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BULLETIN NO. 78.

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Ginseng, Its Nature and Culture.

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LEXINGTON, KENTUCKY.

November, 1898.

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## KENTUCKY

# Agricultural Experiment Station.

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### ADDRESS :

KENTUCKY AGRICULTURAL EXPERIMENT STATION,  
LEXINGTON, KY.



## BULLETIN No. 78.

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### **GINSENG, ITS NATURE AND CULTURE.**

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BY H. GARMAN, ENTOMOLOGIST AND BOTANIST.

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Hunting ginseng, or sang, as it is often called in rural Kentucky, has long been a means of earning pin money to Kentuckians living in the more rugged and unsettled parts of the State. So eagerly has it been sought out that it is now becoming scarce, and in a few years wild plants will be exceedingly hard to find. This increasing scarcity of ginseng together with the high prices paid for it has drawn attention to the subject of its artificial culture for the market, and is the reason for the preparation of this bulletin.

For more than a century the roots of ginseng have been included among the principal exports of the United States. The statement will be a surprise to many of our people, but it is a fact that from 1790 till the present time the quantity annually exported to China from the United States has ranged from 29,208 to 753,717 pounds. From 1820 to 1897 inclusive the quantity of dried roots annually shipped from this country was never below 46,581 pounds, and ranged in value, according to statistics published by the national government, from \$17,339 to \$840,648, the latter sum representing the value of the roots exported in 1897. During a period of sixty-five years (1821 to 1879 inclusive, and 1892 to 1897 inclusive) records published by the Government show that our people exported ginseng roots to the value of \$20,023,710. The

following figures taken from various statistical reports in the Station library show how the supply has diminished and the price increased.

YEAR.	QUANTITY EXPORTED, POUNDS.	VALUE.	VALUE PER POUND.
1821	352,992	\$171,786	\$.48
1822	753,717	313,943	
1823	385,877	150,976	
1824	600,046	229,080	
1825	475,974	144,599	
1841	640,967	437,245	.71
1842	144,426	63,702	
1843	556,533	193,870	
1844	301,408	95,008	
1845	468,530	177,146	
1861	347,577	292,899	.84
1862	630,714	408,590	
1863	372,945	295,129	
1864	360,950	474,920	
1865	414,507	547,653	
1892	228,916	803,529	3.51
1893	251,205	792,928	
1894	194,564	619,114	
1895	233,236	826,713	
1896	199,136	770,673	
1897	179,573	840,686	4.68

This export consists almost entirely of wild roots, for while ginseng has for many years been grown in China, Japan, and probably Russia and other countries, it is only recently that attempts, more or less successful, to grow our species, have been made in a small way in this country. The plant occurs over much of the eastern United States, from Canada to Alabama, and is gathered over the whole of this territory, the bulk of it eventually going abroad from New York City.

The small quantities gathered by individual collectors are sold to druggists, grocers and others in the immediate



neighborhood, and by these in turn sent to the nearest city. Traveling agents of dealers in hides, waste iron, etc., pick up a good deal of the ginseng collected in the mountain counties.

In Canada ginseng is said to have been discovered in 1716 by a Jesuit missionary, Father Lafitau. The Canadian French shortly afterward began collecting it for export to China, and large numbers of Indians were at one time interested in the search for roots. In 1890 Canada is stated to have exported roots to the value of \$100,000. The price paid for dry roots in that region is from \$3.00 to \$3.50 per pound.

**Laws Relating to Ginseng.**

The value of the plant is fully realized by the Canadians, and in the Province of Ontario a law has been enacted forbidding the destruction of plants in the woods during the season when berries are produced. The two following sections of the law are given here as published in Bulletin LXV of the Ontario Agricultural College Experiment Station, June, 1891:

1. Except for the purpose of clearing or bringing land into cultivation, no person shall, between the first day of January and the first day of September in any year, cut, root up, gather or destroy the plant known by the name of ginseng whenever such plant may be found growing in a wild or uncultivated state.
2. Any person who contravenes the provision of this Act shall, for every such offense, upon summary conviction before any Justice of the Peace, be subject to a fine of not less than \$5.00 or more than \$20.00, together with costs of prosecution, and one-half of such penalty shall be paid to the prosecutor, unless otherwise ordered by said Justice convicting.

Our neighbors in West Virginia, who have always derived a good deal of profit from ginseng, have provided for the future by enacting a law prohibiting the collecting of ginseng, or of medicinal roots of any kind, on land belonging to another person, without the consent of the owner, in the counties of Pocahontas, Greenbrier and Webster. Any other county in the State is permitted to adopt the law when one hundred residents petition the Courty Court to have its provisions enforced therein.

The law does not seem as likely to prove effective in protecting ginseng as does the one enacted by the Canadians. It is so easy for roamers in the woods to gather ginseng and other roots without detection, or in other cases to get permission to collect, that it would seem scarcely possible to check their extermination with a law of this sort. A law embodying the ideas in both of the above would very likely prove more effective than either.

#### **Ginseng in Kentucky.**

There is probably not a county in Kentucky in which ginseng is not present and at one time grew more or less abundantly. It is of course most common in the heavily wooded sections, and in the mountains of Eastern Kentucky is still collected in considerable quantities. The experienced ginseng hunter of that section roams the woods armed with a light spade made like a chisel, a couple of inches wide and with a round handle about three feet long, or else carries a small eye-hoe, made for the purpose. Other tools lacking, he uses a sharpened stick, and on a pinch digs up the roots with his fingers or jack-knife. He carries at his side to hold the roots a simple home-made cloth or linoleum satchel, shaped like those used by school children for books; and frequently, with an eye to both pleasure and profit, takes his rifle with him also. A collector whom I met near Somerset some time ago told me that he had that day collected a dollar's worth; and judging by what I saw brought in by other collectors, this is not an uncommon day's wage from ginseng hunting. Few of those who have no established business on their hands could find more profitable employment. To collect successfully requires a certain amount of hardihood and forest lore too, and only he can expect to find the largest and finest roots who has strength and inclination to tramp and climb in all sorts of out-of-the-way nooks, where commonplace men and the ubiquitous hog and cow rarely penetrate. For ginseng is a wild thing, hiding away in deep ravines and in undisturbed forests, so dense that the winds only sweep over the tops, and in their depths the owls hoot in the daytime. In



places such as these it flourishes, sending down its curious forked root into the rich mold consisting largely of the decomposed remains of dead trees and their leaves.

The collector in the mountains often strings his roots, running a needle and piece of twine or thread through them and hangs them to the walls and rafters of his dwelling to dry. The purchaser occasionally gets strings of this sort which are several yards long.

Kentuckians probably began collecting the roots as soon as the demand for them arose, in 1790, or earlier, before the territory was separated from Virginia. In the earlier days when much of its surface was covered with forest, the State doubtless produced a large share of the total product shipped out of the country. In the *Western Farm Journal*, Volume 1, published at Louisville in 1856, I find it mentioned in the market quotations as selling for from 25 to 28 cents per pound. In the issue of the same journal for August 10, 1857, under the head of market quotations it is given a special paragraph which reads: "Prices have again advanced, with sales from store at 37½ to 40 cents, generally at the outside figure, and from wagons at from 36 to 37 cents. The demand is largely in excess of the supply." At present it sells readily for cash at from \$1.50 to \$3.25 per pound, according to quality, the small and poorly dried roots being rated lowest, because, as I am informed by a local buyer, they contain a good deal of waste in the shape of fibrous parts, stems, etc.

Messrs. Speyer & Son, of Lexington, inform me that they handle \$25,000 worth a year, and last year bought \$6,000 worth at Glasgow, Ky., alone. They also buy large quantities about Nashville, Tenn.

Samuel Wells & Company, 211 and 213 Vine Street, Cincinnati, are large dealers in the roots, but tell me they handle but little of the Kentucky ginseng because of its inferior quality. Quality, it seems, is merely a matter of size, and so far as I can learn our roots are not otherwise inferior to those collected at the North and East.

In a recent letter Mr. Aug. Wahking, of the firm of W. H. Newman & Co., 732 West Main Street, Louisville, esti-

mates the quantity of ginseng annually handled in Louisville at 20,000 pounds, at an average price of \$2.75 per pound.

Mr. Isaac Rosenbaum, of 321 and 323 East Market Street, Louisville, tells me he handles 12,000 to 13,000 pounds each year, and, as there are five or six other dealers in the city, thinks the total quantity annually handled, from 35,000 to 40,000 pounds. This estimate includes ginseng collected in Indiana, Kentucky, Tennessee, Alabama, and other states.

A conservative estimate of the Kentucky ginseng handled in Louisville is given below, and has been kindly furnished at my request by Mr. James F. Buckner, Jr., Secretary and Superintendent of the Louisville Board of Trade.

BOARD OF TRADE,  
LOUISVILLE, KY., Oct. 28, 1898. }

*Prof. H. Garman, Lexington, Ky.*

DEAR SIR:—In reply to your inquiry of the 20th inst. asking information concerning the quantity of ginseng handled in Louisville annually and the price paid by dealers here for same, I have to say that, as ginseng is brought in generally in small quantities and sold to a large number of people, it is difficult to obtain very accurate information regarding it; but I have consulted a number of the largest dealers here, and from information received from other sources, I believe I am able to give you information that will approximate the truth, and I enclose you herewith a statement showing the estimates made by four of the largest dealers, and also my own estimate, as to the quantity and average price made from the returns to me above referred to, and from other sources.

The price fluctuates greatly owing to the unevenness of the supply and also to the demand for it from China, that country being our principal market for the product.

The prices given you apply strictly to Kentucky ginseng, as the size of the root affects the price very considerably, and the root produced farther north is considered in the market as of somewhat better quality.

Trusting the information furnished you will be of value,  
I am very truly yours,

JAMES F. BUCKNER, JR., Supt.



## GINSENG.

Estimate as to number of pounds handled annually in Louisville, Ky., and prices paid for same by dealers :

NO. DEALERS MAKING RETURNS.	Average Amount.	Range per Lb.	Av. Price.
D. Davis & Son . . . . .	9,500	\$1.50 to \$3.50	\$2.65
A. Wahking . . . . .	20,000	1.85 to 3.50	2.75
John White & Co . . . . .	50,000	2.80 to] 3.25	3.10
M. Sabel & Sons . . . . .	27,500	2.75 to 3.10	2.90
Board of Trade estimate from returns made and other sources.			
	30,000		\$2.85

JAMES F. BUCKNER, JR., Supt.

Numerous circular letters have recently been addressed to correspondents of the Station residing in every county in the State, inquiring as to the abundance of ginseng and about other matters relating to its growth. From the replies received it is evident that the plant is now very scarce, taking the State as a whole, but that it still occurs in nearly or quite all of the counties. The following letters will serve to give an idea of the character of the replies received.

CLOVERPORT, KY., October 28, 1898.

*H. Garman, Lexington, Ky.,*

DEAR SIR:—In answer to your questions in regard to ginseng, will state as follows :

1. It is not abundant from the fact that it is dug from the time the plant gets above the ground, until killed by frost.
2. It grows best on east and north hill sides, but can be grown anywhere in the shade.

3. No [not extensively collected]. From the fact that there is but little to be collected.

4. It is first sold in the local markets, shipped to New York City, and from there to China. The price paid in local markets is from \$2.50 to \$3.50 per pound, but when exported the roots are carefully assorted and bring fancy prices, ranging from \$8.00 to \$25.00 per pound.

5. There is only one man in this State (Kentucky) besides myself that I know of, that is growing it. I am satisfied that ginseng can be grown successfully. I have only been experimenting in that line four years.

I had my plantation raided upon two occasions, and lost 2,000 four-year-old plants. I then concluded not to cultivate the roots, so the undergrowth would make the digging by thieves more difficult. To balance want of cultivation I covered the land with stable manure and straw as a mulch, but that made a harbor for ground mice, which have proven very destructive. In the future I shall cultivate and take the chances of theft. Will plant largely next month.

Yours truly, W. S. ASHBY.

MIDDLESBOROUGH, KY., Nov. 1, 1898.

*H. Garman, Entomologist and Botanist, Lexington, Ky.*

DEAR SIR:—Your favor of October 3rd has been on my desk for some time. In the meantime I have been endeavoring to secure for you such information as will be of service on the subject of your inquiries.

I have gone out with the "sangers" some this fall looking for the ginseng seed. I find that a great amount of this root has been dug and sold in this county since the close of the Civil War. At one time nearly the whole population turned out to dig it. In the early days the roots were very large and easily gathered. To-day in the more frequented parts of the mountains there is very little left and that is very small, rarely more than three years old.

It is bought up by dealers and shipped east where very much better prices are obtained for it. One of our merchants has more than \$6,000 now invested in it, of roots bought here.

No attempt has been made to cultivate it in this county recently. Some years ago an effort was made to grow it by some enterprising citizens, but some other equally enterprising persons gathered it for them "atween the days," and so the effort was abandoned. I have been trying to get others to try it, but the difficulty of preventing the depredations of the



professional or habitual "sanger" has hindered. I have gathered a few seeds to make an effort myself. It grows luxuriantly on the cool and shady north sides of the mountains but makes the largest root in the more open and exposed localities. It requires some shade and will not grow in the open the "sangers" declare.

Yours truly,

J. M. BROOKS.

Some of the correspondents in Bluegrass Kentucky and in Jefferson and Breckinridge counties, report no ginseng present; others, however, from the same regions report it present, but rare. In such counties as Madison, Clark, Fayette, Montgomery, Bourbon, Scott and Shelby, where stock-raising is the dominating industry, we should not expect to find ginseng common, and it is from these counties that most of the replies indicating its absence come. Yet Fayette is perhaps as closely grazed and cultivated as any county in the State, and I know that a few pounds of ginseng roots are collected near Kentucky River each year. The only counties in which it has been reported abundant are, Rockcastle, Adair, Green, Logan, Trigg, Warren and Barren.

Mr. C. F. James, of Auburn, Logan county, writes under date of October 15, 1898: "It grows abundantly on Mud River in the neighborhood of Lewisburg, the hillsides, sandy hills, being literally covered with it."

The unanimous testimony is that it thrives best in rich soil and in dense shade. Some report it most often found in beech woods, others in forests consisting largely of oak. "Northern slopes" and "deep coves" are common expressions used by correspondents in describing the locations in which it most frequently grows. A correspondent living in Ballard county writes that it does best there in rich soil on what is known as second bottom land. From the testimony it appears that it does well where either sandstone or limestone rocks prevail at the surface, but there is a slight preponderance of testimony in favor of its more thrifty growth and greater abundance in regions where sand is present in the soil.

What it wants is soil rich in vegetable matter, and shade, and with these two conditions fulfilled it seems to do well anywhere in Kentucky.

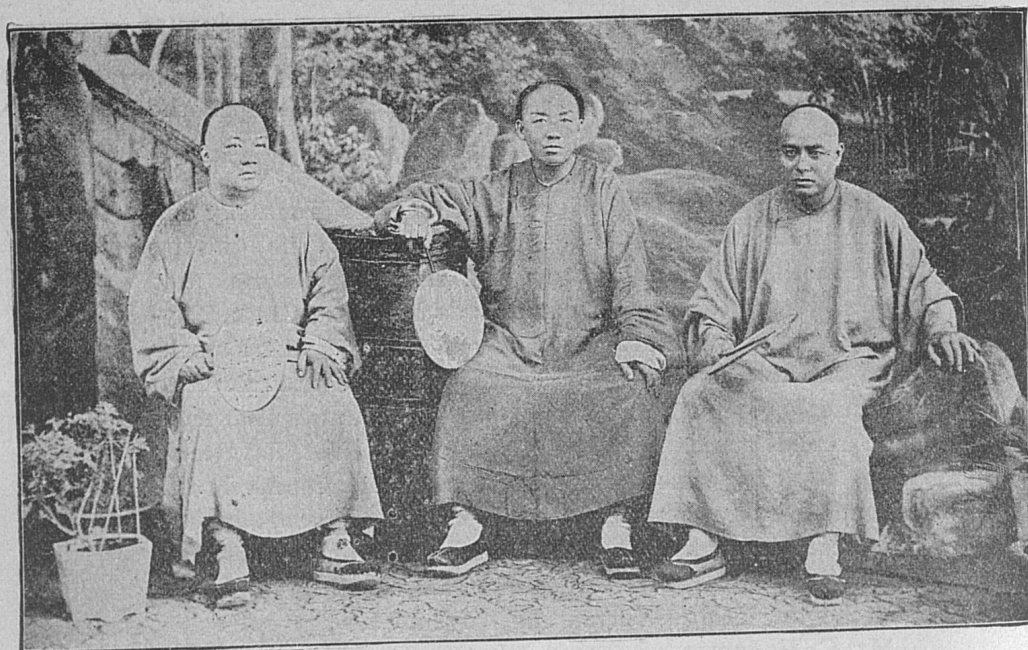


FIG. 1.—A GROUP OF CHINESE MERCHANTS.

**Ginseng as a Medicine.**

Ginseng is used almost exclusively by the Chinese and Japanese, who consider it a tonic of marvelous quality to be employed in cases of debility, much as we use quinine. It is said to be to some extent mixed with quinine by Chinese doctors. While accepting every penny the Chinese will pay for it, our people are disposed to scoff at ginseng as a medicine, and to look upon its use by the Chinese as the result of superstition, aroused by the grotesque resemblance to the human body often assumed by the roots. I have seen it stated that roots most closely resembling the human body in shape are believed by the Chinese to have exceptional virtues in banishing weakness and prolonging life. Even people of scientific attainment unhesitatingly pronounce its healing properties a myth. On the other hand, so firmly fixed is ginseng in the esteem of the Chinese and Japanese that they have "saws" based upon it implying the most implicit faith



in its healing virtues. The substance of one of them is to the effect that ginseng cures only to allow you to die of starvation. And we can fully appreciate the force of the saying when we read the statements of our English writers as to the prices paid for it in China. When of exceptionally good quality the prepared ginseng is said to sell for its weight in gold. It seems there is some evidence even in Chinese literature indicating that the curative properties of ginseng are fancied; but the same thing could be said of our own medicines. The following story is quoted from a Chinese botanical work by an English writer, and serves to illustrate an attitude assumed by some Chinese toward ginseng: "In the region of Wen Ti, Emperor of the Siu dynasty, a man living at Shang-tang used every night to hear a human voice calling to him from behind his house, but could never find out who it was. One day, at a distance of 600 yards from his house, he found a ginseng plant with an extraordinary thick stem. He dug up the root; it penetrated to a depth of five feet, and resembled the body of a man, with the head and limbs complete; after this the nightly voice ceased."

To a very limited extent the dried roots are sold by druggists in this country, the demand coming, it is said, from people who have acquired a fondness for chewing them. In the United States Dispensatory (15th edition), by Wood, Remington and Sadtler, page 1718, ginseng is seriously discussed, but the subject is finally dismissed with the statement that "it is little more than a demulcent."

The root (presumably of the Chinese species) was long ago examined by British chemists, who reported that it contained little or nothing of medicinal value. An American chemist, Mr. S. S. Garrigues, of Philadelphia, some years ago discovered in the roots of our plant a peculiar substance for which the name *panaquilon* was proposed. A recent partial analysis of dried roots is published by Dr. A. M. Peter in the annual report of this Station for the year 1892, and is quoted below:

## ANALYSIS.

	Per Cent. in the Roots.	Per Cent. in the Ash.
Crude Ash .....	5.278	.....
Nitrogen .....	1.660	.....
Lime .....	0.856	16.22
Phosphoric Acid .....	0.535	10.14
Potash .....	0.776	14.70

We have too much respect for the intelligence and commercial astuteness of the Chinese and Japanese, for the latter also use the root to some extent, to be willing to credit all the stories told of their faith in things of no value. Matched with the Caucasian in our schools they have repeatedly shown themselves our equals in capacity for any sort of brain work, while in natural art talent they are far and away our superiors. Anyway it is just as well to suspend judgment on the medicinal properties of ginseng until we know more about it—remembering, at the same time, that the spectacle of a whole people, from the Emperor down to the poorest and most ignorant laborer, tenaciously adhering to a delusion for centuries is not without its parallel in the history of other races.

"And though perchance the cricketer  
Or Chinaman that flies  
His dragon kite with boys and girls,  
May seem to some unwise,  
I see no folly in his play  
But sense that underlies."

The Chinaman has his philosophy of right living, and who shall say that it is not a better one than our own? And we should not flatter ourselves, though a trading people, that



we are more than his match at a bargain. At our trickiest of tricky games he has sometimes shown remarkable aptitude.

“Which I wish to remark,  
And my language is plain,  
That for ways that are dark,  
And tricks that are vain,  
The heathen Chinese is peculiar;  
Which that same I would rise to explain.”

#### **The Name Ginseng.**

The proper Chinese form for the word is said to be jenshen, which means literally man-wort. The Chinese originally obtained all their supply from their native plant, known to botanists as *Panax ginseng*, but the home supply getting low, they were forced first to regulate the collection of the roots by law, large tracts of wild land being made government preserves, and the government itself taking a large portion of all roots collected therein, and finally to import the roots of the closely related American species, *Panax quinquefolium*.

#### **The Botany of Our Species.**

The American ginseng belongs to the family Araliaceæ, including for the eastern part of North America but six species belonging to the two genera Aralia and Panax. The family is closely related to the carrot family. It contains, among other interesting plants widely distributed over the globe, English ivy as one of its species. Four, and possibly more, of the six species found in Eastern States of the Union occur in this State, as follows:

1. Hercules club, Toothache tree (*Aralia spinosa*). A small tree or shrub generally six to ten feet high, but often reaching a height of 25 or 30 feet, and bearing in the fall large broad clusters of small black berries; stem armed with stout prickles. It is cultivated both in this country and Europe for ornament. Occurs throughout the State, but is especially common in the mountains, and in the southern counties elsewhere. Its bark, root and berries possess medicinal properties, being employed as remedies for rheumatism, skin diseases, toothache and other ailments.

2. Spikenard, Indian root, False sarsaparilla (*Aralia racemosa*). This is an herb, commonly about 1½ to 2 feet high, though sometimes considerably taller. The leaflets are more or less heart-shaped, toothed, and pointed at the apex. The flowers are small and inconspicuous, but form rather large elongated clusters, which finally produce small purple berries. The root is relatively large and stout.

It occurs everywhere in Kentucky in rich woods. Its medicinal properties are similar to those of genuine American sarsaparilla, for which plant this species is sometimes mistaken.

3. Ginseng, Genseng, Sang, Jenshen, Ninjin (Japanese), Garentoquen (Iroquois Indians), *Panax quinquefolium*. Our ginseng is a perennial herb, propagated from the roots, which send up each year a new stem bearing at the top, leaves, flowers, and finally berries. Plants vary from six to twenty-four inches in height, sometimes reaching a height of two and a half feet to the tops of the fruit cluster. The leaves vary in number with age. The first year a single one with three leaflets is produced. The second year three leaves develop, each with from three to five leaflets. Subsequently, in cultivated plants at least, the number of both leaves and leaflets increases with age, some having as many as seven leaves and eleven leaflets. The flower stem does not appear the first year. It varies from about an inch in length, when it is much shorter than the petioles of the leaves, to seven or eight inches in length, when it extends much above the leaves. It bears, generally, an umbel of small flowers varying in number from about twelve in young plants to more than a hundred in old ones. The berries are one to four-seeded, often flattened, when ripe with a shining surface and of a bright red color, much like flowering dogwood berries. The roots are in general spindle-shaped, but vary extremely with individual plants, and with age of same plant. The young are more generally without forks, and look much like small carrots or parsnips.

4. Dwarf Ginseng, Ground nut (*Panax trifolium*). Dwarf ginseng may be known from its relative, the true ginseng, by its smaller size, being but about eight inches high,



by its stalkless leaflets, and by its globular root. It is credited to this State by Doctors Short and Peter in a supplement to their list of Kentucky plants published in 1833.

**American Ginseng.**

(*Panax quinquefolium*).

ROOT.—The root of our ginseng is firm to the touch, somewhat juicy, yellowish without, though varying in depth of color with age and soil, the cut surface pure white. In cross section it is circular in outline, and shows concentric rings like a tree, of slightly different colors, denoting its age. The surface at first is smooth, but the second season wrinkles appear, those running around the upper part being especially conspicuous. This wrinkling of the surface is sometimes imitated by wrapping the roots with hair, thus giving an appearance of age; but the deception is readily recognized by any one familiar with ginseng. Under the microscope the cells are seen to be loaded with starch, which indeed is, aside from the cell walls, the most conspicuous constituent of the root visible. In certain cells forming the skin or bark are a good many star-shaped crystals, probably oxalate of lime, such as are often seen in other plants.

The starch when undisturbed is in curious little clusters, or compound grains (D, Fig. 7), like that obtained from sarsaparilla. When it is removed for examination most of these grains are broken apart and the separated granules present angles and surfaces somewhat like those seen in corn starch. At the proper focal distance granules show a small central point, like corn starch, but radiating lines are wanting. Iodine solutions stain large and small granules blue very promptly. They show nothing characteristic with polarized light. The individual granules measure from .002 to .008 millimeter in diameter. A compound grain measures .016 millimeter in diameter, and consists of three or four granules.

The fresh root contains a large proportion of water, and hence loses much of its weight in drying. It tastes of starch and has besides a slightly aromatic carrot taste, with a suggestion of liquorice. These different effects on the tongue

are probably due to as many different constituents of the root.

At the close of the first season the roots are small, too small for the market. Six roots from seed planted by Mr. J. W. Sears, of Somerset, Ky., in the spring of 1898 and taken up in October, weigh, green, just 6.8 grams, an average of 1.1333 gram (.0399 ounce, Av.). These roots vary from  $\frac{7}{8}$  inch to  $4\frac{1}{4}$  inches in length, and the thickest measures  $\frac{3}{8}$  inch in diameter at the top. They are very light in color, without wrinkles, very watery, probably containing  $\frac{3}{4}$  or more of their weight in water. Most of those I have seen are simple tapering roots with the greatest thickness at or near the top, thus resembling a small parsnip. Some, however, are short, while occasional roots possess two widely diverging branches as appears in Fig. 8, A. Each root has at its upper end a small rounded bud, growing out at the side of the attached end of the annual stem. From this bud come the leaves and fruit of the next season.

Two-year-old roots show a decided increase in size and weight. Seven roots before me weigh together, green, 54.2 grams, an average of 7.7428 grams (.2731 ounce, Av.). The heaviest of these weighs a trifle over .5000 ounce, the lightest weighs .1028 ounce, or only one-fifth as much. At this time they have not increased so much in length as in diameter. The longest is five inches, while the shortest is two and a half inches long. A larger proportion are branched than in one-year-olds, the branches developing at the lower end in some cases, and again in others at the upper end, the new branch being produced by a thickening of what was originally only a slender fibrous root. The diameter has now in some cases increased to three-fourths inch.

Three-year-old roots show little increase in length, but a decided increase in weight. Five examples before me weigh together 93.7 grams, an average of 18.74 grams per root, or a fraction more than .65 ounce. The thickest is  $\frac{7}{8}$  inch in diameter. The heaviest weighs 33.9 grams (about 1 and 5-16 ounce). The longest root measures eight inches, and the shortest three and three-fourths. Every one is branched.



Four-year-old roots show a still further gain in weight. Three examples in my possession weigh 114.3 grams, averaging thus 38.1 grams, or about 1.333 ounce. The heaviest weighs 47.7 grams, or about 1¾ ounce. The longest root is 6½ inches, while the shortest is 5½ inches long. The thickest is one inch in diameter, while the most slender measures at its thickest place but 13-16 inch. All are branched.

Five-year-old roots in Mr. Sears' possession weigh, he tells me, in some cases three ounces, and average two and a half ounces. I have not myself weighed roots of this age.

Roots from wild plants are in some respects different from those that have been cultivated. The tendency to branch is somewhat greater, and the disposition of the branches to diverge widely is more pronounced. This I think is in many cases due to the character of the soil, often, probably, the result of its being less easily penetrated by the young roots, and to obstructions in the shape of stones and roots of trees. A glance at Fig. 12, which represents several wild roots, will show more definitely what the difference amounts to. Many wild plants have at the upper end of the thickened root a short underground stem, sometimes two inches long, which in turn gives origin to the annual stem that each year appears above ground. In some wild roots that I have seen, this neck is short, but it is generally quite noticeable. Cultivated roots from one to five years old show only a short thick neck representing this stem, but it increases with age, and its great length in wild plants indicates that they are old. We have thus in this structure a means of approximating the age of plants, and the fact at once impresses us that wild plants grow much more slowly than those which are cultivated and furnished with a rich and easily penetrated soil. A wild root in my possession, which from the length of this stem and the number of scars left by the annual above-ground stem, must be twelve years old, weighs only 7.2 grams (about ¼ ounce); its underground stem measures 1¼ inch long. Another example seven years old weighs 5.3 grams. The former is five inches long with its greatest diameter 9-16 inch. No doubt many wild roots, favorably situated, grow more rapidly

than these appear to have done, but from an inspection of quantities of wild roots I am satisfied that in general they grow much less rapidly than cultivated ones. Some of the very large roots reported by collectors must therefore have represented plants that had persisted in the forest for a long period of time, possibly in some cases for as much as fifty years. Mr. Sears has now in his possession wild roots that weigh from three to nine ounces, green. Some time ago he planted on his place a wild root weighing about ten ounces, cultivated it for several years and finally sold it when it had reached a weight of one pound. One of his uncles, he tells me, dug up at one time, on the place now used by Mr. Sears as a ginseng plantation, a root that weighed one and a fourth pounds. Others obtained in the neighborhood a root weighing one and a half pounds. There is evidence indicating that roots were occasionally found in the early days of ginseng collecting that weighed even more, but the evidence as to the exact weight of some of the notable finds now reported is not as definite and safe as that given above.

STEM.—Either we must consider the stem of ginseng as consisting of an underground persistent part and an above-ground annual part, or else the real stem is the underground neck-like portion already described as conspicuous in wild plants, in which case the stem appearing above ground each year is the petiole of a compound leaf. This latter stem dies away each fall, leaving on the underground stem a scar like that left by the leaf petiole of other plants, and the resemblance to a leaf petiole is enhanced by the fact that the bud is developed in its axil. One thing is certain, namely, that during the first year of its existence this stem must be considered the petiole, corresponding exactly to the petiole of a strawberry leaf, or else we are left in the predicament of assuming that the leaflets have no petiole; for they are attached to the top of this stem, and are sessile at that. See A, figure 3, representing a young plant of the first year.

At the end of the first season this stem is very slender and has attained a height of about four inches. Subsequent seasons show it more stout and tall. A three-year-old plant



in my possession measures twenty inches from the top of the root to the tops of the flowers. Older plants are stouter and taller. Mr. Sears has measured one on his place, that was four or five years old, and found it two and a half feet high.

LEAF.—The leaves vary greatly both in the cultivated and wild plants. During the first season but three small leaflets, from  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inches long, develop. They are attached directly to the top of the stem which grows up from the ground, the individual leaflet having no stalk of its own. They are oval in general shape, widest near the base, the margin simply toothed and the apex acute. The three leaflets are about equal in size. The second year the number of leaflets is increased to five, the two outer ones being generally much smaller than the others and nearly or quite sessile, whereas the three middle leaflets are stalked. The greatest diameter of the middle leaflets has been shifted outward towards the tips, producing what is described in botanies as an obovate leaflet. The teeth on the margin, too, become broken up by additional notches. The tip remains quite acute, the leaf contracting rather abruptly from its widest part. After the second year the number of leaflets increases to some extent. Seven leaflets is a common number; nine are sometimes developed, and occasionally eleven. At my request Mr. Sears has examined his cultivated plants and reports that he finds three to five leaflets on plants during the second year, three to five on those three years old, and from four to seven on plants four to five years old. On a large wild plant transplanted to his place and grown there three years, he finds from five to eleven leaflets. In old plants quite often a leaflet is cut into three portions producing a group resembling the three leaflets of the first year. It has not been possible yet to examine a large number of wild plants with reference to the variation in number of leaflets, but from what has been seen of them it is concluded that they vary in the same direction, but are less variable than cultivated plants.

In color the leaflets are a dull green above, the veins at first not differing in tint. In the fall they are disposed to assume bright colors, when the veins often become pronounced

because of their different color. Below, the color of the leaflets is the same as above, but an obscure luster becomes apparent on turning them about in the light. Single leaflets reach a length in some cases of seven inches.

The number of leaves (using the word as it is applied to ginseng in botanies) varies from two to seven. On young plants three is the common number; on old ones four is a more common one. The petioles may be five inches long.

FLOWER.—The flower stem arises from the midst of the leaves, growing straight up, like a continuation of the stem. Plants do not bear flowers the first year, and only a part of the two-year-olds bear them. The flower stem is short at first, not attaining the length of the leaf stalks. An example measures just one inch. As it grows older the flower stem (peduncle) increases in length. On a plant three years old measured by me it was 9.375 inches long, and no doubt on older plants is considerably longer. At its upper extremity it expands a little and forms a convex-topped platform from which the slender pedicels, or stalks, of the small flowers arise. These little stalks are from one-half to one inch long. Each bears a very small greenish flower at its extremity, the whole forming a compact cluster (umbel). The umbel is convex above, and bears at the base a few slender bracts, these in some cases resembling very small leaves with petiole and blade. The number of flowers composing an umbel is said in one of our best works on botany to be from six to twelve. Like everything else about this plant there is great variation in the number of flowers with the individual, and with age. It can only be said of young plants that they bear few flowers and of old ones that they bear many. An old plant just examined by me, taken in October, has during the season produced 129 flowers. A typical umbel measures from  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inches across, all of the little flower-bearing pedicels arising on the top of the larger stem and diverging from each other, so that when flower and fruit is all gone they appear in the fall of the year somewhat like a dandelion top with ripened seeds, as may be seen at D, Fig. 6.

Other clusters of flowers, and this is most frequently true



of old plants, wild or cultivated, are developed in several rings or whorls, with a terminal umbel, in addition, like that described.

Three wild plants, the tops of which were received in October from Somerset, Ky., show this peculiarity in a very striking manner. They bear respectively 18, 42 and 75 flower pedicels, some of which still retain berries in various stages of development. In one of these plants the lowest whorl of flowers is  $1\frac{1}{4}$  inch from the next, and this is  $1\frac{1}{8}$  inch from the terminal cluster. In the second plant the three clusters are equally distant from each other, about one inch. A noticeable peculiarity of these plants is the tendency to form secondary umbels in the lower flower whorl. In one of the plants there are three simple pedicels, each with a berry at its extremity; one pedicel bears a single branch and has a scar showing that others have been broken off; another stalk arising in the same whorl as these, bears at its extremity twenty-three small pedicels with berries. In the second plant the lower whorl consists of four stalks, bearing, respectively, secondary flower pedicels to the number of 5, 5, 13 and 24 (see Fig. 7, A and C). I have not observed this peculiarity in cultivated plants.

The flowers appear early in the summer, maturing first on the outer pedicels, and continuing to mature towards the center of the cluster until fall. Cultivated plants sometimes bear flowers and flower buds in October. An entire flower measures about four millimeters (about  $1\text{-}6$  inch) in length, and across the expanded petals is about  $3\frac{1}{2}$  millimeters. Normally it has five divisions—five sepals, five petals, and five stamens—while the stigmas number but two, but in many flowers six sepals and six petals may be counted, and three and even four styles and stigmas are often present. The petals are green, with narrow whitish margins; they soon fall off, while the sepals and stigmas remain attached to the maturing berry, the calyx, as in the case of the apple, forming a part of the berry itself.

FRUIT.—Some of the berries are ripe by July 20th, while others are immature when frost kills the upper part of the

plants. They are generally somewhat flattened, are smooth and shining, and when ripe are of a very bright red color. Examples measure from 5 millimeters (1-5 inch) to 14 millimeters ( $\frac{1}{2}$  inch, about) in greatest diameter by from .5 to 9 millimeters in lesser diameter. Examples are frequently quite spherical, others are three-lobed and somewhat triangular in outline seen from above, while one berry from a wild plant is four-sided. Two flattened seeds are generally embedded in the soft mealy pulp of the ripe berry, but the small round berries often have but one, while the three-lobed ones have three, and the four-sided have four. When the pulp is completely removed from them they are seen to have a hard thick coat, slightly roughened (rugose), of an opaque whitish or yellowish color, and to be more or less flattened. When two or more seeds develop in the same berry the inner edges that nearly meet are straight, while the outer ones are rounded; a shallow groove runs about each seed. They look very much like small bits of gravel; would easily be taken for such objects if noticed in the soil. The smallest observed measures 5 millimeters long, 4 millimeters wide, and 2.50 millimeters thick. Larger ones measure 7 millimeters long, 5 millimeters wide, and 2.75 millimeters thick. In small spherical berries the single seed produced may be relatively and absolutely much thicker (as much as 3.50 millimeters).

#### The Cultivation of Ginseng.

By the circular letters already referred to, I have endeavored to learn to what extent ginseng has been successfully grown in Kentucky. Several of the replies indicate that attempts have been made in different parts of the State, but thus far the only instance of success, of which I have absolute knowledge, is that furnished by Mr. J. W. Sears of Somerset. I visited his place this fall and can say from my own knowledge that he is at present growing ginseng both from the seed and from transplanted wild roots. There can be no question but that the plant can be as easily grown as other cultivated plants, provided it is furnished with the *right kind of soil and with shade*. I would not advise anyone to



undertake ginseng culture unless he has on his land the means of supplying these necessary conditions, or else is willing to incur the expense and trouble of furnishing them artificially. The latter procedure is not difficult, especially in a region where forest prevails, and need not deter anyone possessed of average intelligence and persistence from undertaking the growing of ginseng.

PLANTING THE SEEDS.—The seeds are gathered from berries on either wild or cultivated plants during the summer and preserved in a slightly damp loose humus, consisting of a mixture of soil and decayed leaves and other vegetation. They must not be allowed to dry out thoroughly at any time. When I visited him Mr. Sears had his seed mixed with such humus in shallow wooden trays, set on the ground under a small wooden shelter that kept them from the sun and rain. The pulp of the berry may be removed or not as preferred. They should be planted, if possible, like the seeds of walnut and other forest trees, in the fall before heavy frosts occur. They can, however, be planted in the spring, though this may involve a longer wait for their germination. Mr. Sears declares that some of the seeds which ripen early in the season, and some of them are ripe as early as July 20, will, if planted the succeeding fall, germinate the next spring, but that seeds from the same plants ripening late in the summer or fall will when planted germinate at the end of about eighteen months, a year from the following spring. This peculiarity of the seeds has doubtless more than once discouraged men who have, without knowing much of the habits of the plant, attempted to get a start.

The seeds are planted from one-half to one inch deep in a rich loam, or humus, containing a large proportion of decaying vegetable matter. Dead leaves should be raked up in the fall, mixed with soil and made into heaps where they will decay during the winter and be ready for use the following season. The debris or crumbled remains of logs and stumps is excellent for the purpose. In the absence of these, well rotted stable manure may be used. If the plantation is made in an undisturbed forest, but little need be done to prepare the

soil beyond clearing away underbrush and making room for the beds, then digging up the ground with a spading fork. Care must be exercised in this case not to remove so many trees as to expose the ground to the sun. Mr. Sears tells me he made this mistake on a part of his place. In preparing the beds the roots of trees should be cut away where they lie near the surface, and encroach on the beds.

Most growers sow the seed six to eight inches apart in drills, the latter not less than a foot apart to give room for the plants when of large size. The beds may be made of any length, but should not be more than four or five feet wide, and should have a walk between them of 18 inches or two feet in width for convenience in removing the weeds. These paths are an important consideration, since the growth of the plants at the age of four or five years is so rank that it is not best to go among them in the beds. After planting, the beds are covered with a thin layer of dead leaves and left to themselves until the plants come up. When the young plants appear all weeds should be removed to give them as much room as possible. Later, they cover the ground so completely that but little attention is required. In Mr. Sears' place at Somerset I saw recently plants four and five years old, averaging perhaps 15 to 20 inches in height, that looked as thrifty and occurred as regularly in the rows as do strawberry or any other plants commonly grown by us.

**PLANTING THE WILD ROOTS.**—In some cases it is most convenient to collect the wild roots and transplant them in beds. Mr. Sears has practiced this to some extent, and it has been for some years done successfully by others in various parts of the United States. Mr. Stanton, of New York, recommends this as the easiest way to get a start. The soil should be prepared as for the seeds by digging it up a few inches deep and mixing it with a compost made of dead leaves or wood, when the roots may be planted in rows like the seed, care being taken to have the little bud at the top completely covered and thus protected from injury during the succeeding winter. In either case, fall is the proper time to start beds.



PROFITS FROM GINSENG.—The prices paid by country merchants to the collector vary much with the locality and often range widely in the same locality. Of course the price must range with the quality of the ginseng. From the replies received from correspondents giving prices paid for ginseng in Kentucky, it seems that the collector may expect to receive from \$2.00 to \$3.00 per pound for dried roots of good quality—roots that are thoroughly dry and not too small. The stems should always be removed, the root then be washed free from all soil and kept in a dry place in shallow wooden trays until completely dry. The buyers object to the thread on which ginseng roots are sometimes strung, because it requires time to remove it. Green roots are bought by some dealers, the price paid ranging from 0.25 to 0.75 per pound, but the collector will get a fairer return as a rule by looking up the market price of dried ginseng and selling only the dried roots.

It is sometimes remarked that most of the profit from ginseng goes to the middlemen, but the collector generally knows pretty well what his ginseng is worth, and from all I can learn is able to take care of himself. *They say* he sometimes runs a little melted lead into his roots, conceals nails in them, and occasionally adds the roots of other plants, to turn an extra penny and balance the account.

The following are prices paid for the dried roots (except when otherwise stated) to the collectors, as given me by correspondents. Where several reports were received from the same county they are indicated by numbers in parenthesis:

County.	Price per Lb.	County.	Price per Lb.
Adair .....	(1) \$2.00 to \$2.50	Bullitt .....	(1) 2.25 to 2.50
" .....	(2) 2.25 to 2.50	" .....	(2) 2.50 to 2.75
Allen .....	2.50	Butler .....	(1) 2.00
Anderson .....	(1) 2.00	" .....	(2) 2.50 to 3.00
" .....	(2) 2.00 to 2.25	Caldwell .....	1.50 to 2.00
Barren .....	2.00 to 3.00	Campbell .....	1.00 to 2.00
Bell .....	(1) 2.50	Carlisle ..	(1) 0.90 to 2.00
" .....	(2) 2.75	" ..	(2) 3.00 to 3.50
Boone ..	2.50 to 3.00	Carroll.....	2.00
Boyd .....	(1) 1.50 to 1.75	Carter .....	(1) 2.75 to 3.25
" .....	(2) 2.50	" .....	(2) 2.00 to 3.00
Boyle .....	1.75 to 2.60	" .....	(3) 2.50 to 3.00
Bracken .....	1.50 to 2.00	Casey .....	(1) 2.00
Breathitt .....	2.25 to 2.75	" .....	(2) 2.25
Breckinridge .....	2.25	Christian .....	2.00 to 2.25

<i>County.</i>	<i>Price per Lb.</i>	<i>County.</i>	<i>Price per Lb.</i>
Clinton .....	(1) 2.00	Martin.....	(1) 2.75 to 3.00
" ".....	(2) 2.60 to 3.00	" ".....	(2) 2.75 to 4.00
" ".....	(3) 1.50 to 2.00	Mason.....	3.00
Cumberland.....	2.25	McCracken.....	1.00 to 2.50
Daviess.....	2.50 to 3.50	McLean.....	1.50
Elliott.....	1.25 to 2.50	Meade.....	(1) 2.50
Estill.....	2.50	".....	(2) 2.00 to 2.25
Fayette.....	(1) 3.50	Menifee.....	1.75 to 2.25
" ".....	(2) 1.60	Metcalfe.....	1.25
Fleming.....	(1) 0.50 to 1.00	Monroe.....	(1) 2.00 to 2.25
" ".....	(2) 2.60	".....	(2) 2.25 to 2.50
Fulton.....	0.25, green.	Morgan.....	(1) 2.40
Grayson.....	2.00 to 2.50	".....	(2) 2.50
Green.....	2.50 to 3.00	".....	(3) 2.00 to 3.00
Greenup.....	(1) 2.50	Muhlenberg.....	2.00
" ".....	(2) 3.50	Nelson.....	1.50 to 1.75
Hancock.....	(1) 1.50	Ohio.....	(1) 2.50 to 3.00
" ".....	(2) 0.50, green,	".....	(2) 2.25 to 2.50
" ".....	2.00, dried.	Oldham.....	1.50 to 2.10
Hardin.....	1.50 to 3.00	Owen.....	1.00 to 3.00
Harrison.....	0.80 to 3.50	Owsley.....	(1) 2.50
Hart.....	(1) 2.25 to 2.50	".....	(2) 2.25
".....	(2) 2.50	".....	(3) 2.50
Henderson.....	2.50	Pendleton.....	2.75 to 3.00
Hopkins.....	0.50, green.	Perry.....	2.00 to 3.00
Jackson.....	2.50 to 3.00	Pike.....	(1) 3.00
Jessamine.....	1.50 to 2.00	".....	(2) 2.75 to 3.00
Johnson.....	2.50	Powell.....	(1) 1.50
Knott.....	2.50 to 2.65	".....	(2) 2.50 to 3.00
Knox.....	(1) 2.50 to 2.75	Pulaski.....	(1) 2.50 to 3.00
".....	(2) 2.25	".....	(2) 2.25 to 2.50
Laurel.....	2.50	Robertson.....	1.00
Lawrence.....	2.50	Rockcastle.....	(1) 2.50
Leslie.....	(1) 2.25	" ".....	(2) 2.00 to 2.50
".....	(2) 2.50	" ".....	(3) 1.50 to 2.50
Letcher.....	(1) 2.50 to 3.00	Rowan.....	(1) 2.00 to 2.50
".....	(2) 2.50	".....	(2) 2.75
".....	(3) 2.50	Spencer.....	1.00 to 2.00
Lewis.....	2.50 to 3.00	Todd.....	(1) 2.00 to 3.00
Lincoln.....	(1) 2.00 to 3.00	".....	(2) 0.75 to 1.00,
".....	(2) 2.25	green, and	2.50, dried.
".....	(3) 2.00 to 3.00	Trigg.....	3.00
Livingston.....	2.00	Trimble.....	2.00 to 3.00
Lyon.....	(1) 1.50 to 3.00	Warren.....	1.50
".....	(2) 2.00	Washington.....	(1) 0.50, green,
Magoffin.....	2.50	" ".....	2.00, dried.
Marion.....	(1) 2.50	" ".....	(2) 1.50 to 2.00
".....	(2) 2.75	Wayne.....	2.00 to 2.50
".....	(3) 2.00	Woodford.....	2.50 to 3.00
".....	(4) 2.00 to 3.00	Wolfe.....	(1) 2.50 to 3.25
Marshall.....	(1) 2.00	".....	(2) 2.25
".....	(2) 1.50 to 2.50		

The price paid for first rate cultivated roots is better than that realized by most collectors of the wild ginseng. The



roots of cultivated plants are larger and weigh more at four years than the average of wild roots. Mr. Sears has recently sold some for \$4.50 per pound dry, and disposed of ten pounds of green roots for \$2.00 per pound. Not the least valuable part of the crop is the seeds, which sell readily for about \$1.00 per ounce. Mr. Sears writes me that he has lately sold 7½ pounds of seed for \$128.00.

As an illustration of what can be done with ginseng the following experience, reported in *Garden and Forest*, Volume VI, 1893, page 490, may be given:

Mr. George Stanton of Summit Station, New York, obtained in 1893 from three small beds, sixteen feet long and three feet wide, containing in one case plants from roots collected in the woods five years ago, and in the other two beds, four years ago, 833 roots weighing over twenty pounds which he reserved for planting, and had besides fifty-two pounds and fourteen ounces of roots for sale. The latter when dry it was estimated would weigh about seventeen pounds and would be worth from \$3.00 to \$3.50 per pound. In addition to this Mr. Stanton saved from his plants seed to the value of forty dollars.

In writing of his experience somewhat later Mr. Stanton says that his beds have been made in an open garden and that in 1892 they made such a fine appearance that they excited the admiration of every one who saw them. His seed gathered from beds, altogether three hundred feet long and three feet wide, was worth over \$100. It seems his plan at that time was to plant the seed one inch apart and when the roots were two or three years old to transplant them, placing them from four to six inches apart each way. It is not necessary, however, to take this trouble in growing ginseng if one has enough room. No doubt the operation of transplanting roots checks them to some slight extent, and on this account, as well as to avoid expense in handling, it is advisable to plant the seeds at distances sufficient to give the roots room to develop to their full extent without moving them.

In an article published in the *Rural New Yorker*, June 8, 1898, Mr. Stanton gives a more complete and recent state-

ment of the results obtained by him, from which the following is quoted :

"A detailed statement of the product of a few beds will give some idea as to possibilities. In 1895, from  $7\frac{1}{2}$  beds,  $3 \times 16$  feet each, were taken 2,545 roots, weight 148 and 5-16 pounds; from these were taken out for replanting 2,312 roots, weight  $59\frac{7}{8}$  pounds, leaving 88 and 7-16 pounds to be dried for the market, making  $30\frac{1}{4}$  pounds dry, which sold for \$161. Six of the beds also produced 2,408 seedling roots, weight 19 pounds. In 1896, from  $3 \times 28$  feet of ground, 587 roots, weight 46 pounds, were taken, and 491 roots, weight 13 pounds, taken out for replanting, leaving 33 pounds to be dried, making 11 pounds dry, which sold for \$60. There were also 704 seedling roots, weight 4 and 9-16 pounds. In 1897, from  $8\frac{1}{2}$  beds,  $3 \times 16$  feet each, 2,270 roots, weight  $126\frac{1}{8}$  pounds were taken; 1,582 taken out for replanting, weight 29 and 15-16 pounds, leaving 96 and 3-16 pounds to be dried, which made 32 pounds dry, value \$165. There were also 1,505 seedling roots, weight  $8\frac{1}{8}$  pounds. Had the entire product of marketable roots from the 18 beds, 320 pounds, been dried, it would have made about 106 pounds dry, which would have sold for \$575. This will do very well for  $4\frac{1}{2}$  square rods, with five years' cultivation. I do not need to add the value of seed produced during cultivation, or the value of the 4,617 seedling roots. I have said enough already to endanger my reputation for truth. The above figures are matters of record in my books, and open to the inspection of all who may wish to investigate. Can others attain as good results? I don't know, why they may not, but I do not expect all who attempt ginseng culture will make a success."

TIME TO SELL. --The rate at which ginseng grows is shown in another part of this bulletin and need not be dwelt upon here. Roots of cultivated plants can be sold when they are three years old; they are then larger than wild roots when these are much older, and indeed the wild roots I have seen stored in barrels by dealers were, in most cases, not larger than the three-year-old roots. Four years is a good age at which to take them up for market. They have by this time reached a good size and weight, and have assumed all the characteristics that give them value in the estimation of the Chinese. The roots should be taken up in September or later, when they have ceased growing and have their greatest weight for the season.

LOCATION OF THE SEARS PLANTATION.—Mr. Sears' plantation is situated seven miles east of Somerset, among foot hills forming part of the Cumberland mountain system.



It is a natural habitat of the plant, which grew originally without cultivation on the site now occupied by his plantation, and is at present not especially rare in the adjoining country. He began in a small way in 1891, and has about three acres of forest-covered land on a north slope enclosed with a slat fence, to keep out marauders. To make sure that his roots are not stolen he has a man living at the edge of the enclosed land. Perhaps one-third of this enclosed area is at present occupied by ginseng beds. The trees growing on this piece of ground are such as grow everywhere in its neighborhood—oak, flowering dogwood, sugar maple, beech, black walnut, basswood, etc. The ginseng beds are made in the shade of these trees, which cover them in the fall with a layer of leaves, and thus afford at all seasons the natural protection which the wild plants get in the woods.

ARTIFICIAL SHELTER.—Mr. Sears, as well as Mr. Stanton, has demonstrated that ginseng can be grown under an artificial cover. I saw on his place some beds of young plants in a somewhat open place protected from the sun by a structure consisting of upright posts set in the ground, with a light framework nailed to their tops, on which in turn were secured strips of wood an inch or two apart. Ordinary four-foot laths can be made to answer the same purpose. In this case the posts should be placed five or six feet apart along the sides of the beds; their tops should be cut to a level and on these may be nailed strips two or three inches wide, and the lath be nailed from side to side across the top. For convenience in getting to the plants it is well to make the posts four or five feet in height—Mr. Sears thinks the top should be made high enough to permit a man to walk erect under it. Such shelters protect the plants from the fierce heat of the sun, and at the same time allow a free circulation of air. One thing which struck me very forcibly in passing the wooden structure on Mr. Sears' place, was that some young plants, from seed planted last spring and forming part of one of the beds under shelter, were badly scorched and checked in growth by the sun's heat, whereas plants under the frame were still green and bore a thrifty appearance.

THE CULTIVATION OF GINSENG IN JAPAN AND CHINA.—The cultivation of ginseng in this country is in its infancy, but in Japan, Corea and China it has been practiced for a long period, for several centuries in Japan, and perhaps as long in China. A black soil rich in humus is preferred, and must not be too wet. Red soils, they believe, produce a reddish colored root, which is not as valuable as the white ones. The soil is carefully prepared, being enriched when this is necessary, and the beds are protected from the sun by a frame-work covered with straw. The seeds are planted so that they are two or three inches apart every way. The roots are not harvested until the fourth year, and in the fields may be seen at the same time, beds of one, two, three and four year old plants. They are dug up for sale in July and August, being first washed carefully and then dried by heat, sometimes artificially supplied, and ranging from 212 to 248 degrees F. In other cases they are dried in the sun. Dried roots are said to sell in Japan for from \$5.00 to \$7.00 per pound, while in China the same roots bring \$10.00 per pound. From descriptions it is evident that the plant under cultivation is so closely like our own that the experience and methods of the Japanese are a safe general guide for our people in propagating the American species.

THE ENEMIES OF GINSENG.—Moles are very troublesome in the beds at times and are declared by growers to feed upon the roots. Similar assertions have been made concerning their eating sweet potatoes and seed corn, but there is no reliable evidence on record convicting the mole of intentionally eating vegetable matter of any sort. Fragments of such matter are frequently found in its stomach, but their character and number indicate that they are taken only by accident during the capture of worms and insects, which constitute the great bulk of the food. The real injury done by moles consists in burrowing among the plants and disturbing their roots. The best way to get rid of them in most ordinary cases is to watch for them with a spading-fork in hand, and when one is observed moving the earth quickly throw it out and destroy it. Mr. Sears has invented a mole trap, consist-



ing of a piece of plank armed with long sharp spikes, which is set over the burrow on a figure-four support, the plank being loaded with a heavy rock. When the mole releases the figure-four the plank falls and the weight forces the spikes into the ground, thus securing the mole. Similar traps have been on the market for a good many years, and can be bought of most seedsmen in the East.

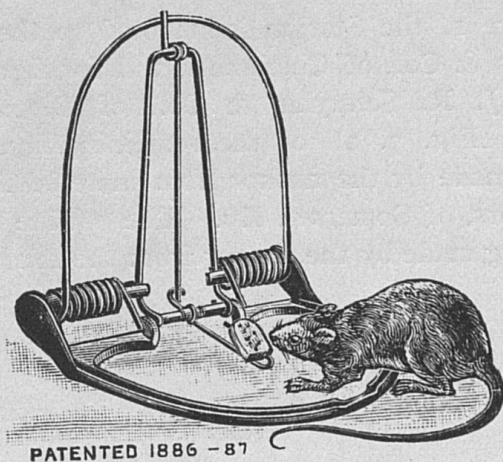


FIG. 2.—SCHUYLER'S MOUSE KILLER.

Mice are also occasionally troublesome, and in this case no doubt the roots are sometimes gnawed. The use of traps and poisoned bait is about the only remedy to be recommended. One of the most excellent mouse traps known to me is manufactured by J. R. Schuyler & Co., Bloomsburg, Pa. It is made of wire, is completely open, and is so simple and inconspicuous that when set in their runways mice often run into it when no bait is used. It is styled by the manufacturer, Schuyler's Mouse Killer (No. 3). Sample traps are sold by this company for 15 cents. To those getting a dozen or more a liberal discount is allowed.

A small green worm or larva (probably the young of some Tineid) has been observed by me feeding on the ginseng leaves. Mr. Sears reports that a white fly (probably an Aphid) sometimes infests the stems. In all probability still other insects will be found to attack the plants in one way or another.

A rot has been reported as destroying wild roots at times, but Mr. Sears says it does not attack his cultivated plants. Whether it will prove to be restricted to plants which grow in the woods remains to be seen. Cattle are said by correspondents to eat the young leaves freely.

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**THE FIGURES.**

For figure 1, the Station is indebted to the courtesy of Samuel Wells & Co., of Cincinnati, and for figure 2, to the kindness of J. R. Schuyler & Co., of Bloomsburg, Pa. Excepting D, Fig. 7, all of the remaining figures are from photographs made by the author from material furnished by Mr. J. W. Sears, of Somerset, Ky. The outline D, Fig. 7, is from a drawing made by the author from the microscope.



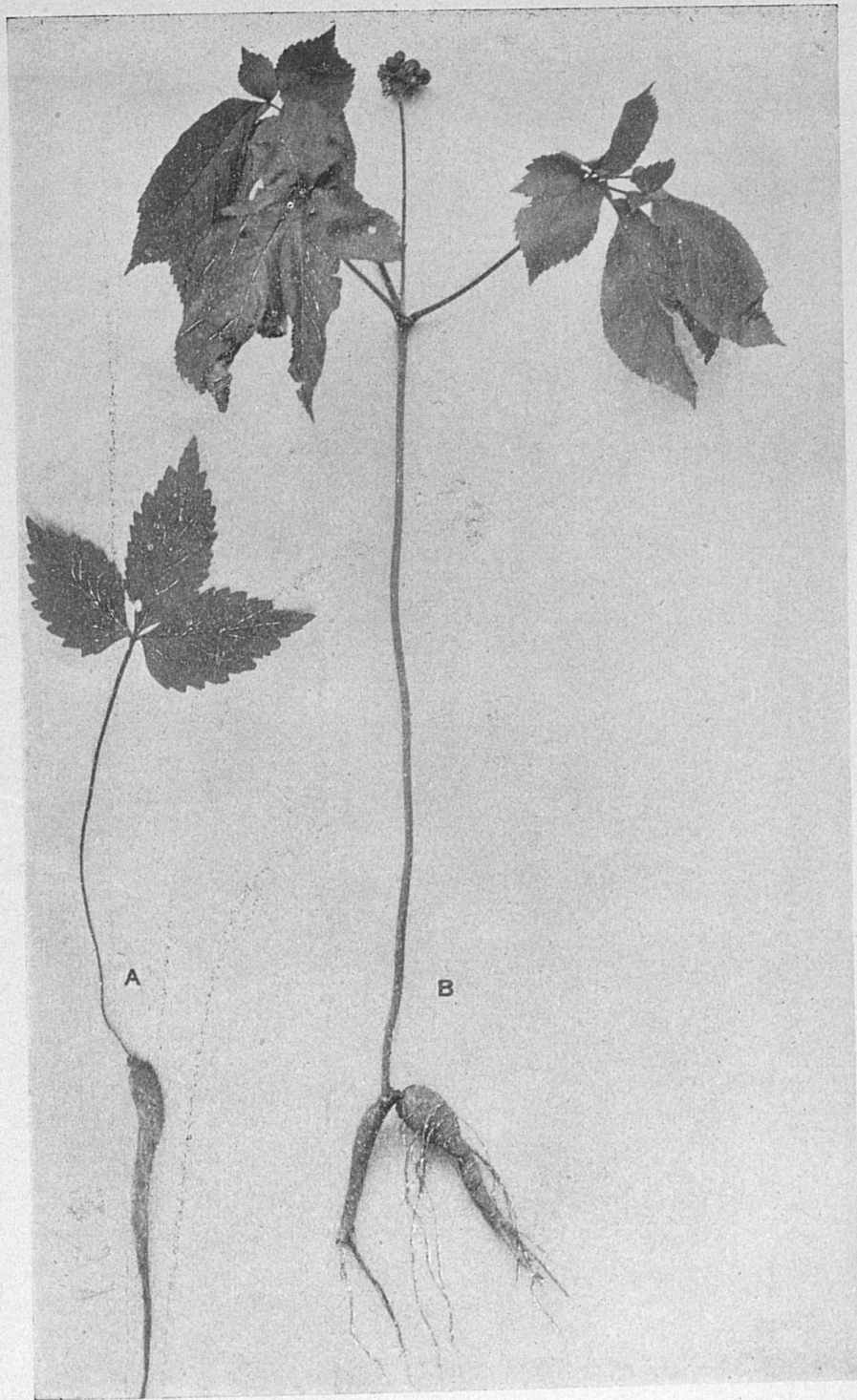


FIG. 3.—*A*, A young plant, as it appears the first year. *B*, A three-year-old plant, with three leaves and a flower stem rising from their midst. Both figures reduced.

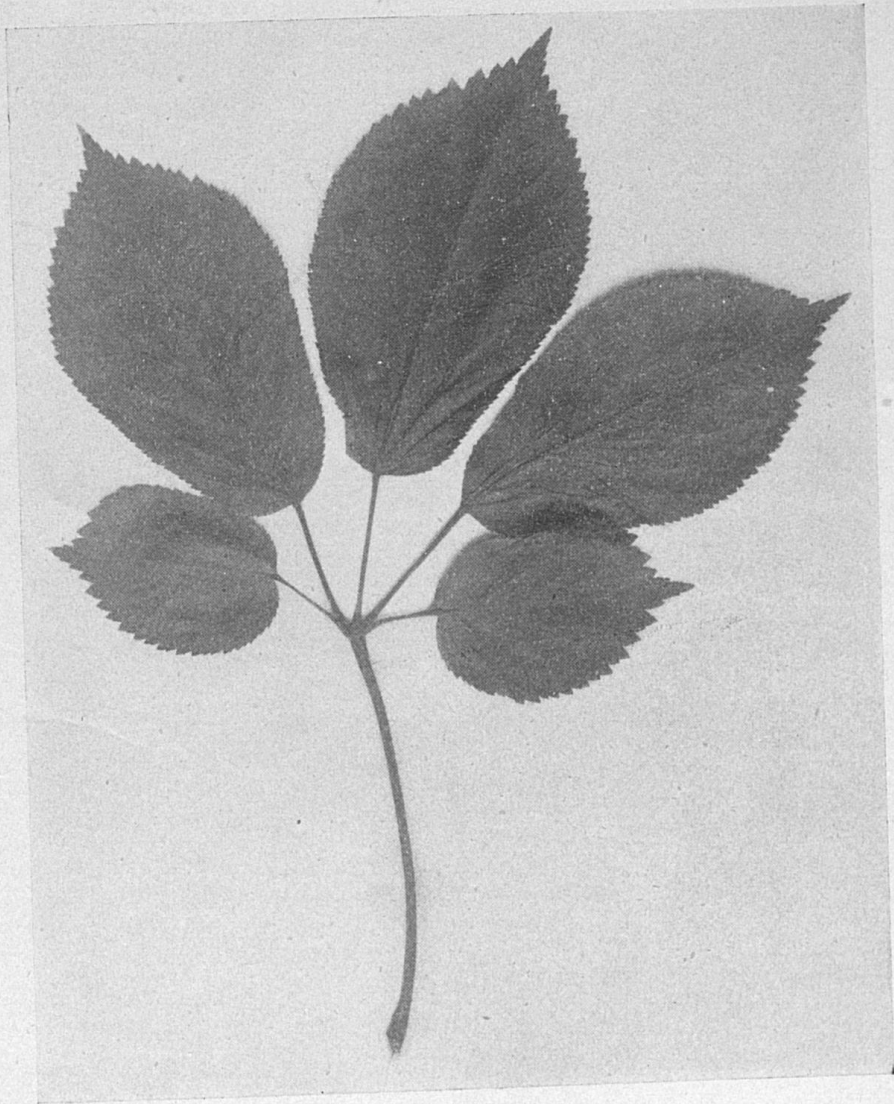


FIG. 4.—A typical ginseng leaf, with five stalked leaflets. Reduced in size from the original.



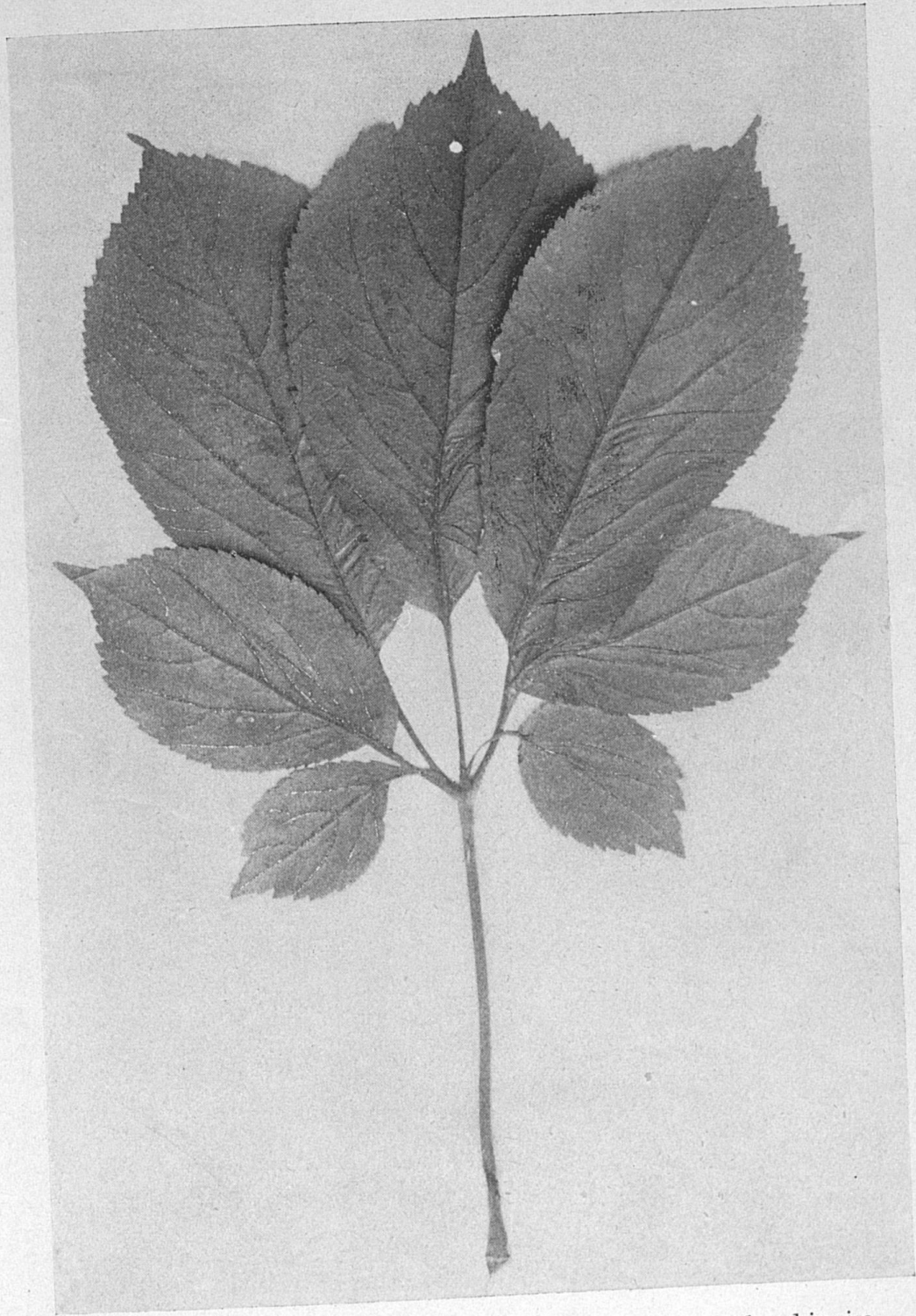


FIG. 5.—A leaf from an older plant, with seven leaflets. Reduced in size.

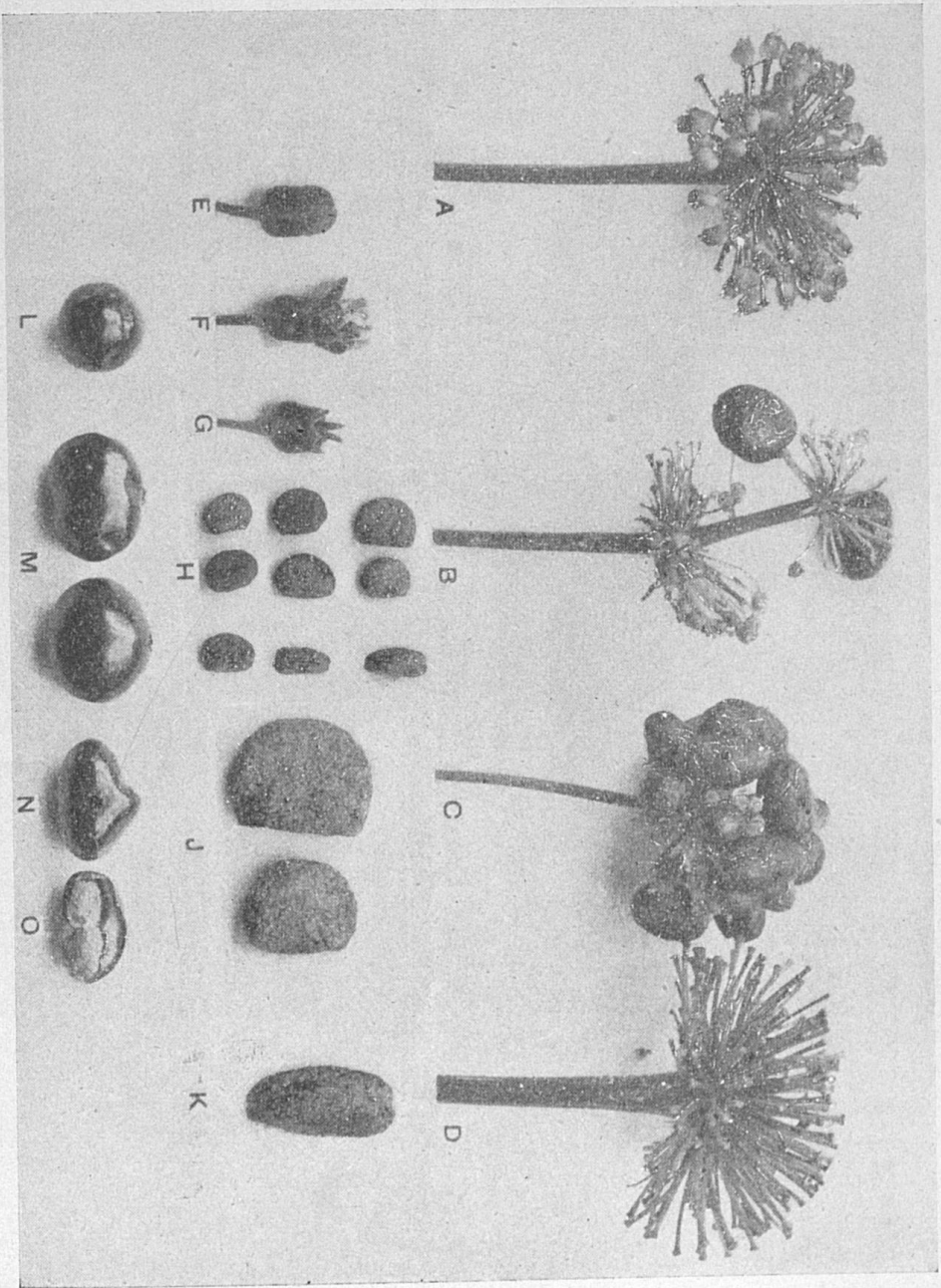


FIG. 6.—A-D, Fruit clusters in different conditions, natural size. E-G, Three conditions of the flower, enlarged. H, Seeds, natural size. J-K, Seeds enlarged. L-N, Fresh berries, natural size. O, A berry cut open to show seeds, natural size.



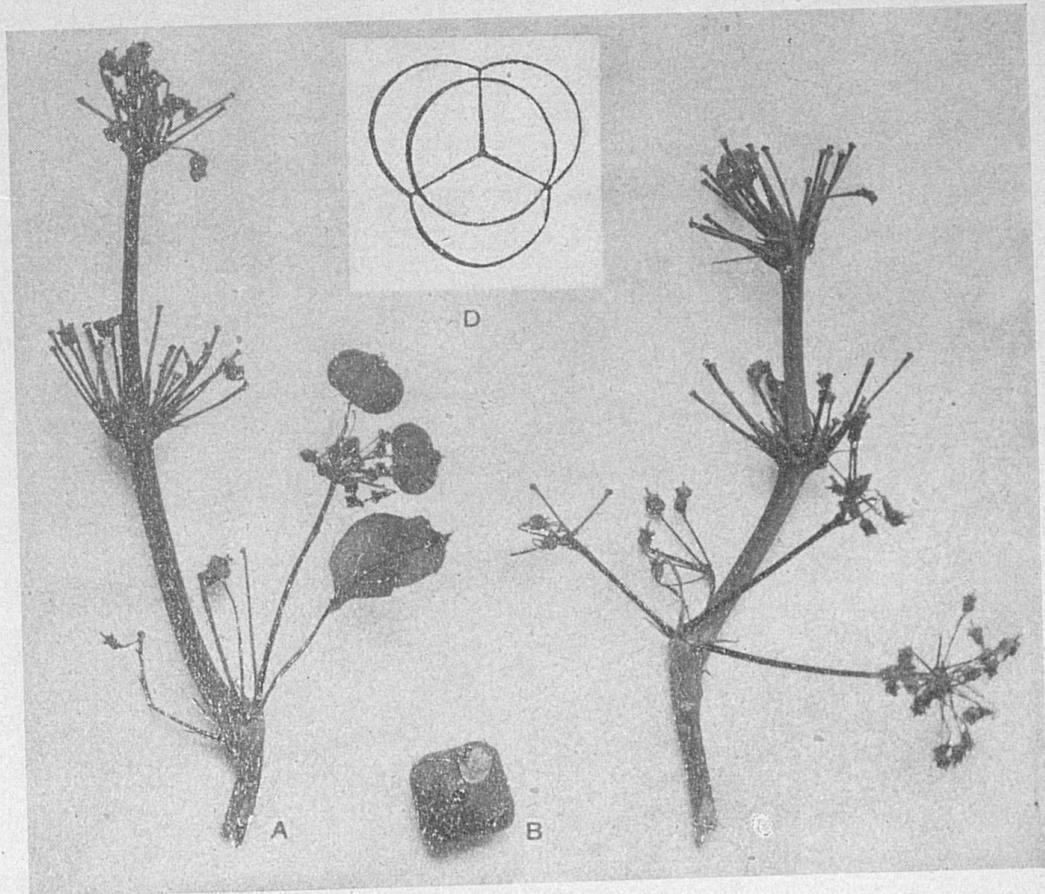


FIG. 7.—*A* and *C*, Tops of wild plants each with three flower clusters, the lower with secondary clusters. *B*, A four-seeded berry, seen from above. *D*, An outline showing character of starch; greatly magnified. Natural size (except *D*).

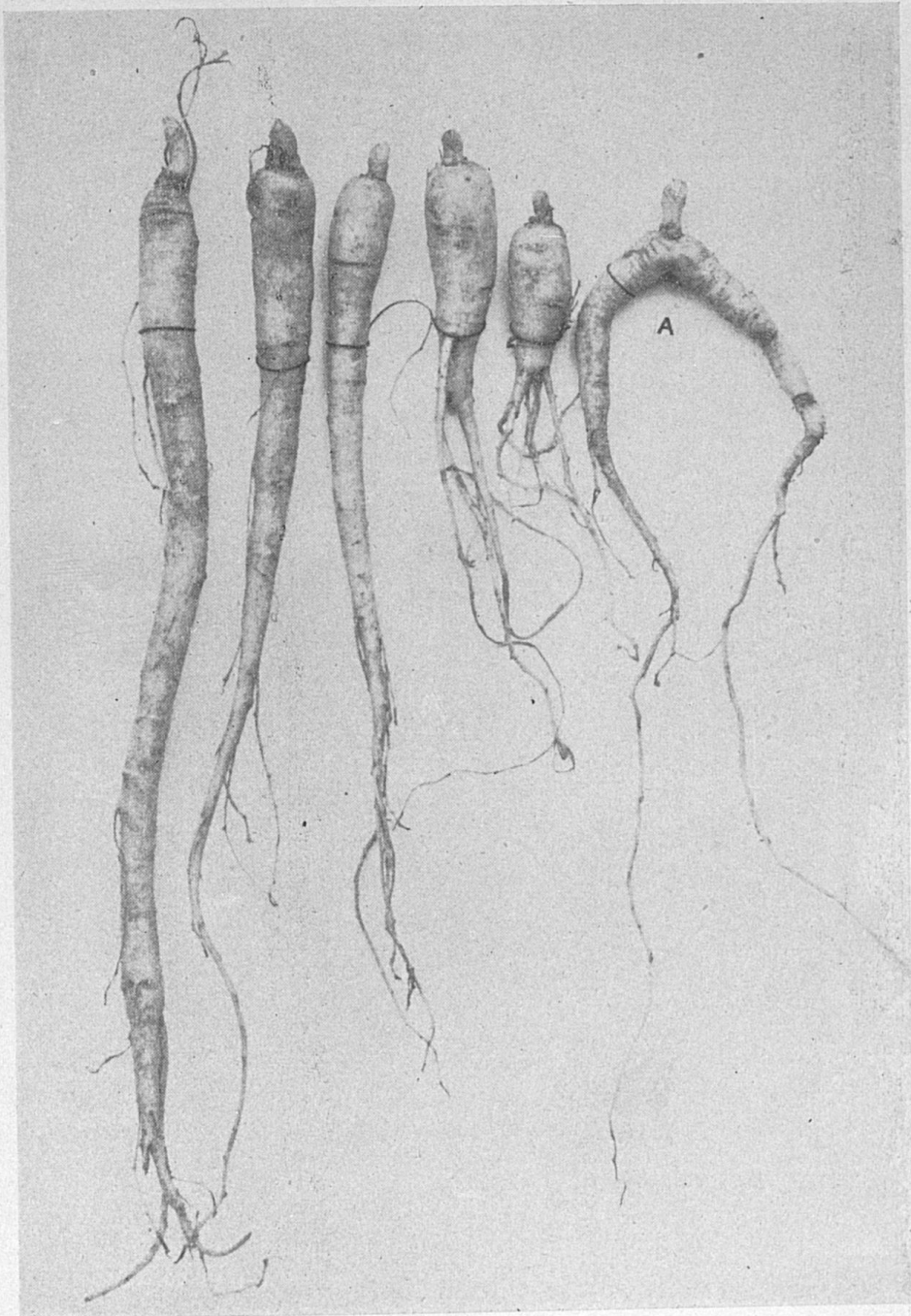


FIG. 8.—Showing the character and varieties of roots of the first year, as they appear in the fall when the bud has developed and the above-ground stem is removed. Natural size.



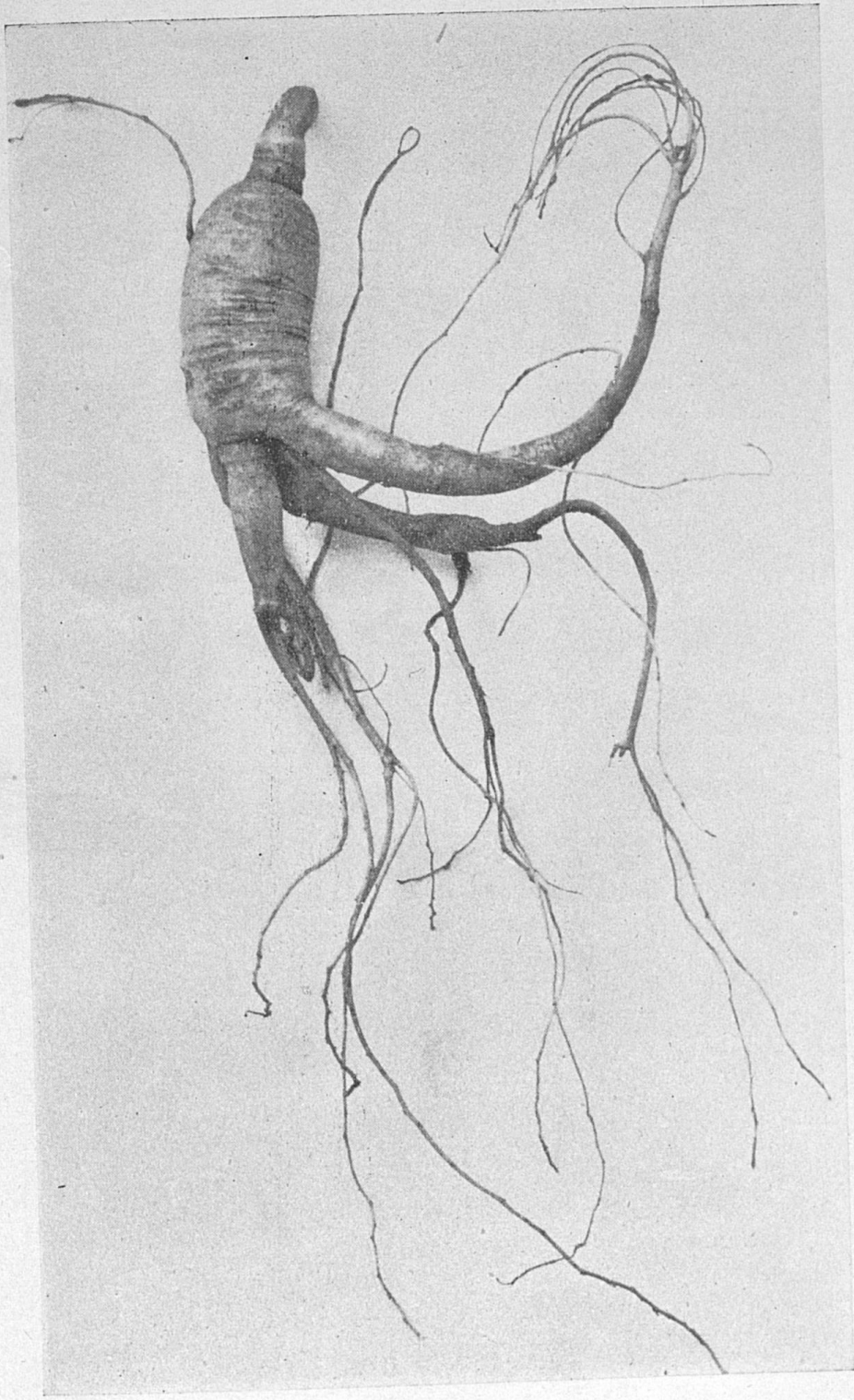


FIG. 9.—A root as it appears in the fall of the second season. Natural size.

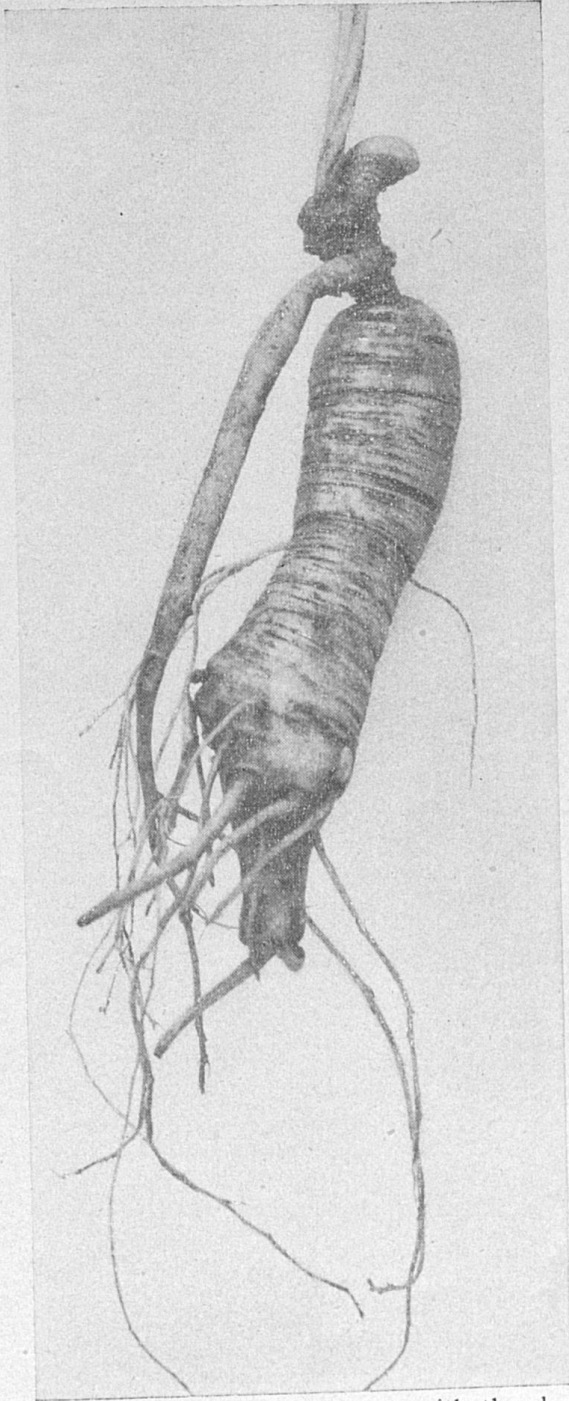


FIG. 10.—A root of the third year with the above-ground stem still attached. Natural size.



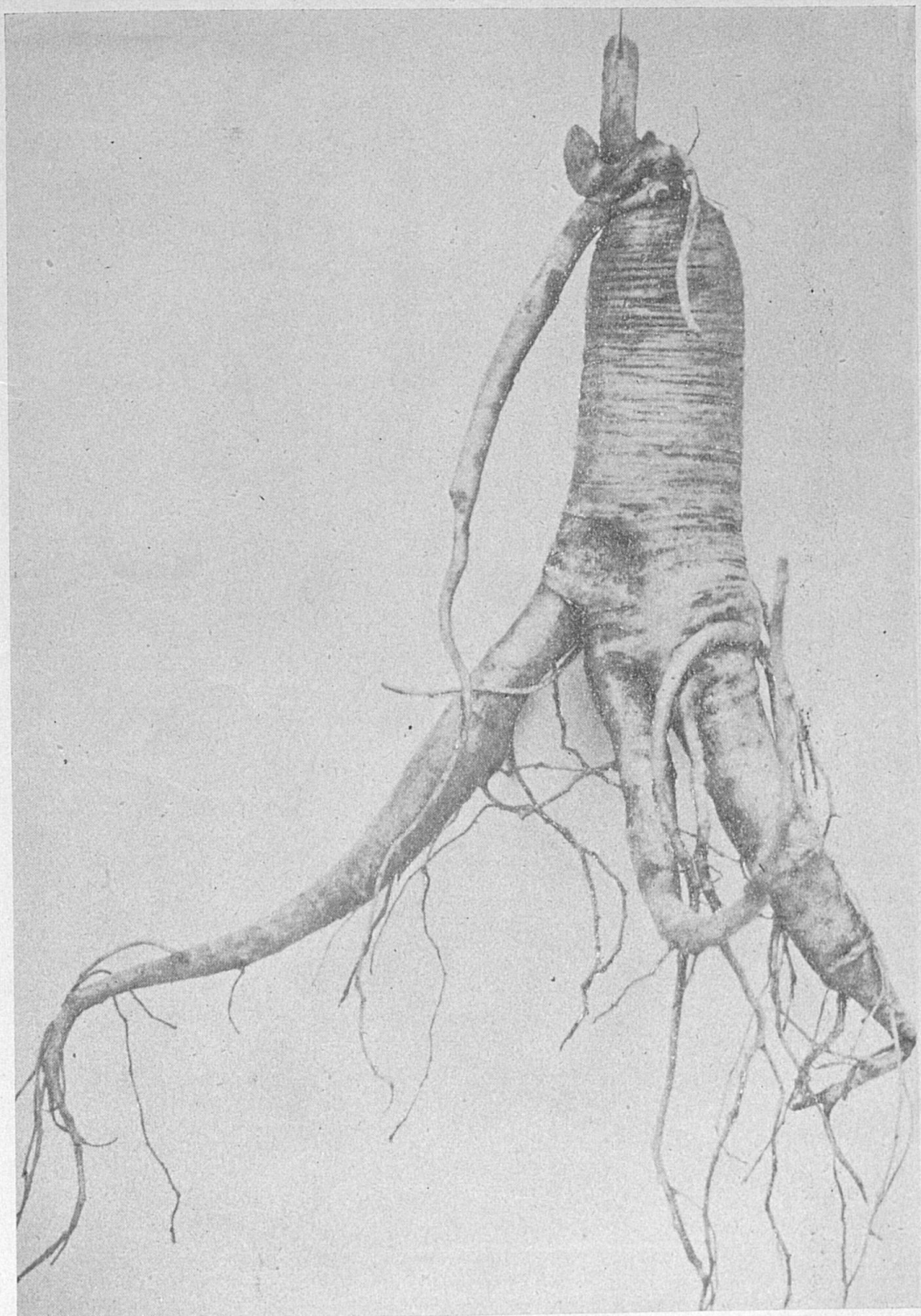


FIG. 11.—A root of the fourth year, showing annual stem and bud at the top.  
Natural size.

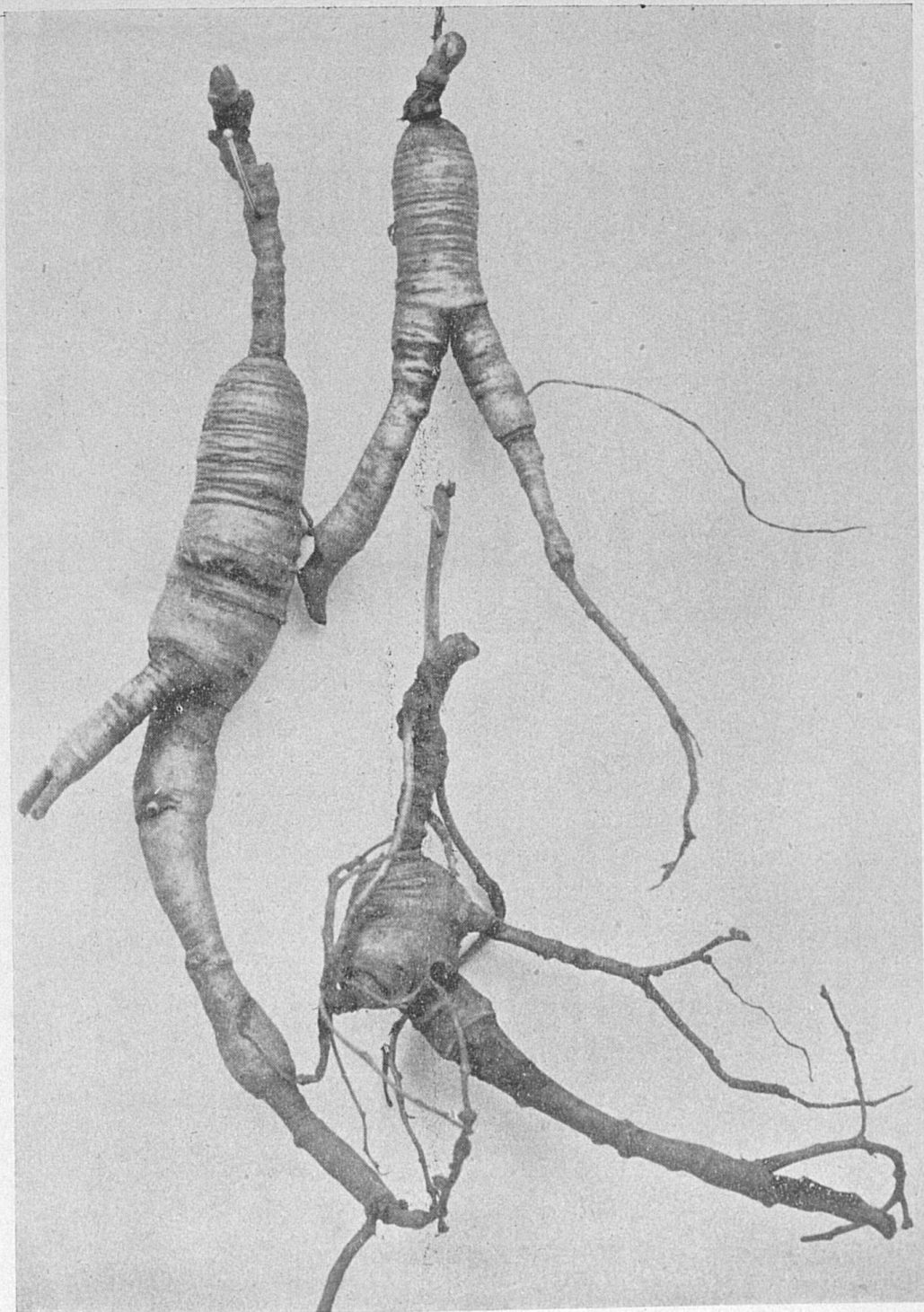


FIG. 12.—Three wild roots, with long under-ground stems. Natural size.