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CHESTNUT BLIGHT RESISTANCE

Castanea Alnifolia and C. Mollissima Show No Signs of Blight—American Chinquapin Seems Almost Equally Vigorous—Japanese Varieties Usually Succumb—Experiments Prove Nuts Develop Freely When Female Flowers Are Not Pollinated.

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EIGHT years ago, when the chestnut blight (*Endothia parasitica*) began seriously to menace my native chestnut forest, situated in the towns of Stamford and Greenwich, Conn., notes were made upon the subject and a number of varieties and species of chestnuts were added to the collection. At that time there were about five thousand old American chestnut trees (*Castanea americana*) upon my country place; there were also half a dozen chinquapins (*Castanea pumila*) about five years of age, and a few grafted trees of named varieties of chestnuts which had been purchased from nurserymen at about the time when the chinquapins were purchased. There were two saplings of *Castanea mollissima*, the Chinese chestnut, which had been given me by Professor C. S. Sargent.

None of these notes in relation to ages of trees and numbers of trees, which follow, are quite scientifically accurate, because as a busy man with many kinds of responsibilities, the matter of records has been left to employees. Changes in the meantime have taken place among the employees. I am writing from memory, rather than from notes, when making this contribution.

When it became evident that the American chestnut trees on my place were seriously menaced, the question of finding blight-resisting individuals among species and varieties came up, and I proceeded to add to the collection various species and varieties until it included twenty-six different kinds. Among these kinds, species were as follows: American sweet chestnut (*Castanea americana*), bush chinquapin (*Castanea pumila*), tree chinquapin (*Castanea pumila arboriformis*), alder-leaf chestnut (*Castanea alnifolia*), evergreen chestnut (*Castanopsis chrysophylla* or *C. sempervirens*—I do not know which species). In addition to these American species of chestnut there were two specimens of *Castanea mollissima*, and many specimens of species not determined by me, from England, France, Italy, China, Korea and Japan. There were also a number of grafted varieties of descendants from European and Asiatic progenitors.

PROGRESS OF DISEASE.

The fate of these chestnuts may be briefly summed up at the present time about as follows:—

The evergreen chestnuts (*Castanopsis*) which I set out on several different occasions, were always eaten during the winter or spring by cattle or by rodents, on account of their attractive green leaves and tender shoots above the snow, notwithstanding various attempts at protection.

Every one of the five thousand old American chestnut trees became blighted, and they were removed. Younger trees and stump shoots of the American chestnut are now practically all dead or dying with the blight.

Various grafted varieties of European and Asiatic chestnuts have shown

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GIANT CHESTNUT IN EASTERN CHINA.

Although the bark disease is found in the groves of this region, the Chinese species (*C. mollissima*) seems to have acquired a high degree of immunity to it. This photograph, taken at San tun ying, province of Chili, shows scars on the tree, where the disease has made its appearance but been overcome. A large number of seeds of trees of this species have recently been introduced by the department of agriculture and distributed among investigators in the United States. (Figure 14.)

different degrees of resistance to the blight. Some of them which show an occasional blighted limb may be preserved with a moderate degree of care. This is also true of the seedlings of European and Asiatic varieties. None of them appear to be as vulnerable as the American chestnut, but most of mine are dead nevertheless.

Korean chestnuts and chestnuts from the Aomori region in Japan resisted the blight almost completely until they were six years of age. Since that time they have shown a marked tendency to blight, but resist it better than does the American chestnut.

Korean and Japanese chestnuts when grafted upon American chestnut sprouts all blighted in their second or third year after grafting while their "parents" remained unblighted, indicating that the sap of the American chestnut furnishes attractive pabulum for Endothia. American chestnuts grafted upon stocks of Korean and northern Japanese chestnuts showed a marked tendency to blight promptly, near the point of union of the graft, while the stocks remained unblighted.

One hybrid between the American sweet chestnut and the chinquapin blighted when about eight years of age and is now dead.

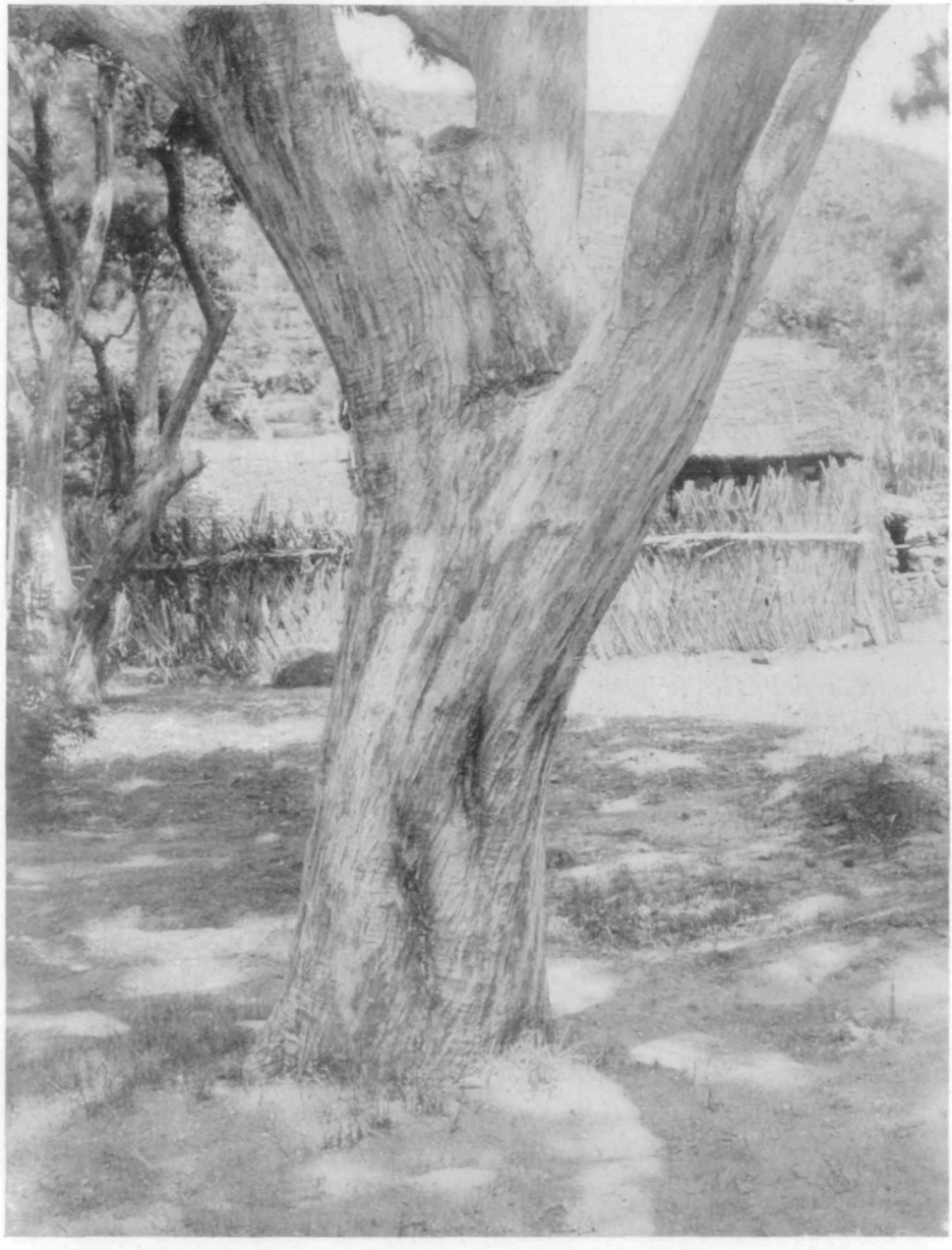
None of the American species of chinquapin, varying from five years to about thirteen years of age, has blighted, with the exception of two limbs, which were injured by falling limbs of a blighted American sweet chestnut tree. These injured and blighted branches were removed and there has been no other blight among the chinquapins.

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TREE SCRAPED TO PREVENT DISEASE

The Chinese method of warding off attacks of the bark disease from their commercial plantations is to keep the trunk and larger limbs scraped clean, thus giving the spores of Endothia little foothold. This photograph illustrating the application of this crude method of prevention was taken at San tun ying, province of Chili, China, by Frank N. Myer, June 1, 1913. (Figure 15.)

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Of the two which were injured one was a bush chinquapin and the other a tree chinquapin.

I purposely allowed dying American chestnuts to remain near the experimental test species and varieties in order to make the test severe. None of the specimens of *Castanea alnifolia* has blighted. None of the specimens of *Castanea mollissima* has blighted but these latter include only five trees—the two given me by Professor Sargent (now eight years old) and three received since that time from the Bureau of Plant Industry, Washington.

BREEDING EXPERIMENTS.

In order to breed hybrid chestnuts which would be resistant to blight, I made various combinations between staminate and pistillate flowers of *Castanea alnifolia*, *C. pumila* and *C. mollissima*. The most promising hybrid for timber purposes would presumably be one between *C. mollissima* and *C. pumila arboriformis*, but my tree chinquapins came into flowering this year for the first time. Next spring I shall make that combination. There are now growing in my collection various young hybrids between *C. mollissima*, *C. alnifolia* and *C. pumila;* likewise a number of other hybrid chestnuts, but these are at present from one to three years of age only and are of no value for data in reference to blight resistance.

When making hybrids between various species of chestnuts, I incidentally determined that parthenogenesis apparently occurs among the Castaneas. Three years ago a number of pistillate flowers of *Castanea pumila*, which had been covered with paper bags, were not pollenized for the reason that I did not happen to have pollen enough to go around. These paper bags were left in place unintentionally. Some three weeks later when they were removed because of unsightliness, the branches which had been covered with paper bags were found to have set full complements of nuts. These nuts went on to full development and were fertile—sprouting later. Some of them showed peculiar freaks. Cotyledons protruding through the involucre before the nuts were fully developed showed a trifle of chlorophyll coloration similar to that of the germ, which also protruded beyond the involucre. Another peculiar feature of the parthenogenic nuts was the disparity in size between shoots which grew from them in the following year, some becoming much larger and some remaining smaller than chinquapins growing from normal gametes. In order to make sure that no pollen had accidentally reached the pistillate flowers by way of insects or wind, carefully checked experiments were made in the following year, and so far as I can judge there is no doubt but the American chinquapin may develop its fruit freely by parthenogenesis or by formative budding from some cell.

Incidentally I may state that similar experiments were tried with *Juglans cinerea*, *Hicoria ovata*, *H. glabra*, and *H. minima*, and all of these apparently developed nuts by parthenogenesis, *Juglans cinerea* freely, and the three hickories sparingly.

The Supremacy of the Mind

We cannot raise the race by degrading individuals. Whatever lowers the humanity of fathers and mothers, whatever elevates the physiological above the psychological, the body above the mind, is an enemy of the race and no method for its regenerators.—C. W. Saleeby: The Methods of Race-Regeneration (1911).

The Biometric Standpoint

General theories of society are of no use, verbal discussions are of no use, philosophical reasoning is of no use. We need to observe, measure and record, to analyze by the methods of exact science, before we can advance in our sociology, before we can aid our working classes to a true insight of the factors which make for or mar our national vigor.—Karl Pearson: Nature and Nurture (1910).

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