"Climate changes and chemicals – the new sericulture challenges"

Silkworm Diseases System Management and Control

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Sheki, Azerbaijan

BASCA in Turkey
2006-03

Silkworm industry in China

North China

East China

South West China

South China

Silkworm industry distribution in China

Tasar

North West China

4%

Mid 10%

East China

34%

18%

West South China

34%

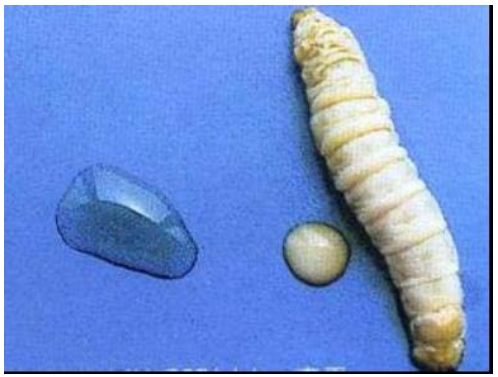
South China

南海诸岛

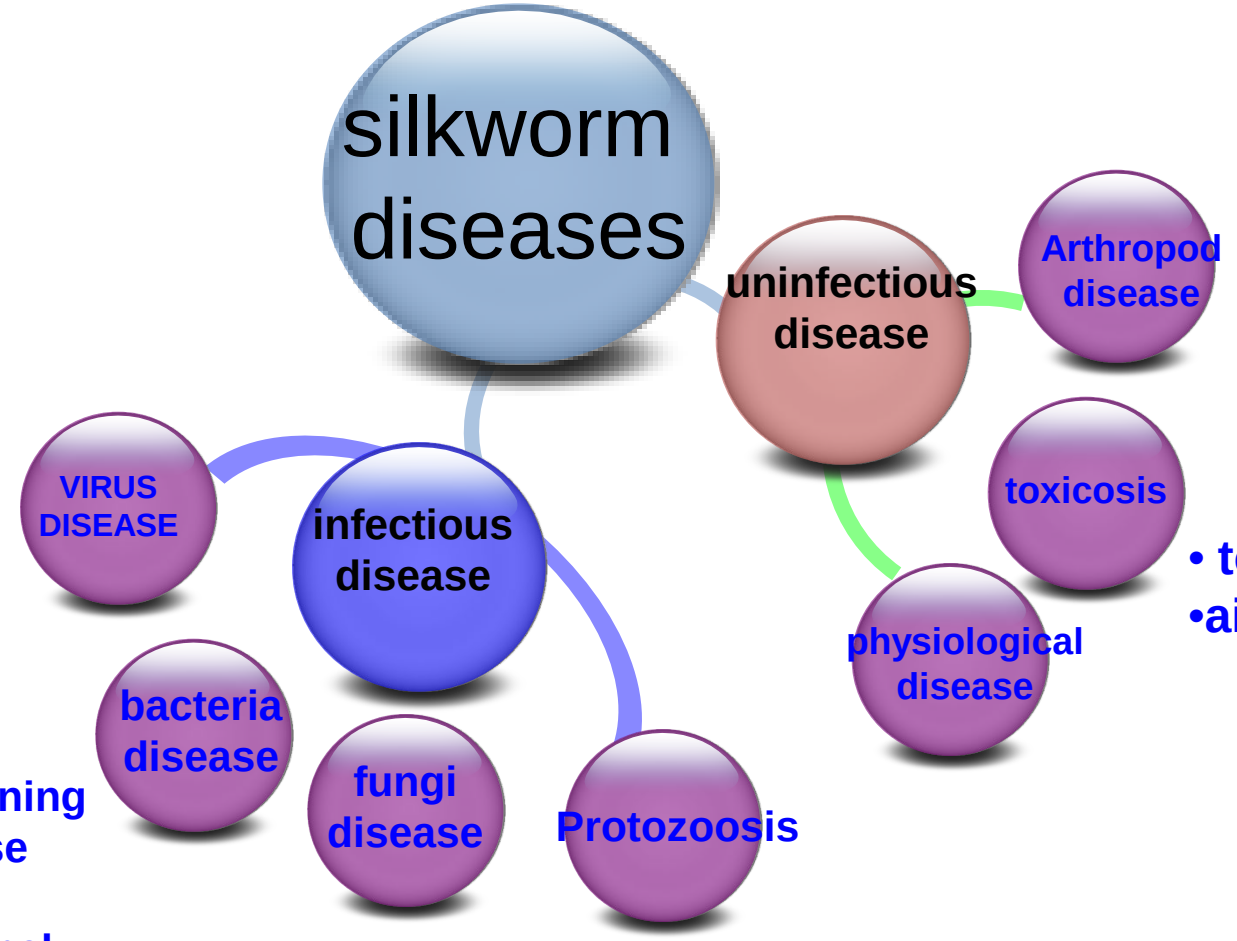
So, no need your any more aid ?

Climate changes and chemicals – the new sericulture challenges

How many diseases in silkworm?



The types of silkworm diseases



- BmNPV
- BmCPV
- BmFV
- BmDNV

- myiasis myiosis
- sting symptom

- toxicosis
- air pollution

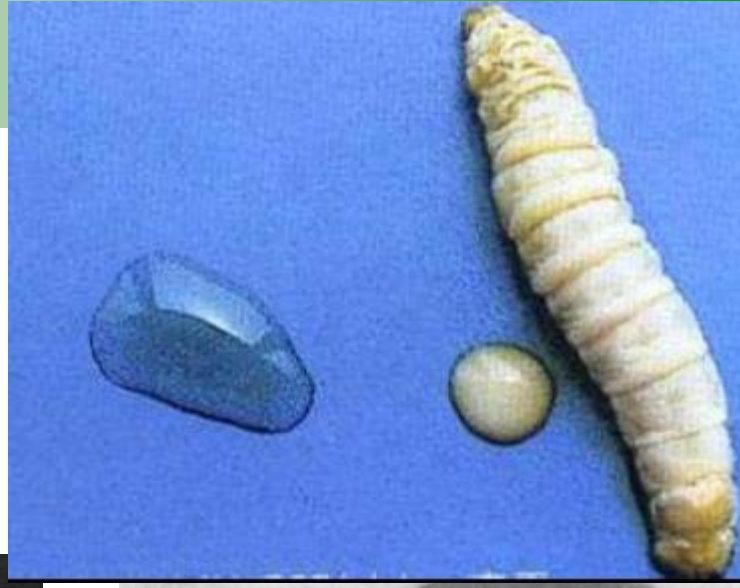
- Blood poisoning
- Sotto disease
- Bacterial gastrointestinal
- ,etc

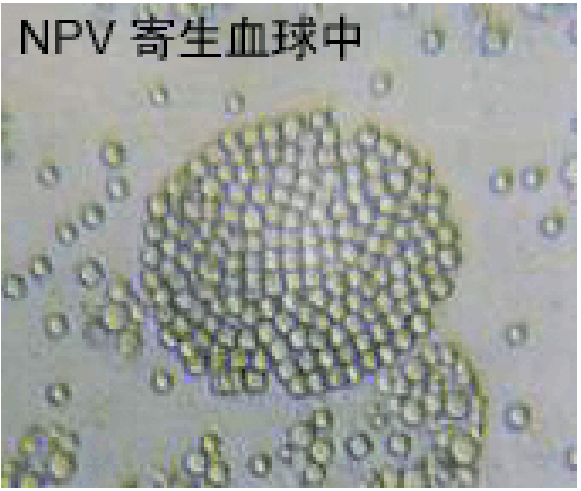
- White muscardine
- Aspergillosis
- Green muscardine
- ,etc

- Pebrine

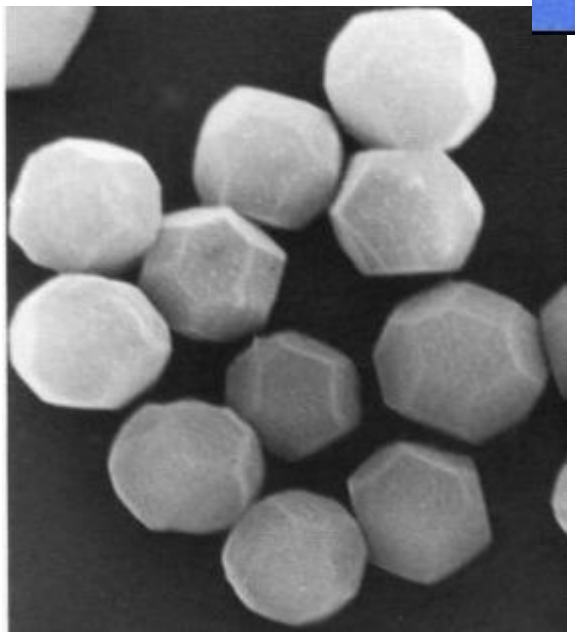
The main type of virus disease

- 1）**BmNPV**

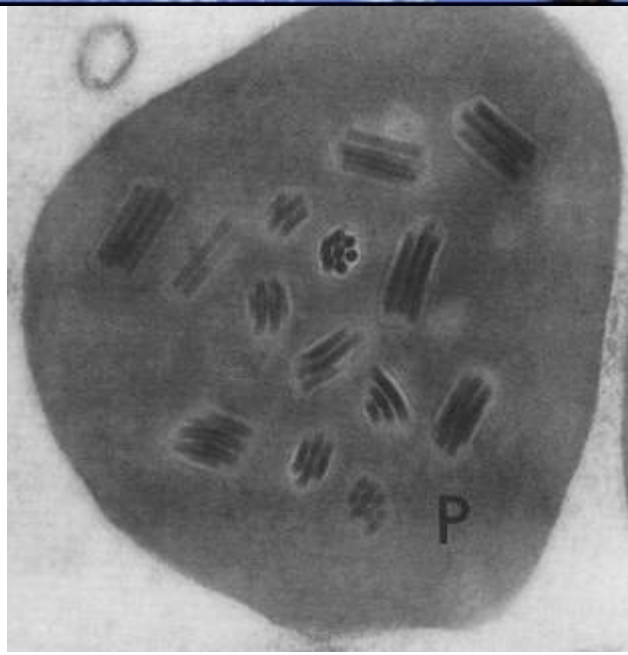




blood of sick silkworm under light microscope



NPB under e-scanning electron microscope

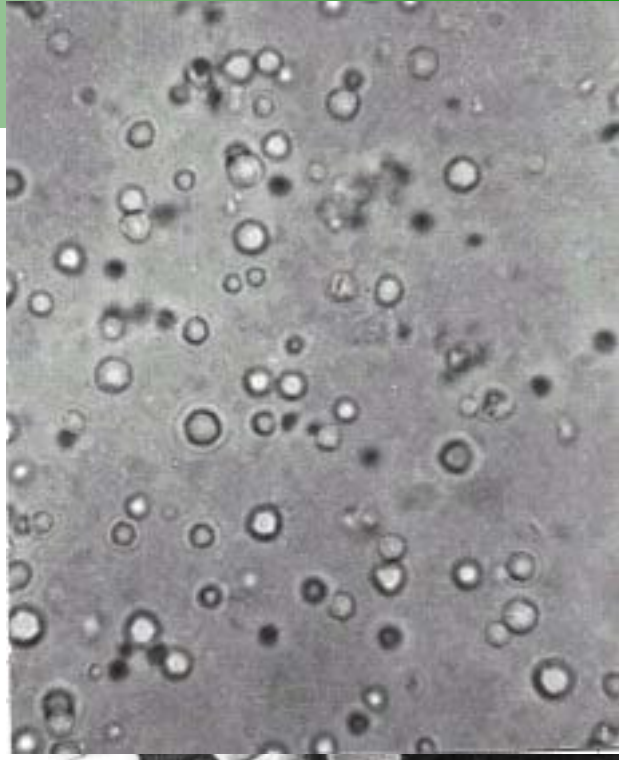


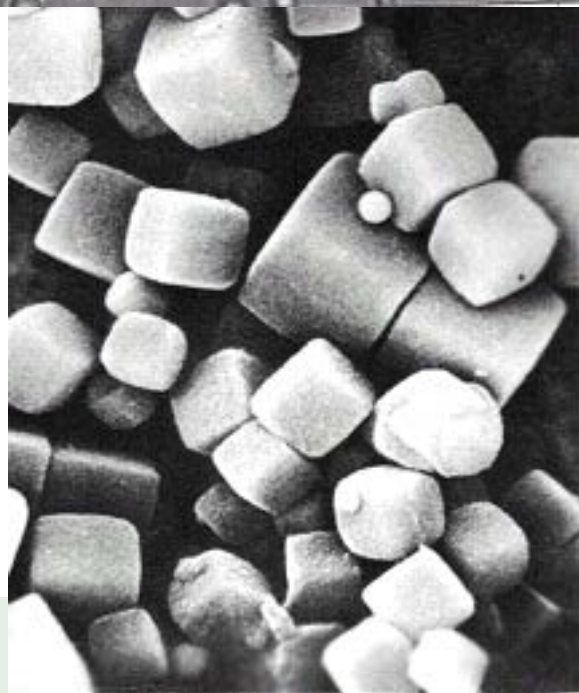
virus particle under transmission electron microscope

silkworm virus disease prevalent in summer

2、BmCPV

the whole body **and head are** transparent **. In this infected silkworm, BmCPV infection ration 75%， the rest of 25%** flacherie or complication。





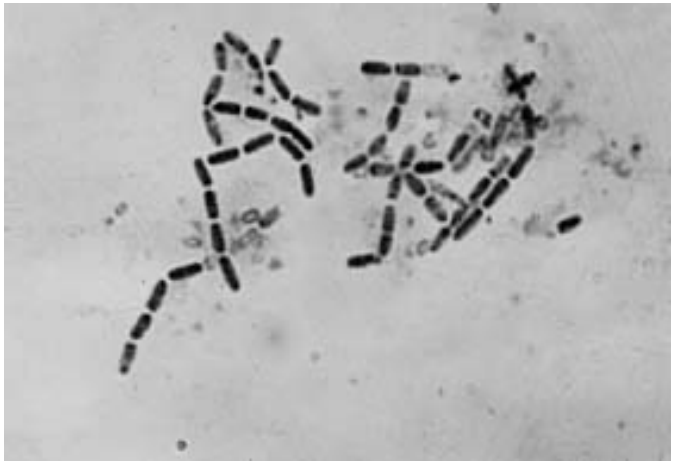
Iron silkworm？

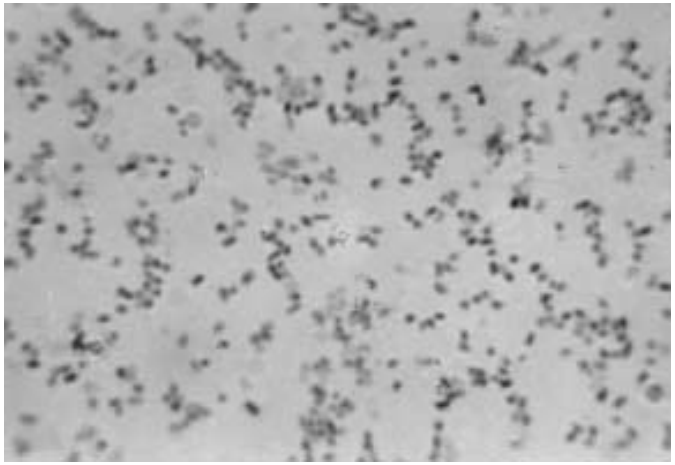
The course of silkworm virus disease

Viral Disease	Instar	Time of Outbreak or Death	pathogenicity
NPV	1~3	3~4ds	acute
	4~5	4~6ds	subacute
CPV	1	4~7ds	chronic
	2~3	6~10ds	chronic
	4~5	8~12ds	chronic
DNV		7~12ds	chronic

Bacterial disease

The silkworm bacterial disease





Bacillus thuringiensis (B. t.)

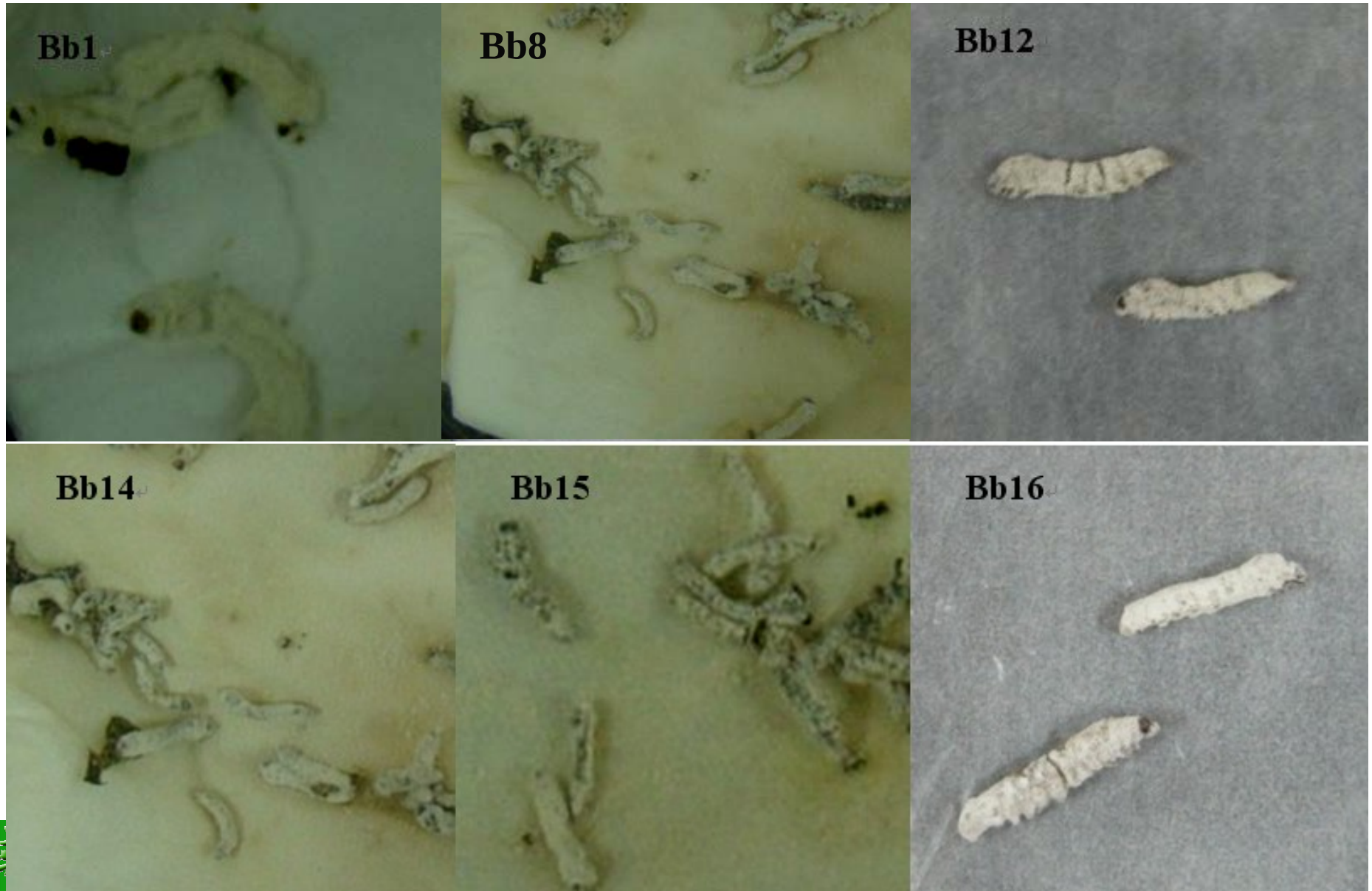
Blood poisoning

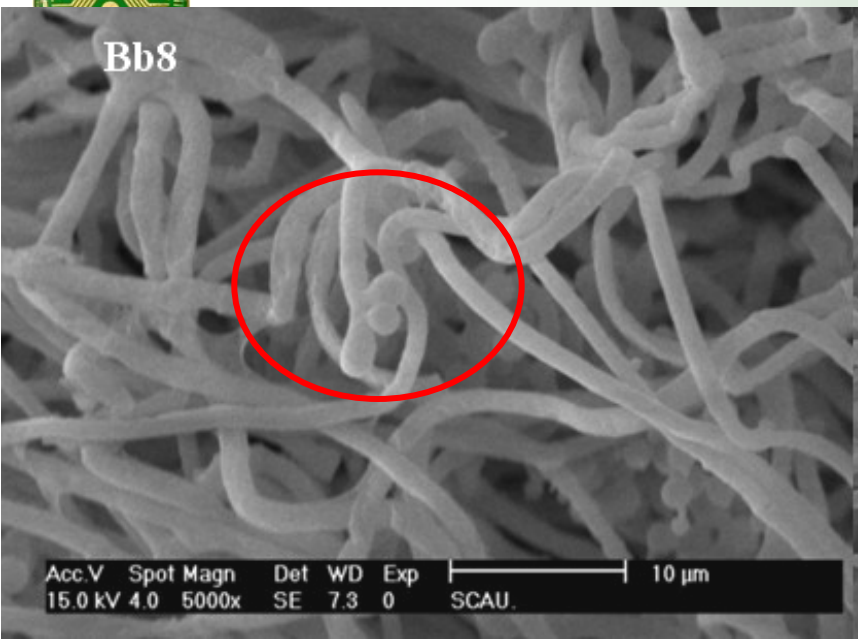
Fungi disease——muscardine disease

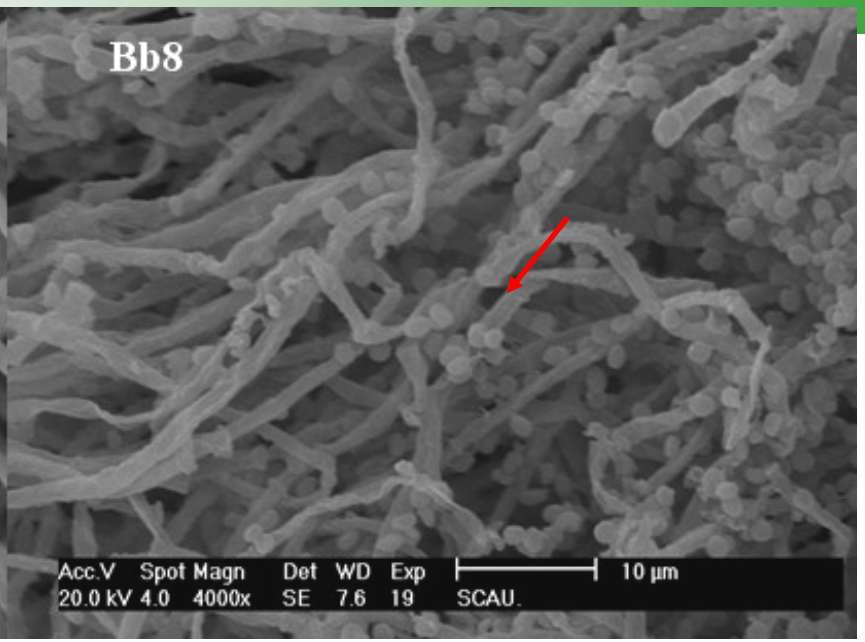
Aspergillosis

Aspergillus spp.

Symptoms in different isolates of *B.bassiana*

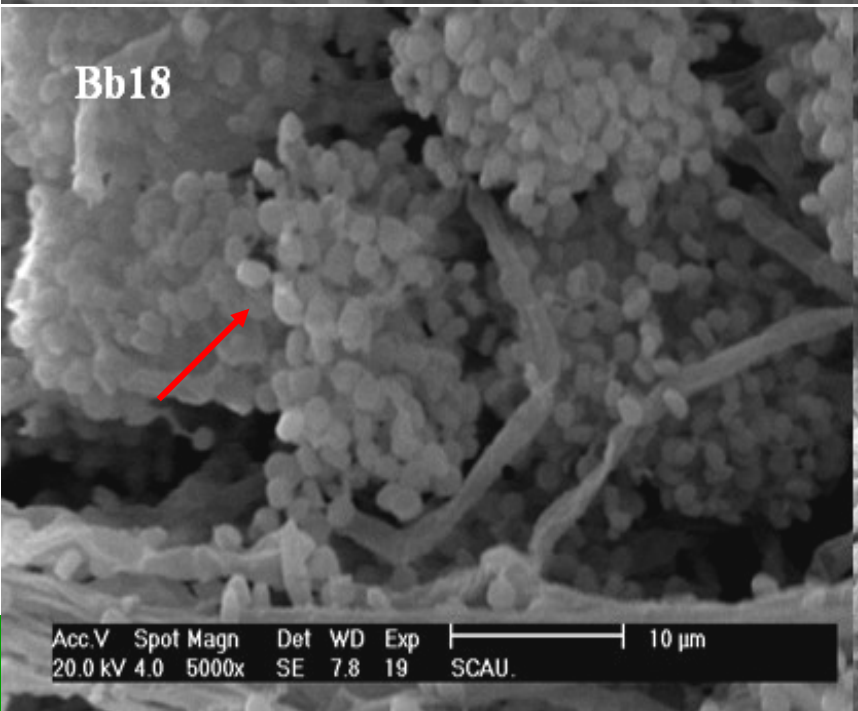






Bb8

B. bassiana



Bb18

Paecilomyces farinosus

B. bassiana Mixing infection in the silkworms

unit：head

No. of Mix with infections	Total	Day1	Day2	Day3	Day4	Day5	Day6	Total infection ratio %
		No. of 2nd infections						
1	100	0	0	0	80	87	100	100%
2	100	0	0	4	98	100	0	100%
3	100	0	1	6	96	100	0	100%
4	100	0	2	11	100	0	0	100%
5	100	0	10	28	100	0	0	100%
CK	100	0	0	0	0	0	0	0

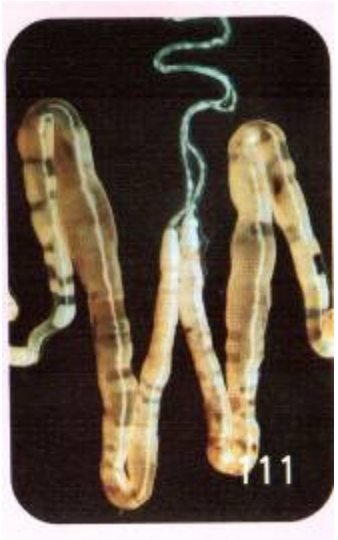
Note：0 means no died

Pebrine disease in silkworms

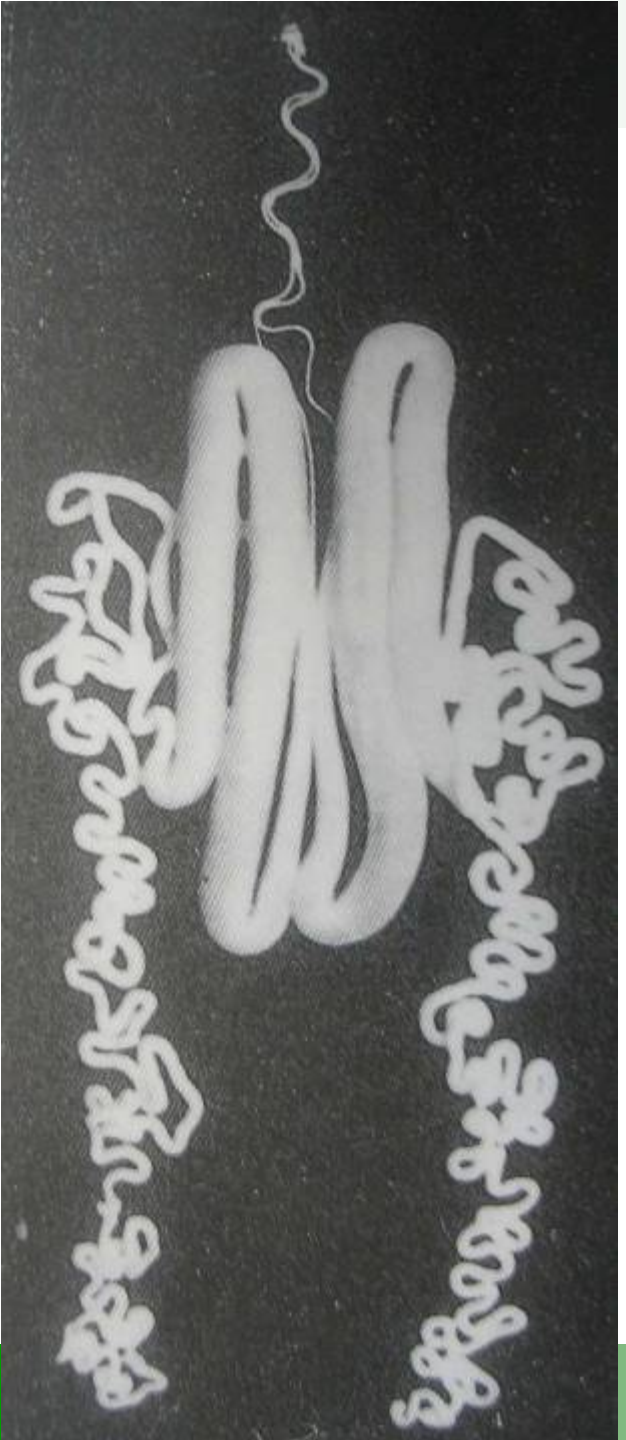
not molting

Pepper spot

batch of silkworms

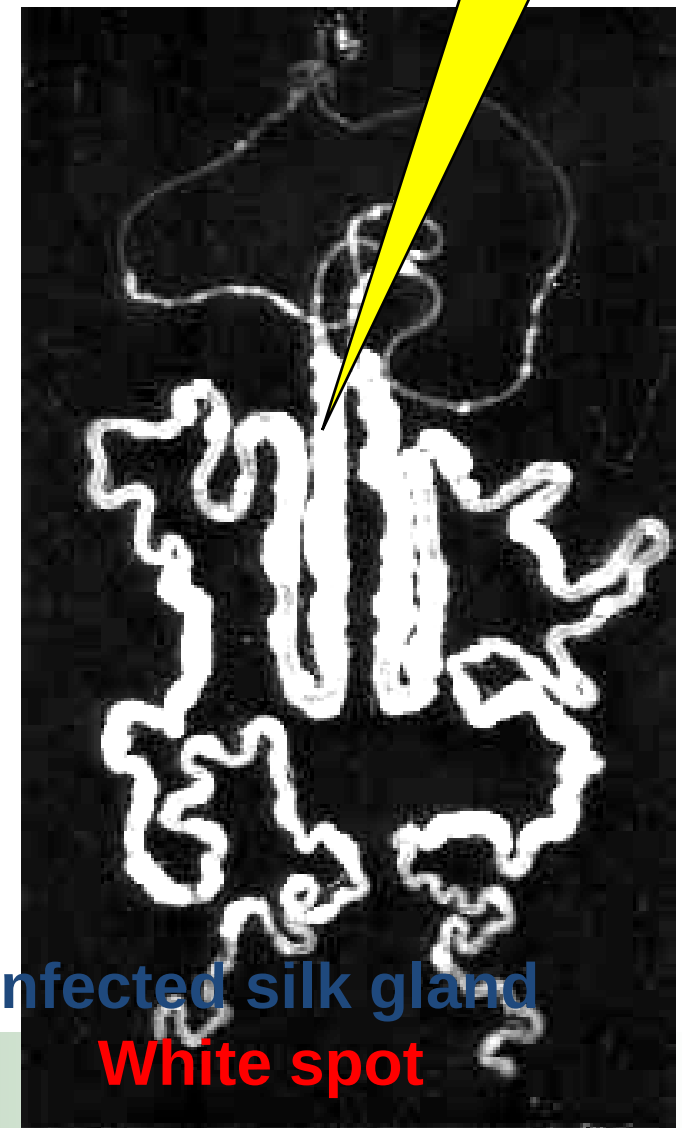


Infected silk gland



Normal silk gland

Infecte d silk gland



Infected silk gland

White spot

Silkworm pebrine is under control in Guangdong &Guangxi ,South China

uninfectious silkworm disease——Arthropod disease

myiasis

Exorista Sorbillans **:Parasitic fly disease**

myiasis

Exorista Sorbillans lay eggs on silkworm body

Fly larvae, pupae and worm hole cocoon

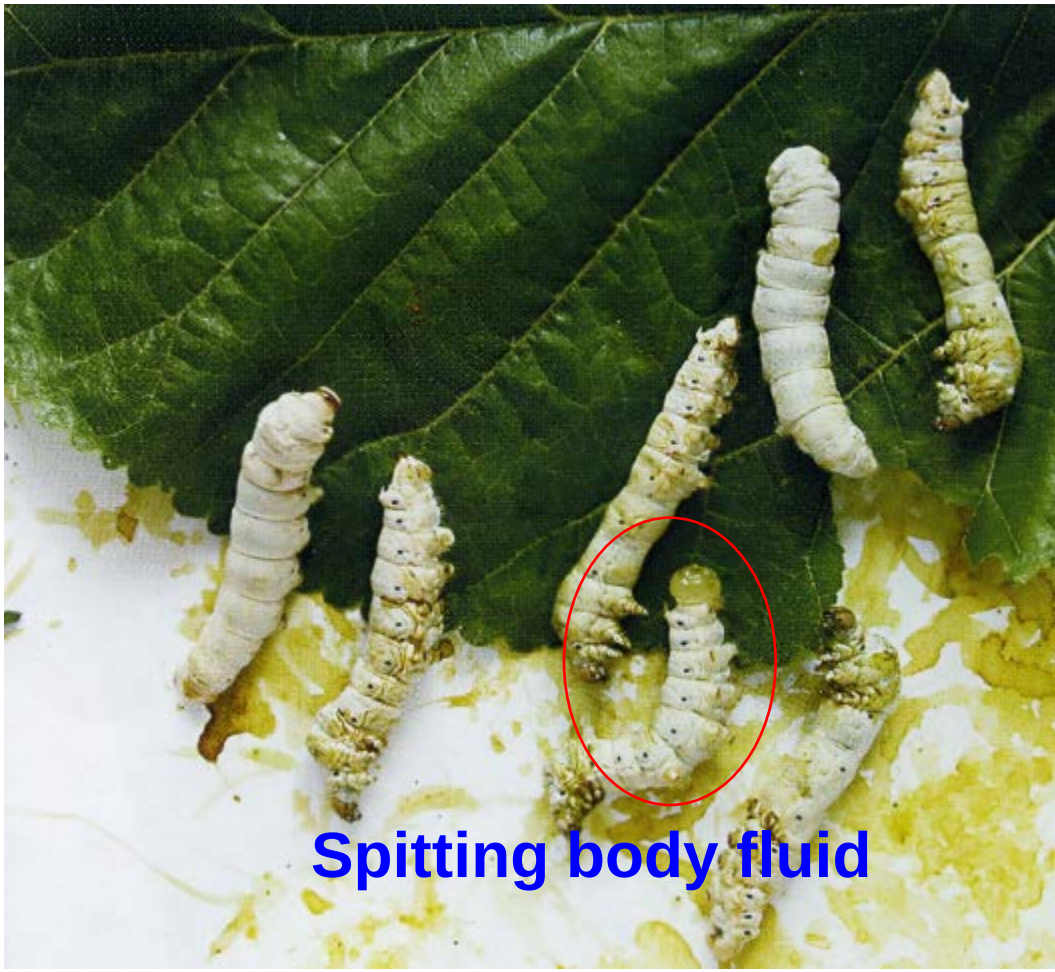
Chenmicals challenges: nosotoxicosis & toxicity

- toxicosis
- air pollution
- factory fumes

Industrial waste gas poisoning

the silkworm groups symptoms of Fluoride(F&HF) poisoning

the silkworm groups symptoms of sulfide(SO_2) poisoning



Chemecals :the symptoms of Pesticide poisoning

- **So, How we do ?**

Climate changes and chemicals – the new sericulture challenges

our ideas and experience :

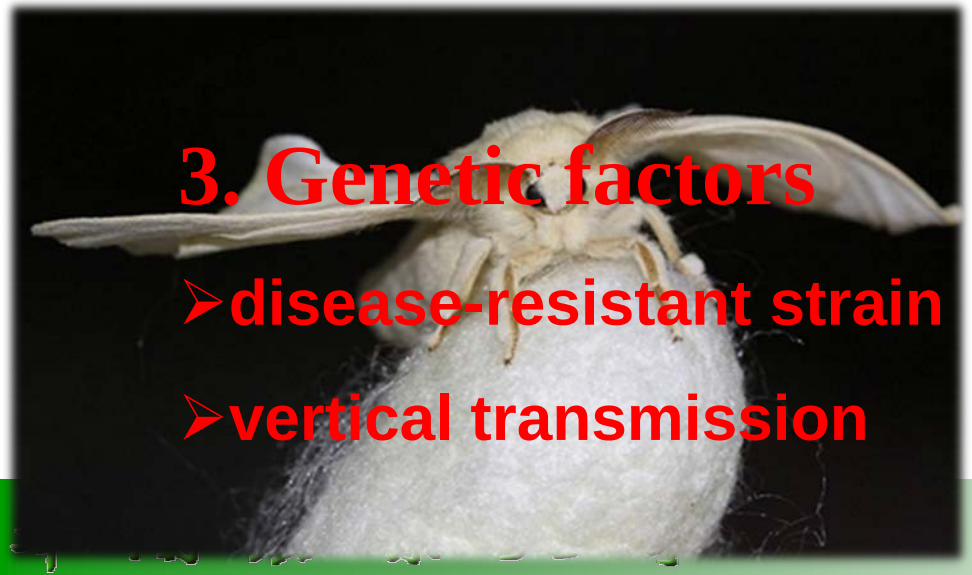
1. the influence factors of silkworm diseases incidence and their interrelationship
2. Integration of the silkworm diseases prevention and control
3. The practice of the system control of silkworm diseases

the basic conditions which influence silkworm disease occuring

1.Environment

2.Breeding technology

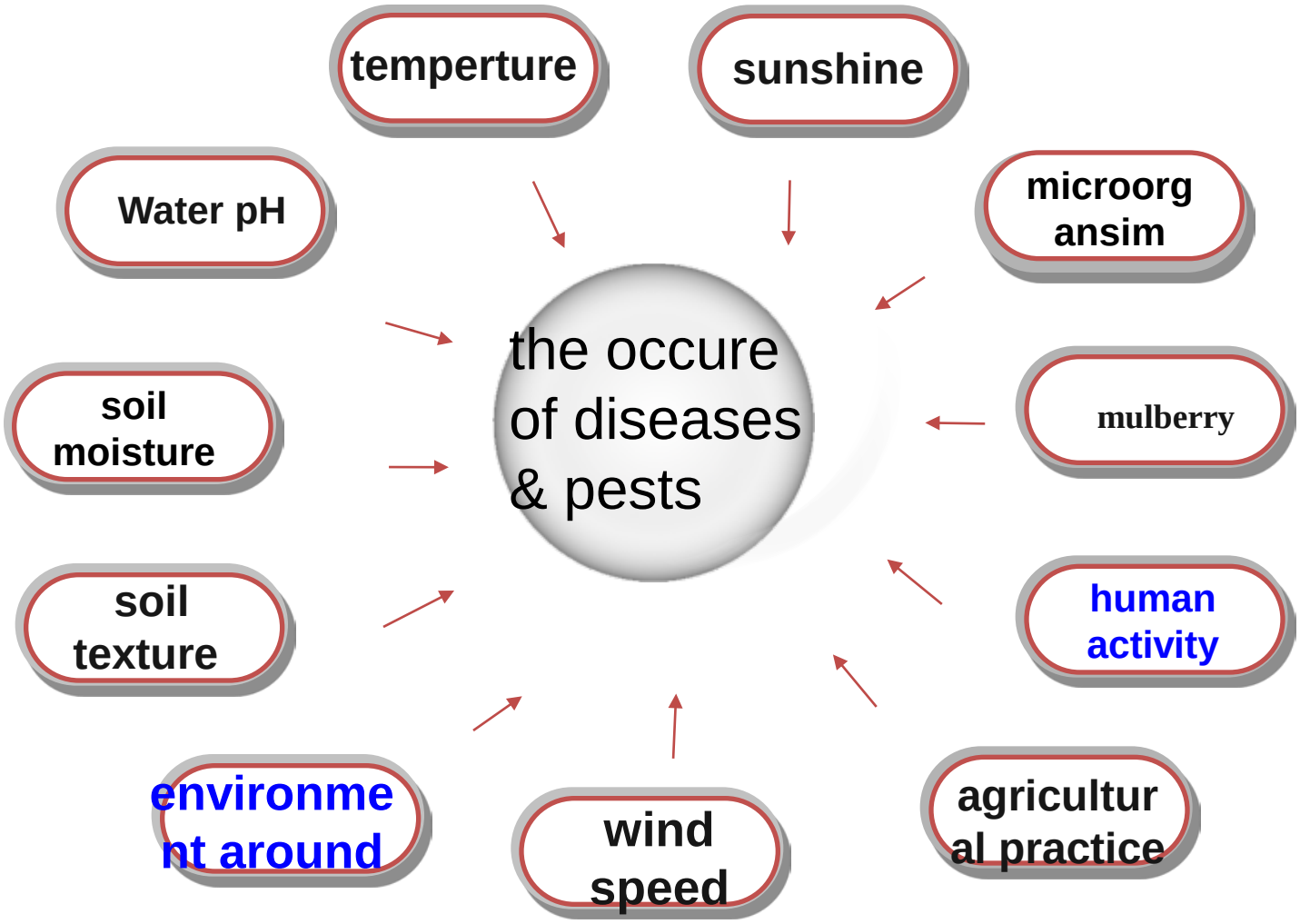
- ◆ good mulberry and Satiation
- ◆ suitable meteorological environment



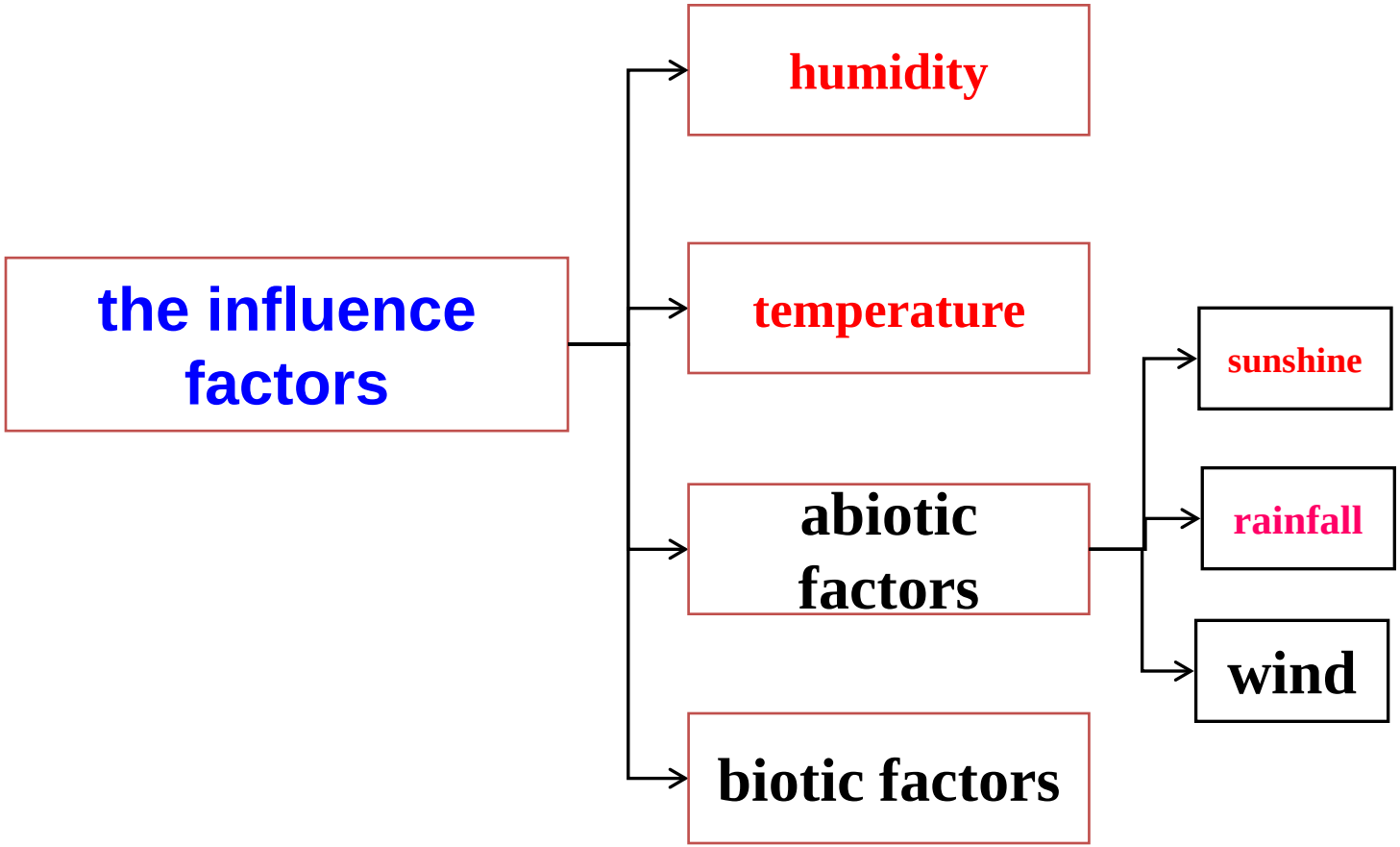
3. Genetic factors

- ➢disease-resistant strain
- ➢vertical transmission

Environment condition influncing silkworm&mulberry diseases occurence and prevalence



1.the influence factor of silkworm disease incidence and their interrelationship



the transmission route of pathogen in infected silkworm disease

Fig. the source and spread of silkworm pathogen

Transmission route of chemicals in infected silkworms

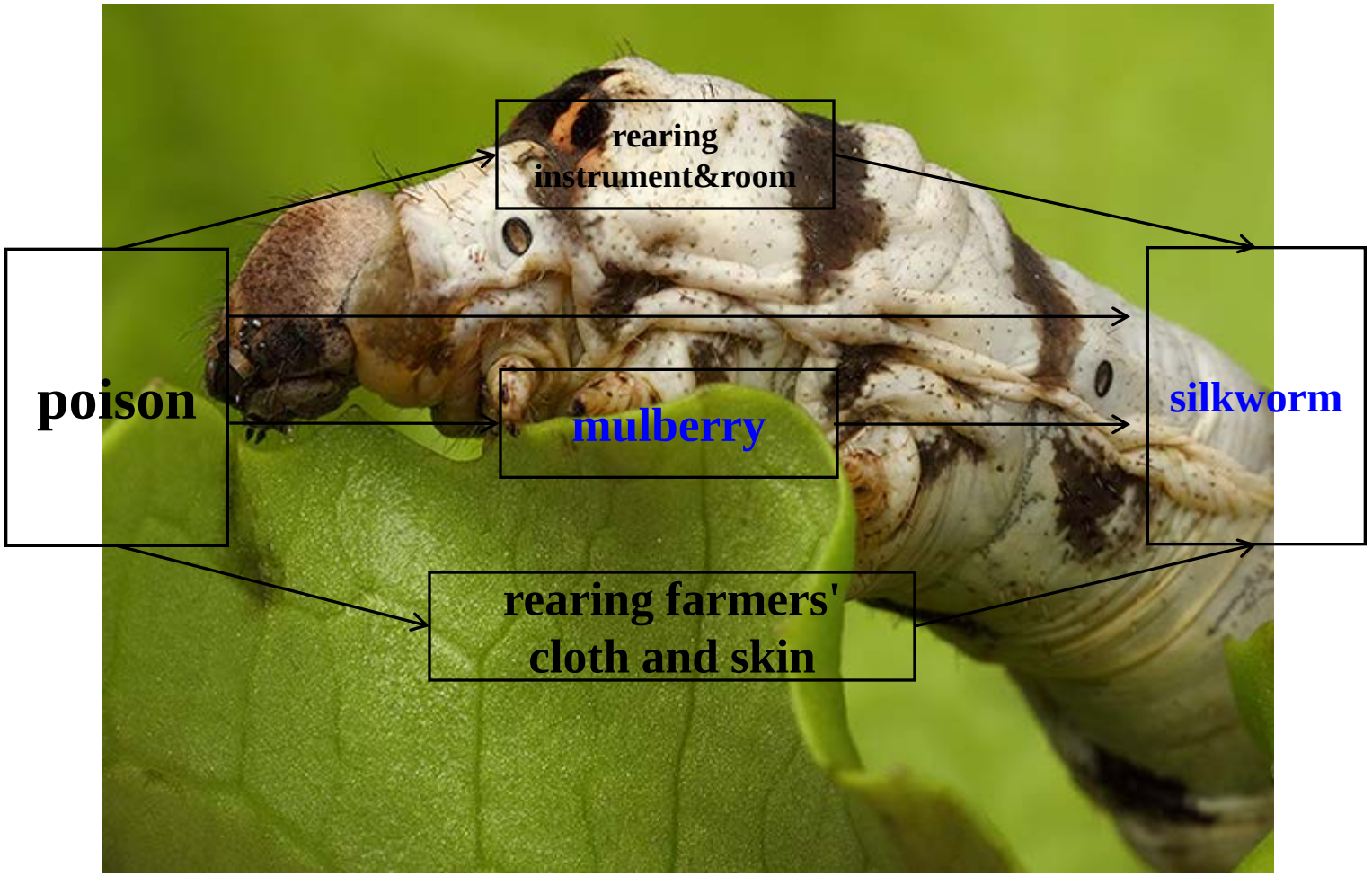


Fig. the main invade route of pesticide for silkworms

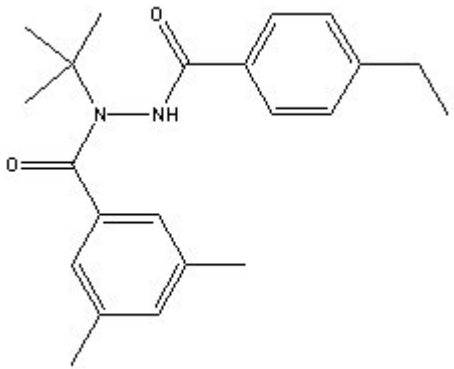
The hydrolysis half time period(in days)of 4 pesticides in different temperture and pH

pesticide	isofenphos-methyl	semiamitraz	pirimioxyph	ethachlor
pH5，25℃	374.6	188.4	37.3	320.9
pH7，25℃	270.8	6.5	55.9	602.7
50℃	78.7	0.6	7.2	302.7
比值	3.44	10.83	7.76	1.99
pH9，25℃	18.3	0.044	32.4	886.4

the degradation time of pesticide is too long!

沈佐锐，2009

the pesticide-resistance of the silkworm？

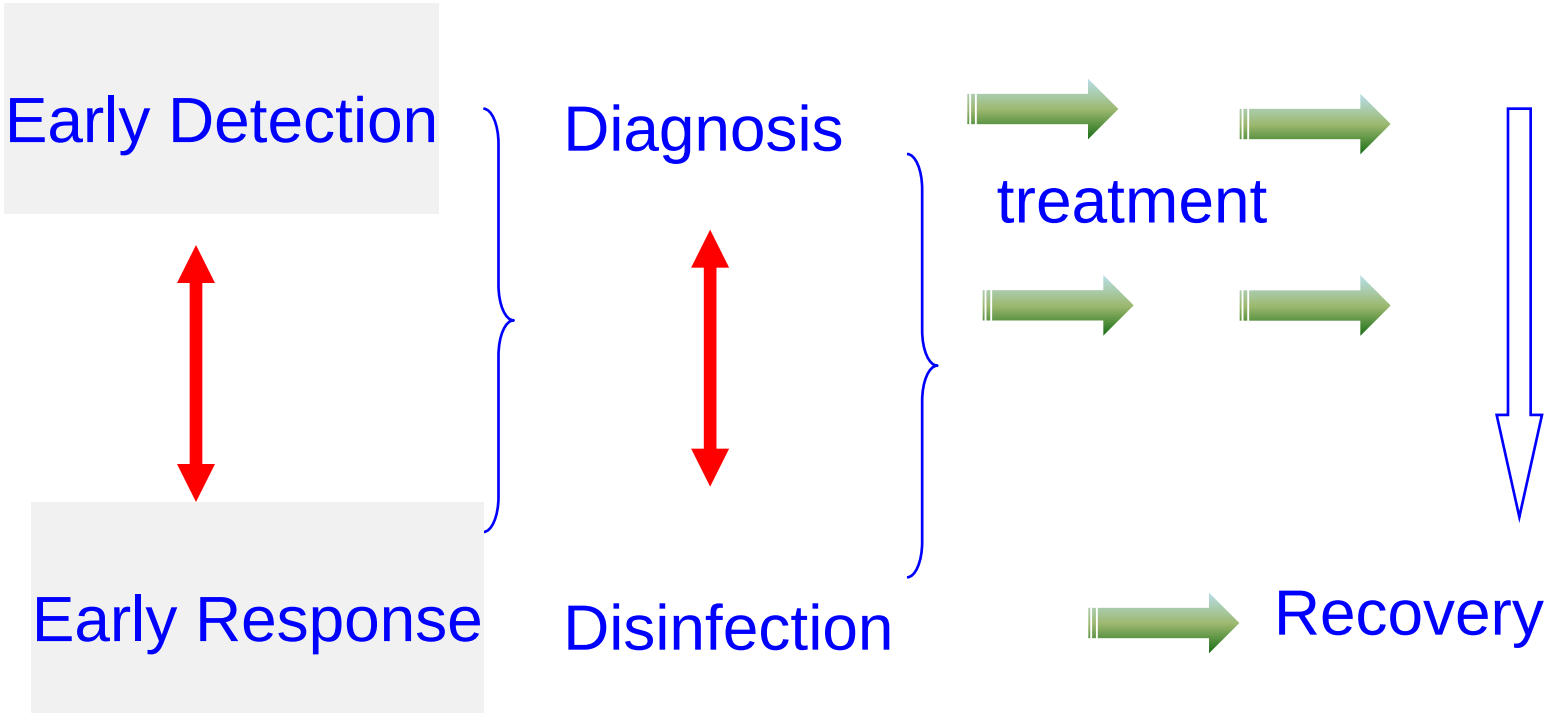


Tebufenozide(LC50 mg/Kg=0.0166)

Tebufenozide suspension

（孙新友等，2011）

2. Integration of the silkworm disease prevention and control



2. Integration of the silkworm disease prevention and control' **Strategy: sysmatics control**

feedback

Environ ment

climates

Nutrition factors

Input

diseases prevalence

Output

Quality

plan

techniqu es

economi cs

1)、The practice of the system control of silkworm disease

2)、Control standards and procedures

3)、Silkworm disease detection technology

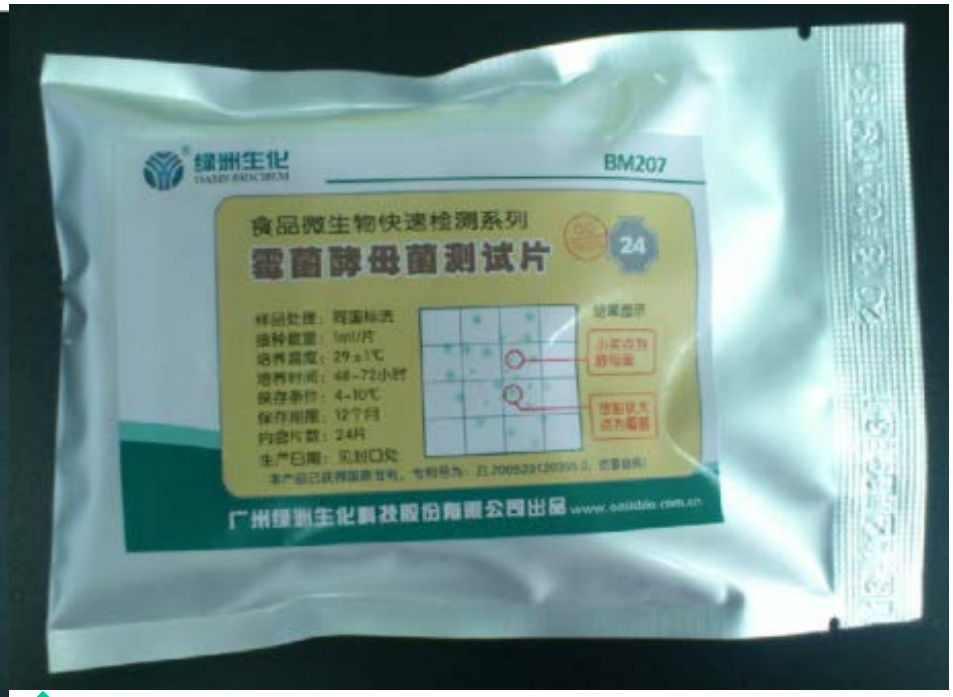
4)、disinfect technology

5)、the research of Treatment drug research

6)、integration and development of Equipment

Rapid detection of environment pathogenic microorganisms

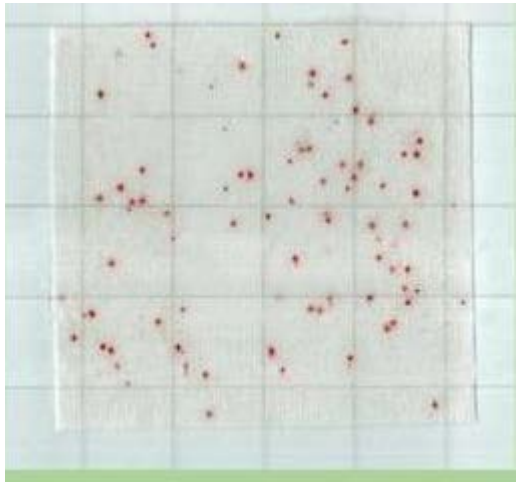
⬇ **Total number of colonies of the test piece**

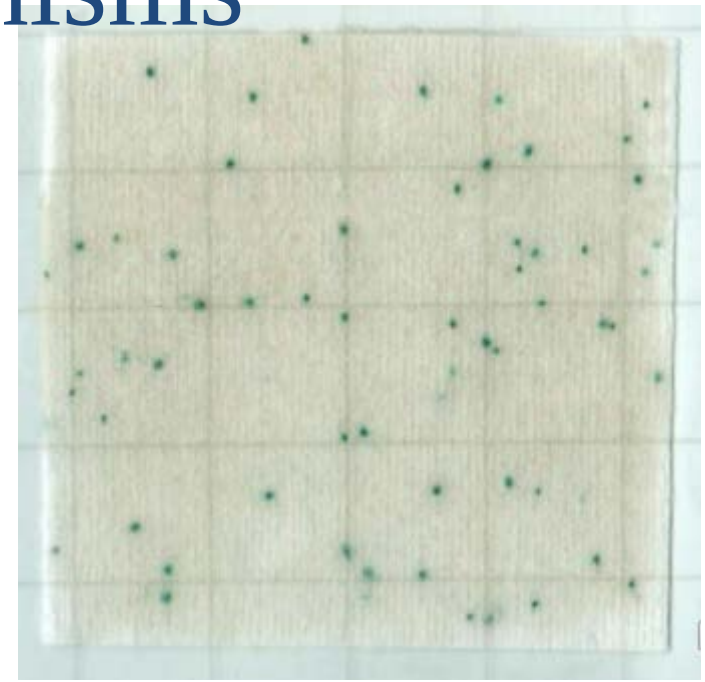


⬆ Fungal yeast test piece

Rapid detection of environment pathogenic microorganisms

- Total number of colonies of the test piece





霉菌酵母测试片

Fungal yeast test piece

2） Mulberry pesticide residues detection

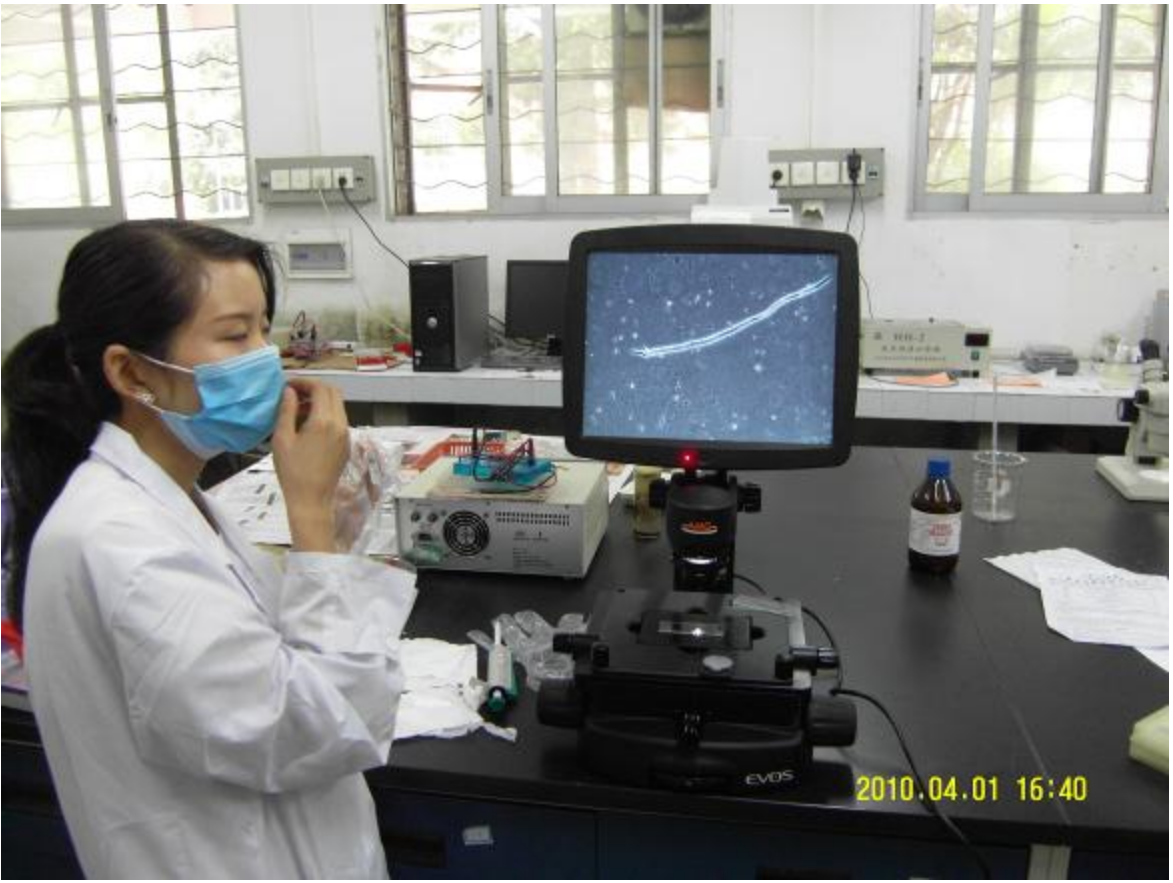
Kit for mulberry pesticide residues detection

Result

3）Research of visualization microscope techniques

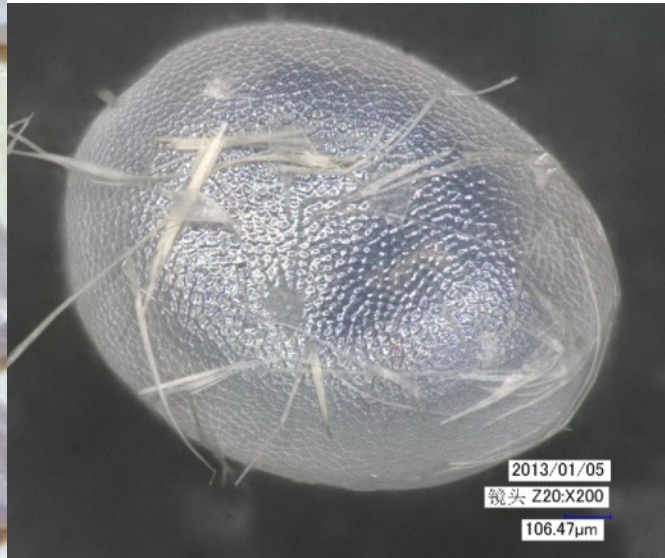

Here

USA EVOS Large screen digital inverted microscope



AMG（AdvancedMicroscopyGroup）produced, $100,000USD/unit

Multi-function LCD digital microscope observe the silkworm eggs

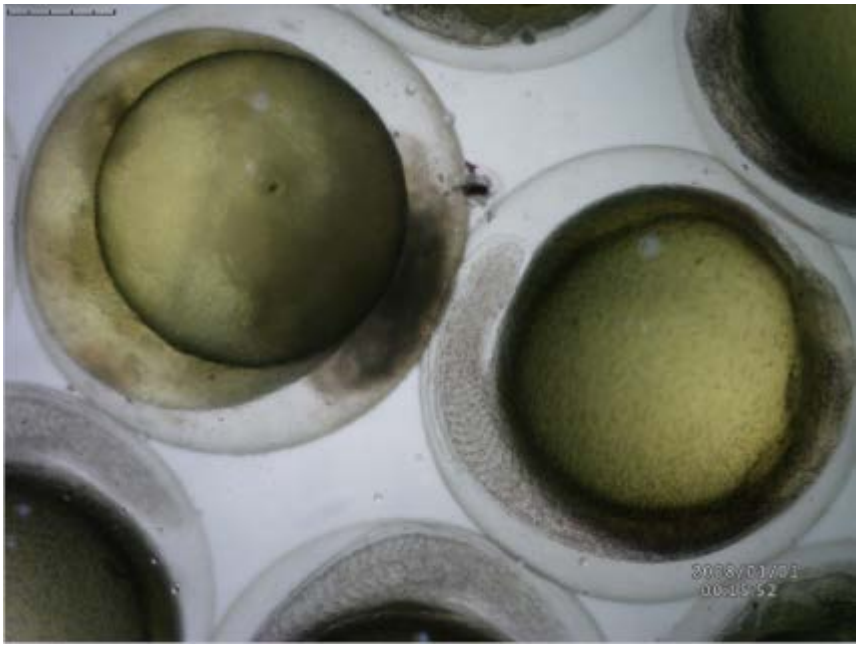


Observation of pests and disease

Powdery mildew

Egg of pest

Digital Multifunction microscopy applied in aquaculture



Observation of zygote of fish

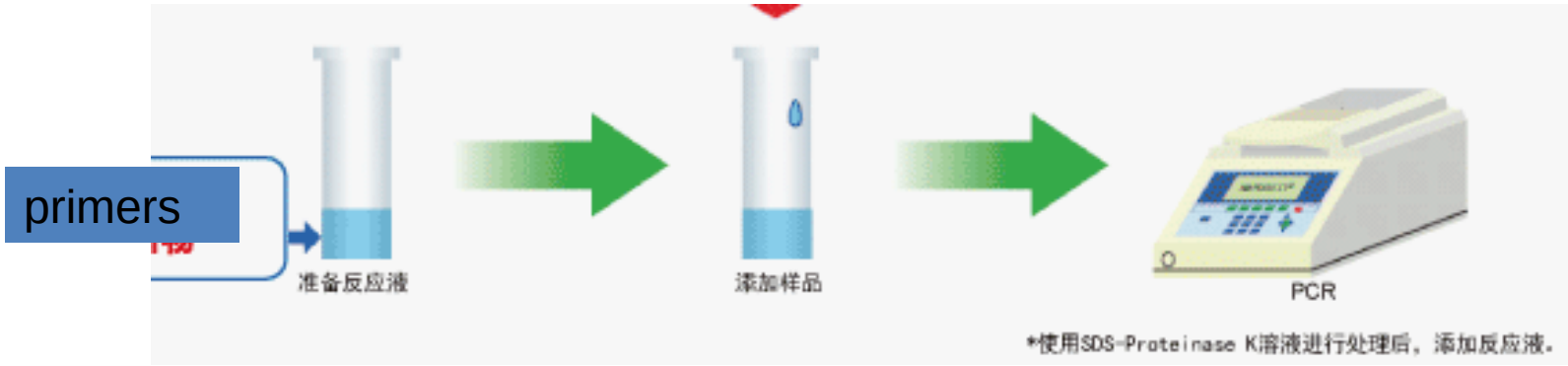
Fluorescence microscopy——Calcoflluor White M2R Staining to identify Microsporidia

N.bombycis spore was stained Cyan fluorescent by Calcoflluor White M2R

Observation

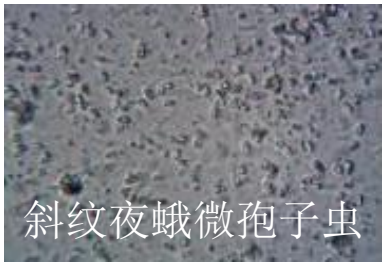
Observation of SILKWORM EGG

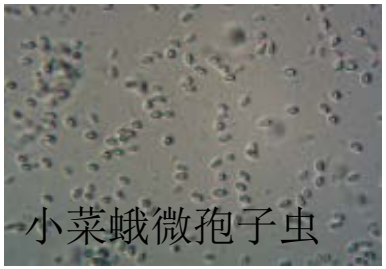
4） PCR & Loop Mediated Isothermal Aplication(LAMP)

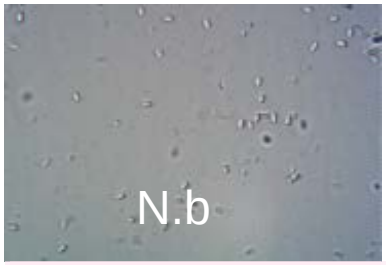


the process of PCR amplification

A rapid method for extracting DNA of pebrine——Boiling method







适用于多种微孢子虫

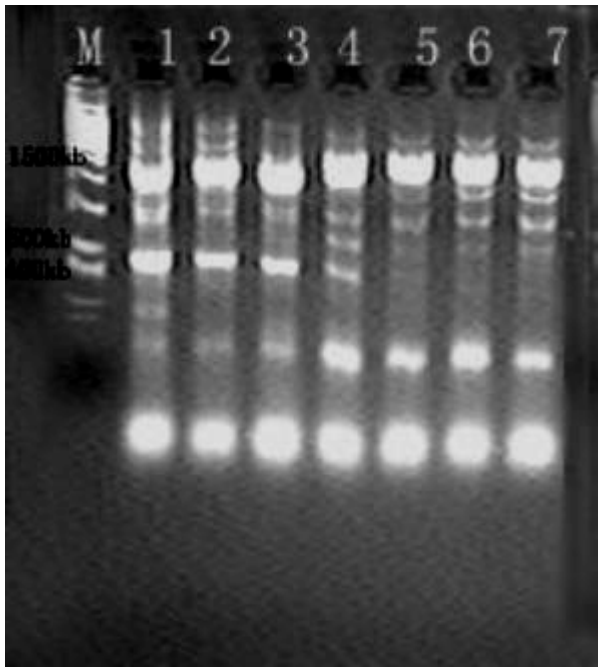


Figure Result of Electrophoresis of *Nosema bombycis* DNA

1：positive；2：10^8spore/mL ；3:10^7 spore/mL ；4:10^6 spore/mL ；
5:10^5 spore/mL ；6:10^4 spore/mL ；7：**10^3 spore/mL** ；M：100bp DNA Ladder。

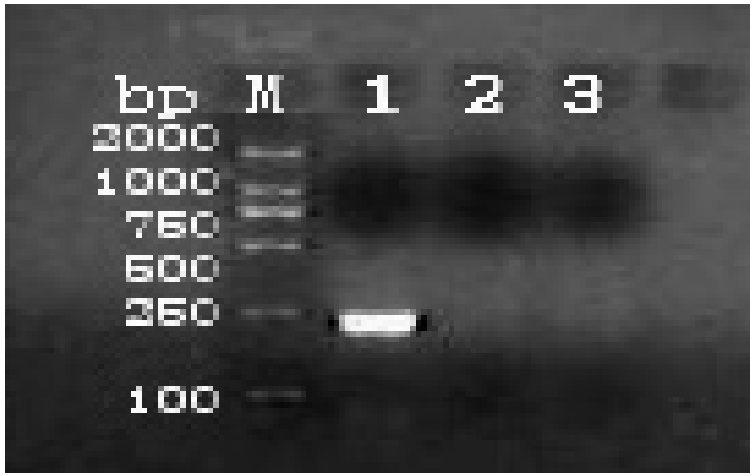
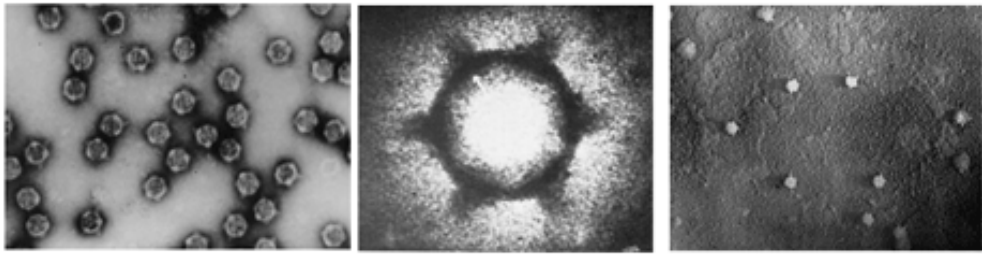


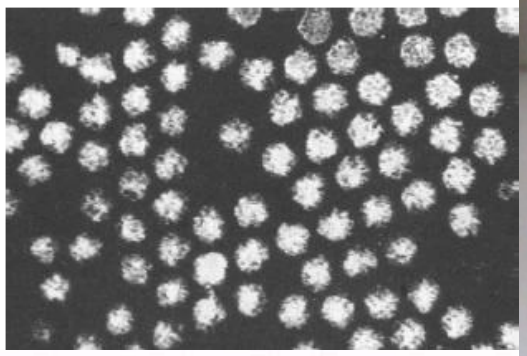
Figure RT-PCR result of BmCPV dsRNA

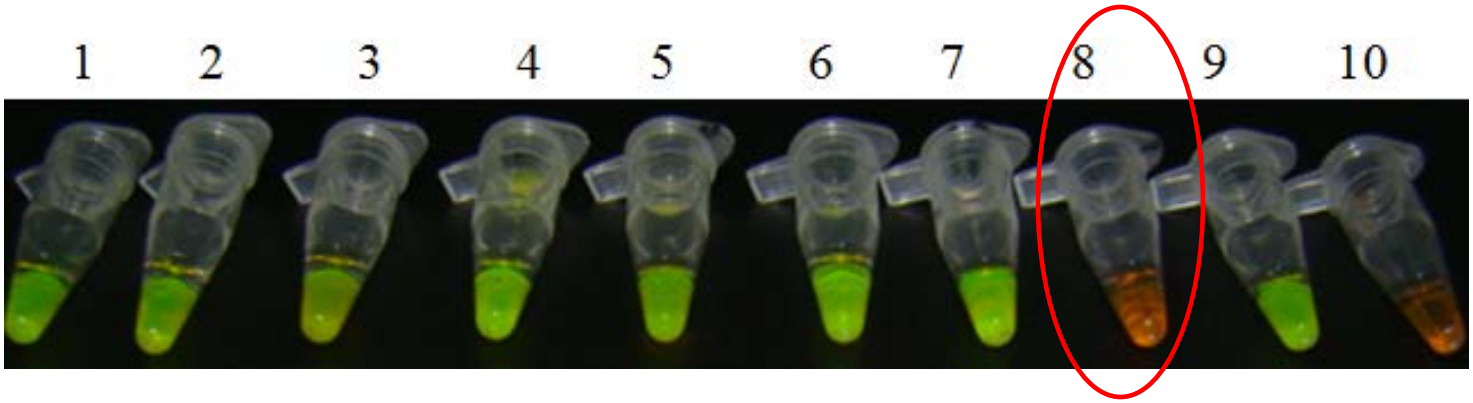
Note：M. DL2000 DNA ; 1. RT-PCR product of BmCPV dsRNA；2. RT-PCR product of healthy silkworm RNA；3. ddH_2O



Patent：

- Target gene primers
- Positive template



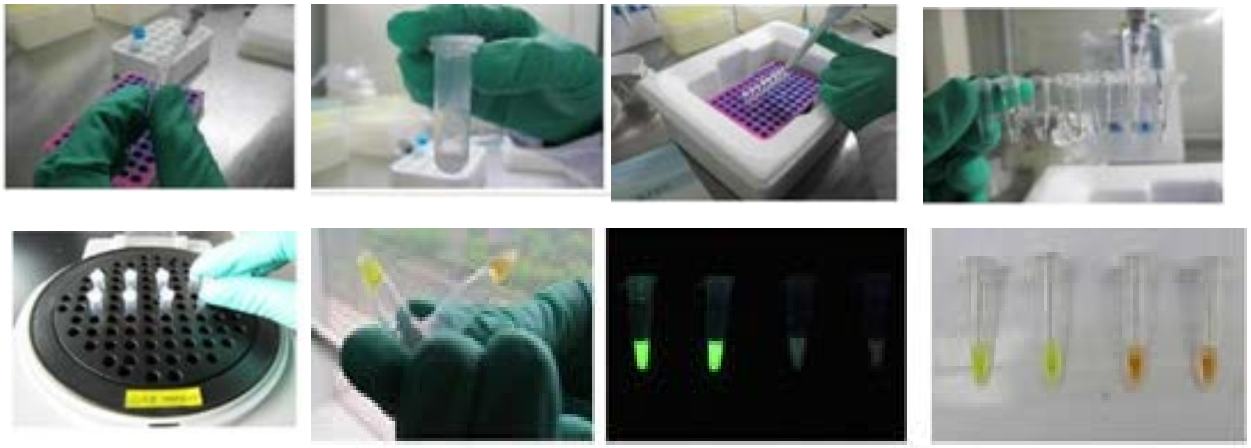


The sensitivity of BmDNV DNA test results

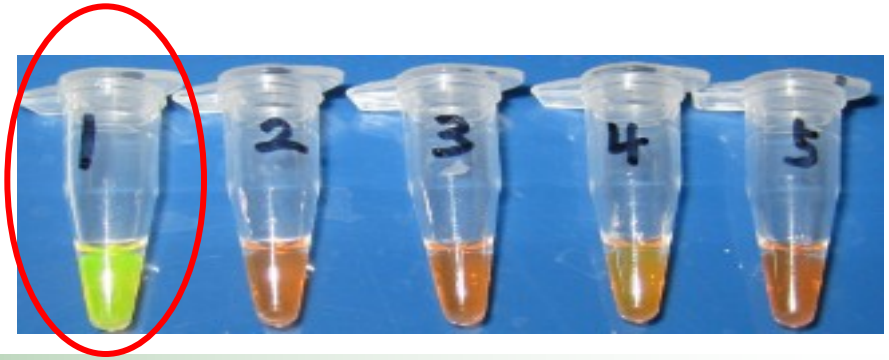
Note：1-8 tubes were 1.5ng/μL、0.15ng/μL、15pg/μL、1.5pg/μL 、0.15pg/μL、15fg/μL、1.5fg/μL、0.15fg/μL BmDNV DNA；5 standerd ；6 ddH_2O

Detection of *Nosema bombycis* by LAMP

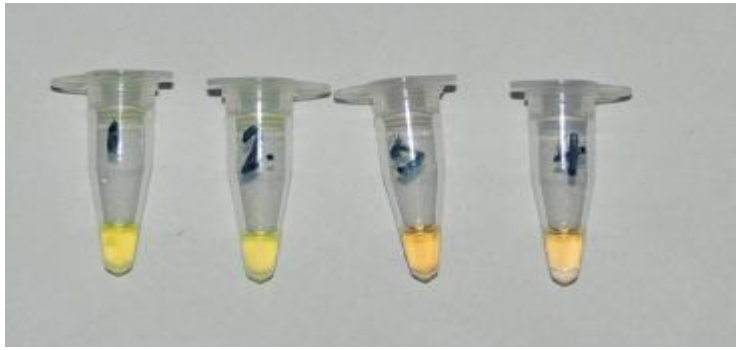
- **LAMP diagnosis kit**



2.5hr



Boiling, mixing, observation？ !



4、Developing of disinfection technology

- 1）Species of sericulture sterile
- physical methods（boil、hot air、sunlight、burn、 compost）
- Chemical methods （ Spraying, dipping, fumigation, disinfection powder）
  - Chlorine disinfectant：bleaching powder、calcium hypochlorite
  - foraldehyde
  - Lime
  - quaternary ammonium compounds
  - Sulfur
  - Antibacterial agents

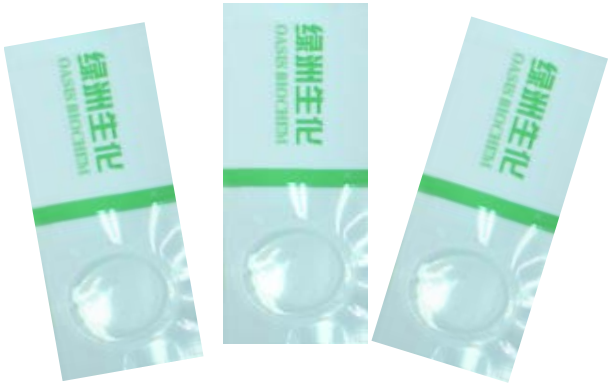
- **1）Physical disinfection: temperature and humidity automatic control of the production environment**

Temperature and humidity automatic control equipment in silkworm rearing

4、Developing of disinfection technology

- **Disinfectant drugs for silkworm**

Detection the chlorine of disinfectant



Shade guide

Suitable for detecting a variety of chlorine disinfectant formulated disinfectant chlorine concentration.

2）Disinfection equipment

①、②Ozone disinfection

③Circulating air ultraviolet light, ozone, negative ions and air filtration and disinfection

- **solar pest killing lamp**

Captured by solar pest killing lamp

斜纹夜蛾

Spodoptera litura Fabricius

桑螟

***Doaphnia pyloalis*（Walker）**

一点拟灯蛾

Asotacaricae Boisduval

粉蝶灯蛾

nyctemera plagifera Walker

人纹污灯蛾

Spilarctia subcarnea Walker

Captured 32 kinds of insects, rate of microsporidia infection is 46.9%

Sanitation on Standard Operating Procedure (SSOP)

Disinfection pool

Disinfection of all tools and appliance

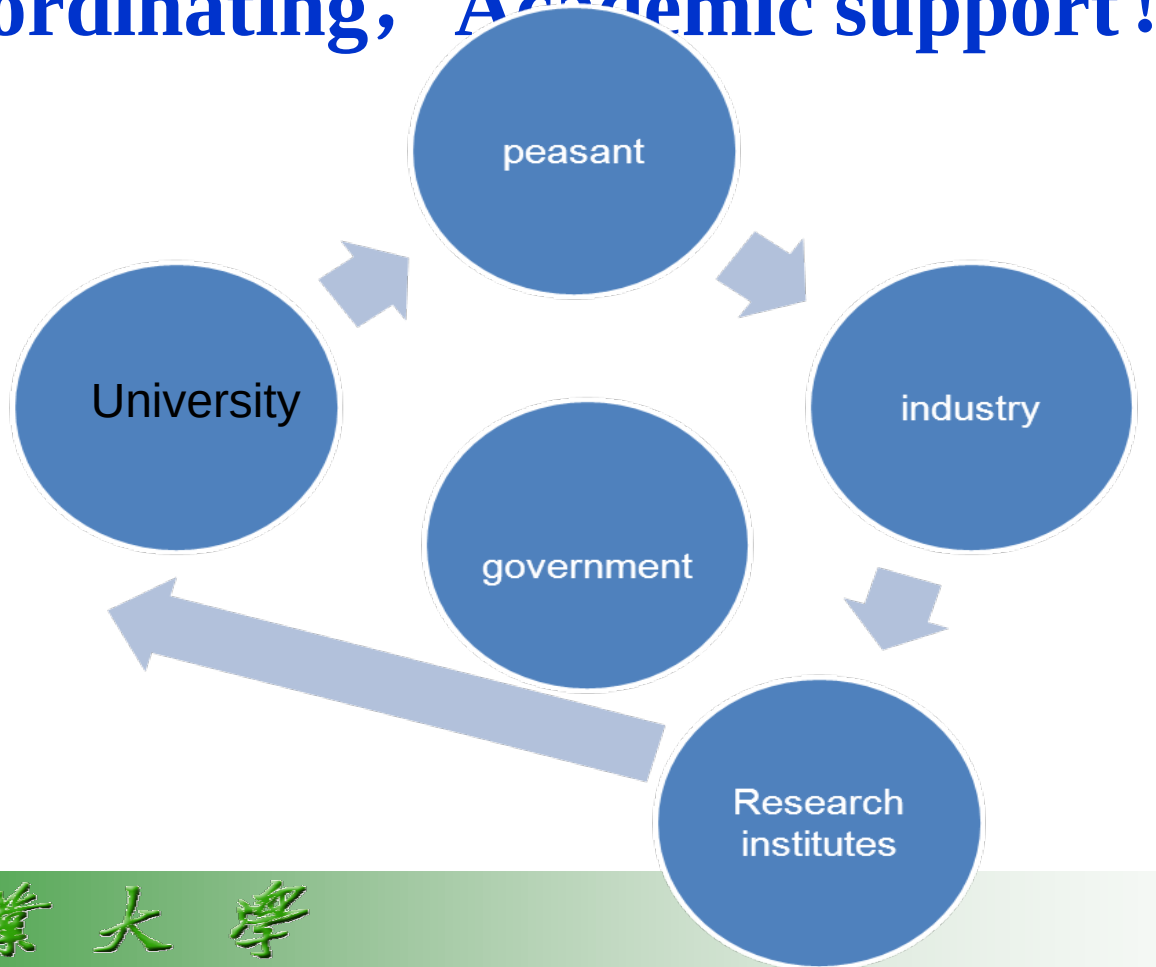
SSOP: changing your shoes, washing hands,etc..

Disinfection on Standard Operating Procedure (DSOP)

消毒池

HOW to achieve effectively control of silkworm diseases?

Answer: government assist, enterprises coordinating, Academic support!



The main constrains and solution for sericulture development in BACSA Countries

1. Technology
2. Land productivity
3. Labour productivity
4. Machines
5. Marketing

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Thank you for your attention！

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