

Test No.	No. of larvae tested	No. of cocoon	No. of healthy pupae	Percent of healthy pupae (%)
I - a	400	218	180	45
b	400	271	217	54
c	400	239	169	42
d	400	222	182	46
e	325	198	164	50
II - a	400	258	211	53
III - a	400	235	169	42
b	200	119	95	48

(February, 1980).-

I : Pafsol spray at 1st - 3rd instar just after ecdysis
- I-a : Pafsol spray at 4th instar just after ecdysis, then SH spray every day from 4th instar
- I-b : Pafsol spray at 4th instar just after ecdysis, then SH spray every other day from 4th instar
- I-c : Pafsol spray at 4th and 5th instar just after ecdysis
- I-d : Pafsol spray at 4th instar just after ecdysis, then lime spray at 5th instar just aftar ecdysis
- I-e : SH spray at 4th and 5th instar just after ecdysis.

II : SH spray every day from 1st instar and Pafsol spray on the ecdysis day of 1st - 4th instar.

III : Pafsol spray at 1st - 3rd instar just after ecdysis
- III-a : Pafsol spray at 4th and 5th instar jus after ecdysis
- III-b : SH spray at 4th and 5th instar jus after ecdysis

The duplicated data was adjusted into one table.

SH : Sodium Hypochlorite Solution of 0,04%.

The larvae of Test III were reared in the formalin-sprayed room.

sprayed from .....

sprayed from 1st instar, showed no poisoning and the healthy pupae percent was comparatively high. The silkworm rearing result in the SH-sprayed room was not inferior to that in the formalin-sprayed room, and it was clarified that SH was safe to the silkworm larvae.

VI.6. Spray of Sodium Hypochlorite Solution to Farmer's Larvae

One of the counterpart, Mr. Hatta M., gave Sodium Hypochlorite Solution (SH) to 5 counselling persons. They sprayed SH of 0,04% to the silkworm F_2 larvae of farmers one time every day from 4th instar just after ecdysis. Then, we obtained the report from them that the F_2 larvae of farmers usually died 50 percent at the mounting time, but it decreased upto 10 - 15 percent in their trials.

VI. 7. Effect of Ready-Made Disinfectants

The ready-made disinfectants used in Japan was examined their disinfection effect. The silkworm F_2 larvae of 3rd instar just after ecdysis was inoculated with Aspergillus spore, which was cultivated for 7 days on the Rose Bengal Agar medium, by the dipping method. After the larval surface was dry, a group of 20 larvae was sprayed with the disinfectants. The larvae were reared for 11 days till mounting time. The result was as presented in Table 21. (page 45). Pafsol was the most effective and also Kabinoran and Kemikuron were effective more than 10 percent, when it was compared with control.

Table 21. Disinfection Effect of Disinfectant

Spore Suspension	Disinfectant	No. of larvae tested	No. of larvae mounted	Healthy percent (%)
1 : 50	Pafsol	40	39	98
	Kabinoran	40	37	93
	Kemikuron	40	34	85
	---	40	29	73
1 : 500	Pafsol	40	40	100
	Kabinoran	40	37	93
	Kemikuron	40	38	95
	---	40	33	83
Control		40	39	98

(March, 1980).-

- The duplicated data was adjusted into one table.

VI.8. Mixture of Lime and Bleaching Powder

The lime powder is easily obtainable in the South Sulawesi and the Project has much amount of bleaching powder. Therefore, we are testing the mixture of both powders as a disinfectant of larval surface. The lime powder and bleaching powder were mixed as 95 : 5, 90 : 10, 85 : 15 and 80 : 20, respectively, and sprayed on the Aspergillus inoculated larvae. The test is continuing now. The test of 80 : 20 was looked like harmful to larval health.

VI. 9. D i s c u s s i o n

In this chapter, several tests were performed in order

to develop the control technique of Aspergillus disease. The experiments were still continuing and only a part of them was presented here.

Even at the Subcenter, where the cleaning and disinfection work were more carefully performed compared with farmers, Aspergillus fungi kept its activity after the formalin spray. Therefore, the effect of formalin spray at Unit was worried.

At present, farmers rear the silkworm larvae under the "high-leg" house, and the disinfection with formalin is very difficult. We thought the use of sodium hypochlorite solution to the disinfection of rearing place and larval body surface, and then we knew its 0,04% solution (effective dose) was effective to such purpose. The counselling person reported that the spray of sodium hypochlorite solution decreased the silkworm disease. The more exact test is at work.

VII. D I S C U S S I O N

Our Project, The Sericulture Development Cooperation Project in Indonesia (ATA-72), is focused to develop sericulture techniques suitable in Indonesia. We have surveyed on the real condition of silkworm disease in the South Sulawesi for one year and then performed several experiments in order to establih the control techniques of silkworm disease.

According to the report by the Preliminary Survey Team (1974) dispatched from Japan, the pebrine disease was the most frequently observed and other diseases were a few, but

Aspergillus disease possessed the possibility becoming a big problem. The result of our survey said that the pebrine disease was likely to not give a marked damage to the sericulture farmer in the production of cocoon for reeling, though pebrine spore was still observed at the silkworm rearing place. At the present, the silkworm rearing for F_2 egg production was limited in the Project institution and the technique of pebrine inspection was improved. These factors were closely connected with the decreasing tendency of pebrine disease in this district. However, sometimes F_1 and F_2 eggs were imported from other districts such as India and Java, Indonesia. We scarecely obtained the information of pebrine inspection about silkworm eggs from other districts except Japan, and we have to always watch such eggs in order not to increase the pebrine disease again.

The Aspergillus disease is one of the most important silkworm diseases and it is the main cause of dead silkworm cocoon. The Aspergillus spore was found at all places of silkworm rearing. The nuclear polyhedrosis virus (NPV) disease is increasing. Especialy in 1979, it was a droughty year in the South Sulawesi and the prevalence pattern of NPV disease was likely to change from the enzootic phase to epizootic phase. We observed several examples that almost all of F_2 larvae of farmers died with NPV infection at the late stage of 5th instar. According to the data performed in Japan, NPV disease was able to stop in the silkworm rearing tray, when NPV - infected larvae were taken off as soon as possible (Aratake and Kaya-

mura, 1974 a). But, this is the data performed under the good disinfection work. Whereas, the silkworm rearing place here is seldom disinfected and NPV is found in the dust of such place. In other word, the silkworm larvae are exposed, in any time , with pathogens and to decrease the silkworn disease is difficult without the cleaning and disinfection of rearing place.

The cytoplasmic polyhedrosis virus (CPV), the green muscardine and the white muscardine were also found, but these disease were not main. It was said that the survive period of CPV was longer than that of NPV (Aratake and Kayamura, 1974b), and the occurence of CPV disease is thought to increase, when NPV disease decreases in future. As to the bacterial disease , we could not enogh examine. Chitra et al (1973 and 1974) reported that in India there was so-called "Sappe" disease caused by several kinds of bacteria. Sometimes we observed an unknown disease such as a part of skin of diseased larvae became "see-through" owing to the fat tissue was destroyed. This unknown disease should be examined well as soon as possible.

On the basis of survey result mentioned above, we thought a fundamental countermeasure of the disease control at the Project, Unit and farmers. The Project bears the egg production - work and must refrains from bad crops of cocoon. For the purpose the Project is expected to give priority to the stabilization of cocoon crops, even though the investment is required. In addition, the equipment for silkworm rearing of the Project is at the place far from houses. Therefore, the up-to-date disinfection or disease prevention technique in Japan is able to

introduce directly. On the other hand, the farmer rears about 1 box of 4th instar larvae delivered from the Unit under the "high-leg" house. The silworm rearing scale by a farmer is small and the farmer possesses a difficulty for investment, and moreover disinfection with formalin is difficult. By such reason, the disease control techniques suitable to the condition of farmer should be made up. The Unit stands between the Project and the farmer. The Unit of good rearing condition is able to be thought as the same with the Project and ones of poor condition as the same with the farmer.

According to the reason mentioned above, our research was focussed to develop the disease control technique for the farmer. The silkworm rearing place of farmer is already contaminated with pathogen, especially Aspergillus fungi and NPV, and to prevent silkworm disease except disinfection is quite difficult; but, the use of formalin is quite difficult, too. Thus, we examined the possibility of adoptation of sodium hypochlorite solution (SH), and learned its disinfection effect of 0,04% (effective dose) to Aspergillus fungi. The procedure of disinfection with SH is thought as follows :

1. Sweeping the dust of rearing place and tools
2. Smearing of lime solution on the wall, ceiling and tools
3. Spraying of 0,04% SH as 1 litre/m2.

The effect of smear of lime solution is (1) inactivation or burying of pathogens, and (2) flattening of the surface. We got a report from counselling persons that 0,04% SH, when it

was sprayed on the larvae every day, was effective to decrease the silkworm disease at the rearing place of farmers.

The floors of silkworm rearing place of farmers is made from soil and it is contaminated with pathogens. The disinfection method of the soil floor using chemicals, especially SH, bleeching powder and lime powder, was remained to be established.

In 1979, the organization of counselling person to the sericulture farmer was established in the South Sulawesi. The counselling person bears a very important role to control of silkworm disease. For the purpose of training of them, we published a textbook entitled 'PETUNJUK PRAKTIS CARA PENCEGAHAN DAN PEMBERANTASAN PENYAKIT ULAT SUTRA' in Indonesian language. We wish that they understand the importance of prevention of epidemics for the development of sericulture in Indonesia.

VIII. REFERENCE

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