Sericulture: Silk Production in the Philippines

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Silk, the cloth of royalty, represents luxury in textiles. But this “most beautiful of all fabrics” is spun by no human hand. Silk threads or filaments are produced by silkworms when they construct cocoons that encase their pupae – a stage in the metamorphosis of caterpillars into moths. Weaving enough silk cloth to make one dress would require unraveling 1,700 to 2,000 cocoons.

The first bolts of silk cloth were produced in China 4,000 years ago. But Japan was the first country to go into sericulture (the art of making silk) methodically, and has been the world’s largest silk producer since 1865. Says a Filipino sericulturist: “Japan has modernized its sericulture operations and it will continue to be the world’s top producer.”

Today, several countries are producing silk on a commercial scale; most of these are still in Asia – the traditional source of the world’s silk supplies.

In the Philippines, a sericulture research is being undertaken by several organizations including the Philippine Textile Research Institute (PTRI). The PTRI project was conceived in 1973 when Mrs. Imelda Marcos, concerned over the rising cost and growing scarcity of raw materials for Barong Tagalog, the national costume of Filipino men, urged the agency to revive sericulture research.

Using MPDA equipment and improvised facilities, the PTRI established a research and training center in La Trinidad. Sayss Deanna J. Enrile, head of the center; “Funds for the project – 300,000 pesos per year is provided by the National Science Development Board.”

Enrile, a commerce graduate of the Far Eastern University, was executive secretaru at the PTRI main office in Bicutan, Taguig prior to her appointment as head of the center.

The center is housed in a new, elegant one storey building on a 2,000 square meter lot beside the Benguet national highway. It is manned by 20 personnel. Two key officials assist Enrile – Dionisio K. Bartolome, 32, chief of technical services, and Robert N. Solano, 24, training and extension officer. Both received training on sericulture in Japan.

The art and science of sericulture is based on adequate supplies of mulberry leaves, the only food of silk worms. The center has a terraced 2.8 hectare mulberry farm, located behind the Mountain State Agricultural College. Worms are reared in the farm’s silkhouse.

The mulberry trees on the farm are now four to six years old. Planted 1.5 meters x 0.8 meter apart, the trees are pruned regularly to a height of about one meter to facilitate harvesting of leaves. Pencil sized branches or twigs removed during pruning are cut into six to eight inch pieces and used for propagation. The cuttings may be transplanted after six months and leaves can be harvested one year later.
The trees are regularly fertilized, weeded, cultivated and irrigated. “Silkworms,” says Soalano, “produce good quality cocoons only when they are fed with enough good leaves.”

The center raises three silkworm varieties: one Korean and two Japanese (kinshi showa and N2 x C2).

“We can only rear from 10,000 to 20,000 worms at a time” says Solano, “because our silk house has limited space. In addition, we only have four manually-operated, cocoon-processing machines.”

Sericulture starts with the hatching of silkworm eggs. The eggs are about the size of “pechay” seeds (100 weigh a gram); these hatch easily, normally 11 days after they are laid. To have a steady supply of worms, the researchers delay hatching by refrigerating eggs at five degrees centigrade.

Says Solano: “Newly laid eggs are soft and have a temperature of 24 degrees centigrade. Sudden change of temperature may spoil them, so we refrigerate eggs 54 hours after these are laid. We refrigerate eggs for six months because this period gives us a high hatching percentage.”

To achieve uniform hatching, refrigerated eggs are first soaked in a heated (46 degrees centigrade) solution of hydrochloric acid and water for five minutes. Then the eggs are washed thoroughly with cold water, and air-dried in trays for five to six hours. Afterwards, eggs are incubated in a wooden chamber at 24 degrees centigrade and at 75 to 80 percent humidity for nine to 11 days.

Newly hatched grubs or “ants” are black in color and 1/8 to 3/8 inch long. These are spread on long, table-like trays and fed with mulberry leaves three times a day (8:00 am, 1:00 pm and 5:00 pm) for 24 to 26 days.

“we feed only young chooped leaves to newly hatched grubs, but we give mature whole leaves to older caterpillars. We make sure the leaves are clean and dry, but not totally dried out. We use lime to disinfect and dry the leaves. Silkworms are delicate insects and must be protected from draft, smoke, odors, noise and direct sunlight.”

Solano says the worms shed their skin four times during their larval stage. The first molting occurs on the third day of feeding, the second on the sixth, the third on the ninth, and the fourth on the 13th or 14th day of feeding.

During the last two to three days of their life as caterpillars, the worms eat heartily, emitting a soft sound like light rain falling on leaves. At this time, the worms have grown to three to 3.5 inches long, and are plump and grayish white, secreting most of the substance from which they will make cocoons. Finally, after the 26th day of feeding, the worms stop eating and wave their heads slowly form side to side – a sign that they are ready to spin. “We transfer the worms to many-celled trays where they can construct cocoons,” says Solano.”Each cell is two by 2.5 inches in size and accommodates one caterpillar. A caterpillar can complete its cocoon in 60 hours and become a pupa. Seven days from the start of spinning, we harvest the cocoons.”

Hard, white or yellow and ovate the cocoons are compact shells which are frequently constricted in the middle, with straggling, flossy filaments on the exterior; and the densely agglutinated interior layers almost resist complete unwinding. Depending on sex and species, the cocoons measure from one to 1.5 inches long and 0.5 to one inch in diameter.
Harvested cocoons are sorted; all thin-shelled and unreelable ones are artificially heated overnight at 86 degrees centigrade to kill the pupae.

A dried cocoon produces a light throbbing sound when shaken and weighs only half of the 2.5 gram weight of a fresh cocoon.

After drying, the cocoons are soaked in hot water with soap and acetic acid for 10-12 minutes to soften the natural gum (sericin) holding the filaments together. After this stage, the cocoons are ready for reeling.

The center accomplishes this task with three manually operated, metal reeling machines, and one reeling machine, all of Japanese design.

To reel, the cocoons are first placed in a basin filled with warm water. Behind the basin is the reeling apparatus which is fixed on a table-high platform. The technician takes the loose end of a filament, threads this through the “eye” of the reeling machine, carries the filament up over two small wheels, and fastens it to a reel. When the reel is turned, the filament is drawn up and wound in one lightly twisted strand. The cocoon bobs up and down in the water as it is unwound.

“Then we remove the strands from the reels,” says Solano, “rewind it through the rereeling machine and twist it into skeins of raw silk.”

About three-fourths of a cocoon can be reeled the remainder in surface floss and husk. The reelable portion of cocoons ranges from 500 to 1,200 meters in length. The thread is usually thicker and stronger toward the middle of the reeled portion than at the end. One can produce one pound of silk from 1,500 to 2,500 cocoons.

“To propagate silkworms we select big cocoons, open these and take out the pupae,” says Solano. “We usually get 100 males and females. A male pupa has horizontal segments running across its body; a female has two line indentations at its posterior end.

‘We place the pupae in a room with a temperature of 24 degrees centigrade. These turn into moths seven days later. We let the months mate immediately. This takes four to five hours. After this, we separate the males and burn them. We put the females on sheets of bond paper and cover each with a funnel made of galvanized iron to prevent it from scattering its eggs. A moth produces 450 to 500 eggs each time it lays, Egg laying takes 12 hours after which we remove the funnels and burn the female moths. Fifty-four hours later we refrigerate the eggs at five degrees centigrade.”

To increase cocoon production, a new silkhouse is being built. It is designed to accommodate 180,000 worms. In addition, more mulberry cuttings are being planted to increase leaf production.

The center has been conducting training sessions on sericulture methods since May 1974 and has, so far, oriented 94 individuals in all the phases of sericulture. At the end of each training period, all the participants are given mulberry cuttings so they can launch their own projects.

“We plan to convince people in other parts of the country to go into sericulture,” says Bartlome.
Recently, PTRI opened another center in Cagayan de Oro city. And the Bureau of Plant Industry is now propagating mulberry cuttings in NOvaliches, Quezon City.