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Introduction to Ban Li-

By Philip A. Rutter

Phil Rutter is a commerical chestnut and hazelnut grower who was Founding President of TACF

One of the great joys of my life was the years Charles Burnham and I spent together, going through everything we could get our hands on that had to do with chestnuts. Typically, once every couple months, I would travel up to the Twin Cities and spend 4 or 5 days with him; sleeping on his roll-away, eating every meal together, burrowing into whatever scraps of original papers we'd been able to dig out since the last time. And over coffee, at lunch, we'd carefully NOT talk about chestnuts; just everything else in the world. It is one of the great pains of my life that he mostly forgot these times, as he got older. I never will.

When we managed to get a copy of this booklet, it was simultaneously fascinating and frustrating- we could see we had something fabulous here- but couldn't read any details; graphs and tables gave us hints- but only to tantalize.

I'm constantly intrigued by how events in the world "connect". We needed not only a native Chinese speaker to translate for us; but a trained forester. The reality of written Chinese is that many characters have different meanings, strictly depending on context, and there are some characters in each different walk of life that people from other disciplines may never see, and do not know the meaning of.

Technical translation is not a light task. We had no money. But we had an odd "connection" possible- when I was in high school, I remember vividly the months when we had a guest in the house; Alison Stilwell Cameron, General "Vinegar Joe" Stilwell's daughter. She'd written a text book on Chinese brush stoke painting techniques, and my mother was her editor. Alison had learned Chinese painting in China; my mother was one of her best pupils, and so could be trusted not to edit out critical information. I learned a tremendous amount about China, just listening at the dinner table, and was captivated. The book, incidentally, is still in print; still considered one of the best English texts on the subject.

As it turned out; my wife's best friend in her graduate school department- was married to the head of the University of Minnesota's department of Oriental languages; Dr. David Wang. Because I knew a little about China, he became a friend of mine. In good Chinese "connections" style, I asked him for help; and he found, and convinced, Dr. Chengguo Wang to do this partial translation for us- free. To us. I'm sure David Wang wound up paying something for it- but we'll never know what. I still owe him.

Charles and I picked out the sections we really wanted to see in full text, and Chengguo Wang (working on his doctorate at the time) provided us a manuscript, part translation, part transliteration, with a few missing places where even he couldn't find a way to translate the information. It was all priceless; providing us with insights into the population structure of a live, healthy, chestnut species.

There were also strong hints that the genetic diversity of Chinese chestnut was very much higher than previous workers in the US had realized, and that the samples of Chinese germplasm we had to work with in breeding for a new resistant American tree were tiny compared to what existed- in China. In spite of huge importations of chestnut germplasm from China by the USDA during their years of work on chestnut breeding, we knew that most of what had been imported was from orchard populations, not the "wild" trees, which were far more likely to contain good and different genes for blight resistance. Charles had arranged for the original plant importation records to be loaned to the University of Minnesota; and I had gone through them; every last one; and mapped them. Besides the fact that during most of their years of importing there was no safe access to wild areas (bandits), it was also evident that little of the imported material survived.

This set the stage for my collecting trip to China in 1989 -just a couple months after the "turmoil" of Tiananmen Square. China was very unsettled, but I was afraid the problem might get worse; I had the chance to go, some

financial help from Brad Stanback (of course), so I went. I made friends who are close still, and was able to bring back quite a diversity of “wild”, and seguin, chestnut; alive. Some of it survives at the TACF farm in Meadowview, some at 3 other professional germplasm collections. Chances are very low that these chestnuts have exactly the same genes for resistance that the USDA chestnuts have- giving us much better weapons against the blight.

Without this translation of the booklet “Ban Li”, written really only for internal Chinese use, we wouldn’t have known what questions to ask, or what answers to look for.

Part of the game, of course, is checking up on information; is it accurate? We had some reasons to wonder, like this excerpt:

“This disease is one of the most destructive world diseases. The distribution is vast and the damage is heavy. Almost all chestnut trees in Europe and America were destroyed by the disease at the beginning of this century. Afterwards, Chinese chestnut was used for breeding resistant variety and chestnut trees were cultivated again. In China, Chinese chestnut trees were consistently considered to be resistant tree species. But in recent years, the disease spread in several provinces of southern China and damages were considerably serious in some places. It is a main disease in chestnut production at present.”

There are several inaccuracies in the first half of the sentence; destruction of European chestnut was not nearly so thorough as American; European breeders rarely used Chinese in their crosses, and it was fascinating to see them report that the USDA breeding program had been successful... And, when I was in China, I found that in Hubei province, at least, chestnut blight was far from a “main disease” - young chestnut scientists had barely heard of it, it was so trivial there.

There is still a great deal of understanding we could glean here, both from this text, and from the much more extensive writings now available. In a very Tolkienesque way, the road goes ever on.

Philip A. Rutter, March 1, 2004.

B A N L I

(CHESTNUT)

A PARTIAL TRANSLATION
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(not contents of this translation)

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(Preparator's note: I have not attempted to restructure the translation into more standard English. Chinese syntax does not correspond precisely with English, and I feel information might easily be lost in the attempt. P.A.R.)

1. THE DISTRIBUTION OF CHESTNUT IN CHINA

Chestnut is one of the earliest tree species people utilized in China. In addition to recorded history, we found the marks which the collected economy of clan society left over during exploring prehistoric culture ruins in Ban Puo of Xian city. Among remains from Ban Puo, there were lots of fruits of chestnut and hazel. This demonstrated the fact that wild chestnut fruit was used 6,000 years ago in order to replenish the insufficiency of agriculture, fishing and hunting.

Chestnut tree distributes in 21 provinces. They are Jilin, Liaoning, Beijing, Hebei, Henan, Shandong, Jianxi, Jiangsu, Anhui, Zhejiang, Fujian, Taiwan, Hubei, Sichuan, Guizho, Hunan, Yunnan, Guangdong, Guangxi, Shaanxi, and Gansu provinces.

The northernmost chestnut cultivation is in Liaoning province about north latitude 40 degrees 30'. The southernmost chestnut cultivation is in Hainan island, approximately south latitude 18 degrees 30'. Most of the chestnut trees, however, are distributed in the Huanghe river and the Changjiang river vallies.

The vertical distribution of chestnut in China, the lowest place is in Tancheng, Shandong, about an altitude of 50 m above sea level and the highest place is in Wenxi, Yunnan, about an altitude of 2800 m. It varies with different zones of topography and climate. There is a tendency, the more southern the chestnut is, the higher the altitude will be.

2. SPECIES CHARACTERISTICS

The chestnut varieties in China are very plentiful. According to the statistics (not complete), there are at least more than 300 chestnut varieties in China.

After surveying in main areas of chestnut production, we divided chestnut into 6 local variety groups:

1. Changjiang River Valley Variety Group.

This group is distributed over Hubei, Anhui, Jiangsu, and Zhejiang provinces. The main characteristic is grafting for reproduction. Wild chestnuts are used to graft on local places. The characters of this group are stable relatively. Most of the varieties have bigger shape of fruit. Average weight per fruit comes roughly to 16 g, which holds more than 50% total variety numbers. Among them, some variety fruit weighs more than 20 g per fruit, such as Qian ci dabanli (short thorn big chestnut), Jiaozha, and Dadiqing. Most of the variety fruits have lower sugar volume. 47% variety fruits contain less than 10% sugar volume. But they contain higher starch volume, about 57%. The fruits of this group are used for cooking dishes.

2. North China Variety Group

It is distributed over Hebei, Shandong, east of Henan and north of Jiangsu. This group has high yield and good quality. Therefore, it takes an important place in chestnut production in China. The main character of this group is fruit seedling for propagation, ie. reproduction of seedling from seed. The variety numbers are fewer and the range of the variety variability is larger. The shape of fruit is smaller. Small fruit varieties which one fruit weighs less than 10 g hold more than 78% total numbers. There are higher quantities of protein and glycogen in the flesh of fruit, about 20%. The average starch volume is 51%. The fruits of this group are used to eat by frying.

3. Northwest Variety Group

It is distributed over north of Gansu, south of Shaanxi, northwest of Hubei, west of Henan, and north of Sichuan. The method of production is being changed from seedling to grafting. Most of the group variety fruits are smaller. Only few are bigger, about 15 g per fruit. Fruit flesh is sweet and has better flavor. Eating by frying.

4. Southeast Variety Group

It is distributed over Zhejiang, Jiangxi, Fujian, Guangdong, and Guanxi. All of this group varieties are propagated by fruit seedling and culture management is extensive so that variation range among trees is bigger in the same orchard. The fruit sizes are medium. The quality of fruit is not good and contains low glycogen volume, but higher starch and water. Only few of this group varieties have good quality.

5. Southwest Variety Group

This group is distributed over Sichuan, west of Hunan, Guizho, Yunnan, and west of Guangxi. Most of this group varieties are reproduced naturally beside some varieties in Hunan production area reproduced by fruit seedling. Fruit, generally, are small and have low glycogen volume and the average starch volume is 62.5% higher than other groups. But there are still some big fruit size, good quality varieties in this group in Hunan province such as Tali.

6. Northeastern Variety Group

This group is distributed over Liaoning and Jilin provinces and is the northernmost variety group in China. The main characteristic of this group is reproduction by fruit seedling and there are considerable quantity Dandong chestnut which belongs to Japanese chestnut system. The varieties in the Japanese chestnut system fruit early and have high yield. The chief drawback of the Japanese chestnut is that the fruit puckery coat can not be got off easily. But the breeding and grafting experiments were carried out during the past few years.

According to the actual situation from grafting area, there seems to be a stunted tendency when using wild chestnuts as stocks. So they are suitable for close planting. The shortcomings are tree situation weak, tree life shorter and yield per plant low. Comparing with two chestnut producing areas, where different stocks were used. The results can be as reference when selecting stocks. (see Table 7)

TABLE 7: Situation of Using Stocks in Different Areas

Areas	Stock Types	Tree Height	Tree Health	Yield Per Tree	Tree Lifespan
Luotian, Ma Cheng, Hubei, Changxing Zhejiang	Seedling	>5 m	strong	>10kg	becoming decrepit after 60 years
Yixing, Li Yang Jiangsu, Anhuei, Guangde, Hubei, Yichang	Wild Chestnut	<5 m	weak	<10kg (most)	becoming decrepit after 40 years

Because seedling chestnut (***Castanea mollissima*** Bl.) and wild chestnut (***Castanea mollissima*** Bl.) are often called as "Mao li" (***Castanea seguinii*** Dode) in many places and some scientific research units still confuse them even at present, it is necessary to clarify them and differentiate them strictly in commercial production. Differences among seedling chestnut, wild chestnut, Mao li and Zhuei li are shown in Table 8 and figure 7 (see page 28 in book).

Table 8: DIFFERENCES AMONG SEEDLING CHESTNUT, WILD CHESTNUT, MAO LI AND ZHUEI LI

Varieties	Seedling Chestnut	Wild Chestnut	Mao Li	Zhuei Li
Name	***C. mollissima***	***C. mollissima***	***C. seguinii***	***C. henryi***
Distribution	Around chestnut producing areas	Hills	mountains	hills and mountains
Character-istics of	1. high and big arbor	1. small arbor	1. small arbor	1. high and big arbor
chestnut trees and	2. first bears at 5-7 years	2. first bears at 1-2 years	2. first bears at 1-2 years	2. fruit period late
their repro-duction	3. 1-3 fruits per fruit branch	3.produces nuts in chains, over 10 or 20 fruit nuts on	3. produces nuts in chains	3. 1-5 fruits per fruit branch

		one fruit branch		
	4. fruit nuts big	4. fruit nuts small	4. fruit nuts small	4. single fruit nut, conical
	5. Leaf big and wide; star-shaped hairs on lower side scatteredly	5. leaf short and small; star-shaped hairs on lower side	5. leaf short & small; scaly glandular punctations on lower side	5. leaf narrow; glabrous on lower side
Reactions after grafting	1. High survival rate	1. High survival rate	1. extremely difficult to survive	1. difficult to survive
	2. Tree situation very strong, long life	2. tree situation weak, short life, hollow often inside stem		

In addition, there are many other wild oak trees in China, such as white oak (***Quercus alba***), cork oak (***Quercus suber***), and so on. They were used as stocks for chestnut grafting, but all failed.

TABLE 2: SUITABLE TIME FOR BRANCH GRAFTING

Area	Sprouting Period	Grafting Time
Hebei province	2nd & 3rd 10 days in April	1st & 2nd 10 days in April
Jiangsu	1st 10 days in April	3rd 10 Mar & 1st 10 April
Guanxi	3rd 10 days in March	1st & 2nd 10 days in March

3. BUDDING AND GRAFTING

1). Grafting technique

a. It varies with different grafting methods. Branch grafting usually is carried out when stock buds begin to sprout and bark can be peeled easily. The concreting time is varied with local weather conditions. (see Table II) When grafting choosing good weather is recommendable. Rainy and windy weather is unsuitable. The appropriate grafting temperature is about 18° C.

b. Grafting types and methods

Cut grafting: It is the most common way for grafting at present. This method is suitable for small stock grafting. Stock diameter is about 1 cm, so we can use stock-seedlings economically. This method is an important graftage for culturing grafted-seedlings in nurseries.

The graftage is shown on page 35 of the book, figure 8. Stocks are suitable to be cut away about 3 cm above ground. Then a short inclined plane is whittled from outer to inner with a grafting knife. The whittled area must be smooth. Then the grafting knife is used to cut the short inclined plane downward about 2.5 cm long , and the thick is good with little xylem. Scion is about 6 cm long with more than two buds. One cutting is made slowly and obliquely at the opposite of the lowest bud of the scion. The scion section is little longer than that of the stock. Then another short cutting is made obliquely at the opposite of the first cutting section. The scion is inserted into the stock and make sure their cambiums are contacted tightly with each other, tieing them with plastic cloth string. Finally, we use soil to cover the grafted- seedling in order to keep a suitable humidity.

Insert bark grafting: It is suitable for big stock grafting. The advantages are that scion has a large area contacting with stock cambium, healing easy, survival rate higher about more than 90%. But the grafting time is limited. The method is only carried out when tree fluid has flowed completely, tree bark can be peeled easily and scion buds do not sprout. So, the period of time for this kind of grafting method is shorter.

The graftage is shown on page 35 of the book, figure 9. Stocks are suitable to be cut away about 20 cm above ground. Fruit-bearing shoots are usually used for scions. The scions are cut in 18-20 cm and the low ends off the scions are whittled to horse ear-like inclined plane, then put the scions between your fingers, pinch them and get their barks opened. Then put the scions in your mouth in case drying. A layer old bark is cut off from stock. The depth of the cut is suitable for seeing the green bark. The length and the width of the cut are the same as scion's. Then, the scion is inserted into stock between cortex and xylem. Some old newspaper and a piece of plastic film are used to wrap them and tieing them with rice straw. Finally, we cover the linking place with some clay.

Insertion grafting: It is almost the same as inserting bark grafting. See page 36, figure 10.

Grafting under bark: See page 38, figure 11.

Bud grafting: Chestnut bud grafting is the same as apple tree bud grafting, that is T-shaped bud grafting. At present, successful experience in this method is small. It is not used in production very much. The main reason is low survival rate. So when bud grafting, you must pay attention to these problems: (1). Because there are ridges and grooves on the outward appearance of stock xylem, they influence the integration between grafting bud and stock. So the location of grafting must be chosen at smooth surface of the ridge back. According to observation, the smooth surface is just located under the leaf scar. So here is the right T-shaped bud grafting place. (2) Thick grafting bud is better than thin one, because the thin grafting bud is easy to get dry and inside the bud there are larger gaps which influence the integration between grafting bud and stock. Moreover, the thick grafting buds have stronger resistance to low temperature. (3) Bud grafting should be started when buds have grown well and healing ability is very strong.

Preliminary conclusions can be drawn that 3 kinds of branches can all be used as scions, among which fruit branch is the best with high survival rate in grafting, having shorter and thicker twigs, and flowering and fruiting earlier. Developmental branches are also a kind of good scions, having high survival rate, large amount of growth, longer and thicker twigs. If branches from middle and lower parts of the tree are used, survival rate is even greater. It can be widely used in the commercial production. Excessive branches can also be used as scions, but survival rate is low, twigs are weaker.

In new chestnut developed areas, because large amount of scions are needed, developmental branches, even excessive branches as well as fruit branches are used. According to the preliminary results, both vegetative and fruit branches seem to be good. Comparison experiments were done in 1973 by the Institute of Botany in Jiangsu province using fruit branches, developmental branches and excessive branches and developmental branches from upper, middle, and lower parts of the tree as scion, and the results of which are shown in the tables 9 and 10.

TABLE 9: Survival Rate in Grafting Using Developmental Branches From Different Parts of the Tree

Tree Area	# Trees Grafted	% Survival
Upper	117	11.1
Middle	98	21.4
Lower	83	27.7

TABLE 10: The Relationships Between the Type of Branches and Survival Rate in Grafting, Growth, and Development

Place	Type of Branches	# Trees Grafted	Survival Rate %	Amount of Growth Per Year (cm) Total Length	Mean Length	Total Thickness	Comments Mean Thickness	
Liyang, Jiangsu	fruit	20	80					
	developmen.	20	55					
	excessive	20	0					
Nanjing, Jiangsu	fruit	8	62.5	209.0	108.9	3.17	1.57	All showed m few f flowers
	developmen.	29	48.3	334.3	167.2	3.12	1.56	male showed
	excessive	7	42.9	300.0	150.0	2.93	1.47	male showed

4. CHESTNUT DISEASE (*Endothia parasitica* (Murr.) And et And)

(1) Distribution of the Disease and Damage Situation

This disease is one of the most destructive world diseases. The distribution is vast and the damage is heavy. Almost all chestnut trees in Europe and America were destroyed by the disease at the beginning of this century. Afterwards, Chinese chestnut was used for breeding resistant variety and chestnut trees were cultivated again. In China, Chinese chestnut trees were consistently considered to be resistant tree species. But in recent years, the disease spread in several provinces of southern China and damages were considerably serious in some places. It is a main disease in chestnut production at present.

Not heavily damaged trees which stems are infected partly are weak and influence fruit production. Heavily damaged trees which stems are ulcerated probably die at last.

(2) Symptoms and Infection Ways

The disease takes place mostly on cortex parts of main stem, very few on branches.The initial symptom is round, yellow-brown spot and later becomes larger and red-brown irregular spot. It surrounds the whole stem and develops upward and downward. Diseased parts appear dropsical swells and wet rot inside, alcoholic smell. After drying, the barks become splitting longitudinally and the withered and yellow diseased tissues.

According to the observation in Nanjing area, the disease comes on in March and produces orange to red-orange asexual fruit-body. A lot of conidia spill over from the fruit-body. The conidia are disseminated by birds, insects, rain water and so on. Ascospores are produced in October. The ascospores are disseminated to healthy plants by wind, rain water and insect in next spring. The main infection gateways are different wounds.

(3) Control Methods

a. Seedlings and stocks are quarantined and sterilized to prevent the disease inoculum.

b. Strengthen management. Decreasing wounds.

c. Selecting and breeding resistant varieties.

Up to now, absolute resistant variety is not found. But chestnut variety resource is very rich in China. There is much hope of selecting and breeding resistant varieties or types.

d. Chemical control.

According to indoor and outdoor tests made by Jiangsu botanical research institute, Antibactericide 401 plus 0.1% ping ping jia can control the disease developing very effectively. The Antibactericide 401 solution concentration is 400-500X.

5. CHESTNUT GALL WASP (*Dryocosmus kuriphlus*)

(1) Distribution and Damaging Situation.

The pest is distributed widely. It causes serious damage in Japan and Korea. In China it takes place in Liaoning, Hebei, Shaanxi, Shandong, Jiangsu, Anhui, Zhejiang, Jiangxi, Hubei, Hunan, and Fujian Provinces. It is more severe in seedling propagation areas.

This kind of insect only damages chestnut buds. Damaged buds sprout short twigs in spring. Swelling gall can be formed on branches, petioles, and leaf veins. After adult insects eclosion, most of the short twigs died. Damaged chestnut trees are weak and fruit production is low.

(2) Form and life habits.

Adult body is 2.5-3 mm long, yellow-brown to black, lustre. Front and back wings are transparent. The veins of the front wings are black. Eggs are oval, milk white, a thin handle at one end of the egg. 4-5 eggs are often laid inside a bud. Larva is 2-2.5 cm long, milk white. Its head is dark-brown and thicker than its tail part. Pupa is about 2.5-3 mm long, milk white, later dark brown.

The generation takes place once a year. Every insect forms appear not uniformly. First age larva overwinter in buds. Larvae grow rapily with buds growing in next April. Damaged buds are stimulated to swell and become galls. there are generally 3-4 larvae inside a gall, but some may be more than 10. The galls are green at first, later become red to brown. Larvae change into pupae in galls in the last ten days of May and first ten days of June. Eclosion takes place in June and the first ten days of July. Eclosion adult insects stay in galls for 10-15 days, then fly out of the galls. The flying ability of adult insects is weak. Their life-span is short. All of the adults are

females, so the propagating form is parthenogenesis. Eggs are laid inside the buds that are on thin and weak twigs. Eggs hatch in August. Larvae begin to overwinter in October.

(3). Control Methods

a. The basic way to control this pest is selecting, breeding and applying resistant variety. There are 34 varieties in Japan. Among them 11 varieties have been selected and bred to be resistant ones. So, developing of the insect is controlled effectively. China is original chestnut tree producing place. Local variety resource is very rich. There is a possibility to select and breed resistant varieties to control the pest.

b. Combining with pruning, the weak twigs inside the tree crown should be pruned in winter time so as to kill the overwintering larvae and improve the tree nutrition condition.

c. Biological control

Known ***Dryocosmus*** natural enemies are 7 species. The important one is ***Eupelmus spongiportus*** Foerter, which is a kind of wasp. In Nanjing area, parasitic rate is about 19-70%. When the parasitic wasp is laying eggs in April and May, galls are picked from trees and stored in dry places. Don't make them to be moldy and heating. The pests inside the galls die sequentially, but the parasitic wasps don't die. Next spring, put back the branches with galls in chestnut orchard. Then, parasitic wasps will eclosion and parasite again.

d. Chemical control

In June, when eclosion, but not get out of the galls. E605 solution (1:1000X) is sprayed for two times. The chemical can kill the adult pests inside the galls. Mortality can reach to 90-97%, but it is not harmful to the parasitic wasps (***Eupelmus spongiportus***).

e. Prevent scions and seedling carrying the pest, especially in new developing chestnut areas.

In order to protect natural enemies and kill the insect, the differences between ***Dryocosmus*** and ***Eupelmus*** are listed in the table below.

FORM	***DRYOCOSMUS***	***EUPELMUS***
Larva	Body corpulent, white color, body hair not clear, not lively	Body thin, small, yellowish, with yellow-brown hair, lively
Pupa	Black and corpulent, large	Black, thin, small, with golden-green gleam

Adult	Appear in June-July	April- May

6. CROSSING TECHNIQUE

(1) Emasculating and Covering

Before female flower stigmas appear, fruiting branches at the top and periphery of the crown are chosen and the male flowers are picked off completely. Then female flowers with several leaves are covered with a glass paper bag. Bag size is about 11X20 cm. Finally the bag mouth is tied up with plastic string.

(2) Collecting and Storing of Pollen

Pollen for crossing is good to collect when male parent is in full bloom. The collected male inflorescences are dryed by airing on clean papers. Then pollen is got off from the inflorescences with a toothbrush, sifting the pollen with a sieve. Pollen is put in petri dishes and put into dessicator for using later. If collecting several male parent pollens at the same time, the brush and sieve must be treated with 75% alcohol to prevent pollen mixing.

(3) Pollination

Pollination is carried out when the female styles branch. In order to avoid other chestnut pollen in the air falling on the styles when opening the bag, the best way to do it is powder spraying method. That is using a glass tube which internal diameter is about 7 mm. One end of the glass tube is drawn into thin capillary. Put pollen into the tube and plug other end of the tube with a ball of cotton. Then put a rubber dropper head on the end. When pollinating, put the thin glass tube end into the bag and the mouth of the tube aim at the female style. Push your fingers on the rubber dropper head and the pollen would be sprayed on the style. After spraying, the hole which was made by glass tube must be sealed with sticky tape. This method is very simple to perform and very efficient. It increases the efficacy seven times more than using writing brush smearing method. (see page 163, fig. 54 in book)

(4) Labelling and recording

Every crossed fruiting branch is hung with a paper or plastic plate and numbered. Crossing combination (showed as female parent X male parent), number, pollination date, pollinating bag numbers and female flower numbers.

(5) Bag opening

After pollinating for 20-30 days and style head rolling back and getting wilt, the bags can be taken off. The fructifying rate is counted up at the same time.

8. PREPARATOR'S COMMENTS AND ACKNOWLEDGEMENTS

Profound thanks are due to the translator, Mr. Chengguo Wang, for his highly competent, good-hearted, free, and open-handed contribution to international scholarship.

This accomplishment would also have been impossible without the efforts of Dr. Steven Wang, Dr. Charles R. Burnham, and Mr. Mark Kane, who first brought the book to my attention after he ran across it in the library of the Missouri Botanical Garden while preparing a magazine article on chestnut. Monetary support for this preparation was provided by the Badgersett Research Farm, the South Bear School, and the Ruth Lewis Benevolent Fund. Copying and distribution provided by The American Chestnut Foundation.

This is an important document. It updates our knowledge of the Chinese populations of ***Castanea***, and fills in many blanks. It also makes some statements that pique our curiosity. The following comments are numbered according to the page they are relevant to.

5,6. Variety groups-(also see map, p. 18) The Chinese authors separate their cultivars into 6 distinct, sometimes overlapping, groups. This is something we have previously been completely unaware of. All the surviving material imported into this country came from groups 1 and 2. Regions, and more importantly, "groups" that might carry better hardiness and possibly better blight resistance were unsampled.

Are these groups so distinct that they might properly be considered subspecies? There is no indication here, but the size of the geographic area involved makes it possible.

7,8. The population the authors call "Wild Chestnut" is one unmentioned elsewhere. An examination of the tables on page 7 and 8 show the population, considered to be ***mollissima***, is intermediate between ***mollissima*** and ***seguinii***.

The possession by "Wild Chestnut" of such characteristics as precocious bearing, small tree size, and the production of 10-20 nuts per fruiting branch, all desirable characteristics in a nut cultivar, and all lacking in other ***mollissima*** groups, makes me doubt that the cultivars were derived from this population. The marked grafting incompatibility also raises doubts.

Is "Wild Chestnut" a hybrid swarm? Or an unrecognized species? Clearly, it should be of interest to anyone breeding chestnuts, for the precocity alone. There are also reports by Chinese scholars that "wild" populations are much more blight resistant than the population of cultivars currently being used as a source of disease resistance in this country.

11. The authors mention an increase in damage from blight in southern China in recent years. The translator, however, adds that in his province, Shaanxi (North Central), the large industry, which ships many nuts to Japan as a cash crop, is completely free of blight. This is a startling statement, and needs to be confirmed. If accurate, there are 2 alternatives; either trees in that region are immune (very interesting!) or the blight is a relatively recent development in China, and has not reached into the cold, continental areas of the population. Note that the spread of the blight in the US and Europe has slowed greatly as it reached cold continental regions. Previous chestnut researchers assumed that the blight was endemic to China and of long-standing. There is no evidence to corroborate the assumption, however, and it may be equally likely that the disease is "evolutionarily" a young phenomenon. The somewhat ineffective genetic resistance system evolved so far in the ***mollissima*** cultivars makes me wonder; as well as reports by early plant explorers of populations in Shandong dying from blight in the early part of this century.

12. There may be useful chemical treatments available here.

12, 13. Chestnut Gall Wasp is already considered a serious pest by Chinese chestnut orchardists in the South East US. The existence of the parasite ***Eupelmus*** , and its use to control the Gall Wasp, I was previously unaware of. The Gall Wasp also attacks, and can kill, American chestnut.

16,17. The information on controlled crossing technique is most useful. Having personally pollinated chestnut flowers more than 8,000 times in the last 3 years, I judge the pipette and sieved pollen technique to be far superior to anything else available so far. It can put much more pollen on the stigmas, more easily, than any other method.

17. The authors state that they can reliably tell burrs holding fertile nuts from burrs carrying only unfertilized nutlets at 30 days after pollination. My experience with pure ***dentata*** is that fertile and infertile burrs are virtually indistinguishable until 1 week before nut drop (about 70 days after fertilization) Is this a reliable difference between ***mollissima*** and ***dentata***?

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