

producing coagulation of the blood within the blood vessels of a living animal. A very small dose will kill a rabbit or a dog, and death is as a rule produced by extensive clotting within the vessels, especially in the veins. Under certain conditions, however, especially in the dog, they produce the opposite result, namely, a loss of coagulability similar to that produced by peptone. Wooldridge termed this the "negative phase of coagulation."

A practical outcome of all this work is the discovery of alexines or protective proteids. These appear to belong to the nucleo-albumen class also. In small doses they confer immunity on animals to larger doses of similar poisons, and thus the long-hidden secret of the *modus operandi* of vaccination and other forms of protective inoculation is at last beginning to be unraveled.

[FROM THE BULLETIN OF CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION.]

#### PEACH YELLOWS.\*

By L. H. BAILEY.

THERE is no disease or difficulty of fruit trees in New York State which is the subject of so much misapprehension as the yellows of the peach. Not only are the origin and course of the trouble obscure, but the disease itself is frequently not recognized as a distinct and fatal malady, but is confounded with any weak or yellow condition of the tree. The name of the disease is unfortunate, since it leads people to regard yellowness as one of the first and indisputable symptoms of yellows, while, in fact, the disease may become well seated and may show its unmistakable symptoms in trees which are dark green and robust. It is for the purpose of enabling fruit growers to distinguish the true yellows from a multitude of other ailments that I have prepared the present report.

It should first be said that the yellows is generally spread throughout the State. I have made a careful study of the peach industry of Western New York during the present season, and I have run upon the yellows in almost every region which I have visited. It is particularly bad in Niagara County, which is the leading peach section of the State. It also occurs along the central lakes, in the Hudson River valley, and, no doubt, wherever peaches are grown to any extent. Yet the disease is not also so serious in certain regions as people have supposed it to be. I have visited orchards which were said to be dying with yellows, and have found only borers and that sublime neglect which characterizes so many peach orchards of the State. Orchards which are never cultivated or pruned or fertilized soon become sad-looking objects, making little growth and that of a feeble and yellow sort, and the borers hold unmolested carnival. In such cases, the first remedial treatment must be applied to the owner, for unprofitable or diseased orchards cannot cure themselves.

Fruit growers should know that peach yellows is a distinct disease, with characteristic symptoms, that it attacks the very best and strongest trees of the orchards as well as the weak ones, and that its end is always fatal. I have sometimes thought that the most vigorous trees are most liable to attack. It is certain that orchards in otherwise prime condition may be completely swept away with the yellows.

The most lamentable circumstance connected with the yellows in this State is the legal complication which arose in Niagara County † in 1889, when an attempt was first made to enforce the law which demands that yellows shall be eradicated. Commissioners were duly appointed and they proceeded with their duty of examining orchards and marking diseased trees. There was little general or popular knowledge of the disease, and the commissioners consequently met with opposition. It was charged that they marked trees which were not diseased. Whether this is true or not, it transpired that a certain peach grower refused to cut the trees which the commissioners had designated. Under the law, the officers cut the trees, but the owner refused to pay costs, and the people brought suit against him for misdemeanor. The trial was long and stubbornly fought. The trees which had been cut were destroyed, and there was therefore no evidence to prove that the trees in question had had the yellows. Much testimony of a general nature was admitted by the court as a matter of general interest and education, but the question which went to the jury was the specific one concerning the defendant's trees. The jury disagreed, and the defendant was acquitted. The result was regarded as a great victory by those who opposed the operation of the law; and it has had the effect of discouraging further efforts toward its enforcement in that county. The outcome has been most disastrous. The yellows is now widespread throughout the region which is naturally the best peach section of Western New York, and the dying and neglected orchards of careless peach growers are a constant menace to the peach industry. It will never be known, beyond the parties immediately concerned, whether the trees over which the suit occurred had the yellows; but I have this year visited the neighborhood which was the scene of the conflict and I found orchards ruined by the disease. Any law is impotent unless it is sustained and enforced by public sentiment. Every farmer should understand that peach yellows is a fatal and communicable disease, and that it is, therefore, amenable to control by the police powers of the commonwealth. Like pleuro-pneumonia and tuberculosis, it is a public nuisance.

When the yellows attacks a bearing tree, the first sign of its presence is usually in the fruit. The one unmistakable symptom in the fruit is the presence of bright red spots which may be likened to measles blotches, and the flesh is also more or less marked by

red spots and streaks which often run through to the pit. When the attack is slight, these red streaks in the flesh may be faint or even almost absent, but the external spots are characteristic. The illustration (Fig. 3) shows a diseased peach. In addition to these marks upon the peach, the fruit generally ripens prematurely, although I have seen cases in which the spots were present upon fruit ripening in its normal season. On the other hand, yellows peaches sometimes ripen six weeks in advance of their season, particularly after the disease has run a year or two. Mere prematurity is not an indication of yellows. I have repeatedly been shown trees, during the past season, which were said to have yellows because the fruit ripened pre-

are likely to pass unnoticed; and in such cases one must rely very largely upon the fruit for a diagnosis of the disease. In rare instances, the blossom buds upon diseased shoots may expand in the fall.

The third symptom of yellows is the appearing of abnormal shoots along the larger branches or even upon the trunks. These yellows shoots generally appear earlier in the season than the tips, and may make considerable growth. They are marked by short and narrow leaves which stand at nearly right angles to the stem, as seen in Fig. 5. They rarely grow more than a foot in length in this State. But the most striking form of this third feature of yellows symptoms is the bunchy growth shown in Fig. 6. Ordinarily a healthy peach shoot does not branch as it grows, but makes a straight stem one year and branches the next year. These yellows shoots, in confirmed cases of the disease, may branch into several or many fine



FIG. 1.—YELLOWS "TIPS."



FIG. 2.—HEALTHY TERMINAL SHOOT.

maturely, but which were suffering only from borers, neglect or drought. These peaches lacked entirely the bright red spots of the yellows. Yellows peaches are usually poor in quality, particularly in sweetness; yet when the attack is recent and the fruit is not markedly premature, the quality may not seriously suffer. In the second year of the visible attack, however, the quality of the fruit is perceptibly low.

Yellows generally appears at first upon a part of the tree only. Sometimes only one or two peaches may show any indications of the disease, and the tree may appear to be perfectly healthy. Whether the branch upon which these peaches are borne is removed or not, the disease will be found the following year to have spread, involving more branches and possibly the entire tree.

The second characteristic symptom of yellows—or the first in trees not in fruit—is the appearing of short, yellowish, unbranched shoots or "tips" upon or near the ends of the healthy branches. These sometimes appear upon the ends of lusty water sprouts, and in such cases I have seen them well developed even when the fruit showed no signs of disease. These little shoots spring from buds of the season, which under normal conditions would not have pushed into growth until the following spring. These shoots may appear as early as July or even June, but in the early stages of the disease they are usually not seen until late summer or fall. In this State, I see them first, as a rule, in September. When they appear at this date, they rarely grow more than three or four inches long. The leaves upon these

branchlets the very year in which they start. These tufted shoots may spring from old branches two and more inches in diameter, or even from the main trunk itself (Fig. 6). They often spring out with uncommon luxuriance from the stumps of trees which have been cut with yellows. These bunchy growths rarely appear before the third year of the disease in this State, and in the great majority of cases of yellows which I have seen in New York they are wholly absent, even in the final stages. They appear to be less abundant in dry years. It is the first two symptoms—the red spotted fruit and the "tips"—which must generally be relied upon in this State for the diagnosis of the yellows; and even the tips, as I said, may be so little developed as not to attract attention. The one unmistakable and invariable symptom of the peach yellows is in the fruit.

The fourth and final stage of the disease is that in which the entire tree assumes the narrow, yellow or reddish and rigid leaves, and in this condition the tree is not readily distinguished, by the novice, from trees which are much debilitated by borers or neglect. The length of time from the outset of the disease at which this final stage and the death of the tree occur is not a fixed period. It is undoubtedly modified by many conditions. From the time when the first symptoms appear, it is not less than three years before death occurs, and it is oftener five or six years. But death is sure to come sooner or later, for there is no indisputable case on record of yellows having been cured.

There is abundant proof that yellows is communi-

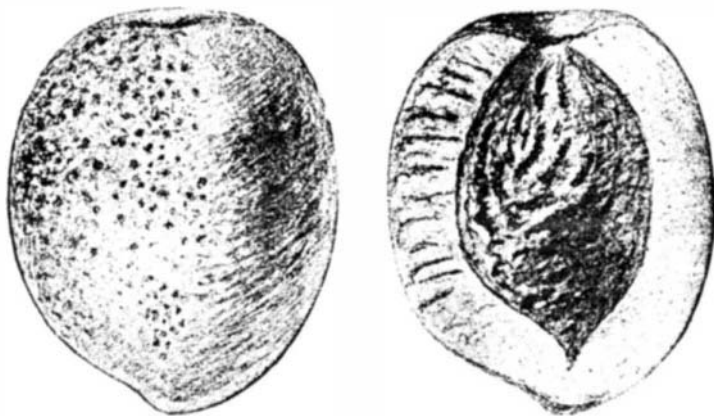


FIG. 3.—YELLOWS PEACH.

yellows "tips" are small and narrow, yellowish, and they usually stand out stiffly at nearly right angles to the stem, contrasting strongly with the drooping healthy leaves below them. Sometimes several of the uppermost buds upon a twig will start out into this short stiff tip-like growth. This feature is shown in Fig. 1. Contrast this shoot with the healthy twig, taken from the same tree, shown in Fig. 2. These tips sometimes appear late in fall after most of the leaves have fallen. The winter buds simply expand their sickly leaves and the stem may make no growth. Fig. 4 shows such tip, appearing late in October. Occasionally one may see these tips expanding prematurely in earliest spring. Frequently, in this State, these tips are so little pronounced, even upon trees badly diseased, that they

cable from tree to tree. Sooner or later, every peach tree in any community in which the disease appears may be expected to die from it, unless rigorous measures are taken to keep it in check. The disease is so insidious and often so slow in its progress that it usually becomes thoroughly established in a community before it attracts attention, and peach growers generally procrastinate in applying restrictive measures. It is unknown how the yellows spreads, but it is not through the soil, for young trees may be set with safety where yellows trees have been removed. Neither is it always, if ever, conveyed from flower to flower, for trees which have not yet blossomed often contract the disease. It does not inhere in the roots, for trees grafted upon plum stocks contract it. There is every reason to believe,

\* Those who desire to make a more particular study of peach yellows should consult the following publications of Dr. Erwin F. Smith, who is the recognized authority upon the subject:

"Peach Yellows: A Preliminary Report." Bull. 9, Div. of Botany, Dept. Agric., 1888.

"Additional Evidence on the Communicability of Peach Yellows and Peach Rosette." Bull. 1, Div. Veg. Pathology, Dept. Agric., 1891.

"The Chemistry of Peach Yellows." I. and II. Proc. Amer. Pomol. Soc., 1889 and 1891.

"Peach Yellows." Report of State Hort. Assoc., Penn., 1893.

"Experiments with Fertilizers for the Prevention and Cure of Peach Yellows." Bull. 4, Div. Veg. Pathology, Dept. Agric., 1893.

"Peach Yellows and Peach Rosette." Farmer's Bull. 17, Dept. Agric., 1894.

† Annals of Hort., 1889, 70.

also, that it is not carried on pruning tools. The means by which the disease spreads will probably not be known until the cause of the trouble is ascertained. Respecting this cause, there has been distinct progress in eliminating almost every origin which has been ascribed for the disease. It is known that yellows is not due to conditions of soil or climate, to mechanical injuries, to over bearing or starvation, to methods of propagating, pruning or cultivating, to insects or fungi, and Dr. Erwin F. Smith, of the national Department of Agriculture, who is the recognized authority upon the disease, now declares that "it is almost certainly not a bacterial disease." Dr. Smith thinks that the disease is "nearest allied to that phenomenon in plants known as variegation." It has been long known that most variegation is an abnor-



FIG. 4.—YELLOW "TIP" APPEARING LATE IN OCTOBER.

mal state or condition and that it can sometimes be communicated to normal plants by means of budding; but it is difficult to conceive of any means by which such condition can become contagious without the presence of germs.

But there is every reason to expect that when the cause of the yellows shall have been discovered the treatment will remain the same as now—extermination of the affected trees. This seems to follow, from the fact that when the first symptoms of yellows are discovered upon any branch, the entire tree is diseased. Numerous critical experiments have been made to determine this fact, by cutting off the diseased limb. In every case the remainder of the tree has shown yellow

peaches rarely have good seeds, but the pits from the apparently healthy portions of diseased trees may be expected to convey the disease to the offspring.

So far as known, peach yellows, like pear blight and plum knot, is a purely American disease, and has not been introduced into other countries. It is generally



FIG. 5.—YELLOW SHOOT.

distributed in peach sections east of Mississippi River and north of North Carolina and Tennessee. It first attracted attention about a hundred years ago in the neighborhood of Philadelphia, whence it appears to have spread throughout the country. It was probably introduced into the peach region of southwestern Michigan, where it appeared nearly thirty years ago, by diseased Eastern stock. As near as I can learn, it appeared in Niagara County, New York, about twenty years ago. The disease seems to prefer the peach, but it is known to attack the nectarine, almond, apricot and Japanese plums.

The only check for the spread of the yellows is extermination of the affected trees, and I doubt if a better method will ever be discovered. There is much



FIG. 6.—YELLOW TUFT—One-half natural size.

lowers, usually the following year, but sometimes not until the second year. And these results are exactly in line with the experience of all peach growers who have had to deal with yellows. It will also be necessary to exercise the same caution in the choice of buds for propagation, for it is known that a bud from a yellow tree—even from that part of a tree not yet visibly affected—will make a yellow tree and will communicate the disease to the stock. Premature yellows

difference of opinion as to when and how the trees should be removed. If but a single branch is affected and the disease shows only in the fruit, it is considered to be safe to burn the diseased branch and fruit at once, but to allow the remainder of the tree to ripen its crop. As soon as this crop is off, pull up and burn the tree, root and branch. If the disease appears upon a tree not in fruit—even if upon but a single branch of it—I should forthwith, as soon as the disease was dis-

covered, pull out the tree and burn it. There is a tendency in this State to allow the trees to stand until fall work is done or until some other convenient season shall arrive; but growers who practice such methods are not long troubled with peach orchards.

This method of immediate extermination has been proved time and again to be completely effective in holding the disease at bay. The experience of the Michigan peach growers is often cited, and it is undoubtedly the best illustration extant of the effectiveness of timely and co-operative effort. The oldest commercial peach region of Michigan is that lying in Berrien County, in the southwestern corner of the State. Here the yellows first appeared. At that time, the disease was little understood, and growers temporized with it, and tried to cure it. As a result, the entire peach industry was wiped out, and small fruits, grapes, and truck gardening took its place. Lying twenty-five miles north of this St. Joseph region, and then separated from it by several miles of wild country, is the South Haven region. In this second region the disease finally appeared and destroyed a number of orchards, but the people, profiting by the disastrous experience of their neighbors upon the south, soon began a vigorous war of extermination against it. The local pomological society united the leading peach growers in the crusade, and the State legislature was prevailed upon to pass a law providing for the legal exercise of police powers upon the part of townships. This was probably the first American law aimed at a disease of plants, and from it have sprung the perfected laws of recent years relating to yellows, black knot and other diseases and insect pests. There were some growers of influence who resisted the law, but upon the whole the community was united in the one determination to checkmate the yellows. For a time the disease seemed to override all opposition, but it was finally checked, and it has not seriously interfered with the peach industry for the last dozen years. It is still present, however, and in certain seasons it breaks out with renewed vigor, but these recurrences are as vigorously met by the growers, and the disease again subsides. These years of renewed activity of the yellows are apt to follow years of comparative immunity, largely because of the less careful scrutiny by the yellows officers in the years of freedom from the disease. This determined fight against a common enemy has knit the peach-growing community together and has developed a local pride which is entirely absent in the peach sections of New York State. Public sentiment demands that no yellows peaches shall be shipped. A sign hangs in the warehouse at the port with this legend:

"All peaches left here infected with yellows will be destroyed and the owner prosecuted."

This sentiment is unknown to the New York peach growers, as a body. Everywhere I see yellows peaches on sale. These peaches are not injurious to health, so far as known, but they are inferior in quality, and the Michigan people have learned that the sale of them hurts their reputation and market. But the New York growers, as a rule, have not yet got beyond the point of asking if the diseased peaches are unwholesome, and have not risen to the plane of demanding that only good fruit, like pure milk, shall be allowed to make their reputation upon the market. And the clause of the law forbidding the sale of yellows peaches is practically a dead letter.

The success of the Michigan growers in stemming the invasion of yellows has revived confidence at St. Joseph, and that region is again growing peaches with its earlier eminent success. I do not expect equal success in eradicating yellows in this State, from the fact that the peach industry is nowhere extensive enough to make it the one absorbing interest of the community. As soon as it becomes the chief occupation of any region, the people will combine in self-interest to hold it in check. Yet the individual grower, if affected orchards do not adjoin his own, can keep the yellows at bay with a loss of only a few trees each year. There are such growers in Niagara County and other parts of the State, and their success should reassure all those who despair at the inroads of the yellows. But it must be remembered that the most painstaking vigilance is required to keep orchards healthy, and the best remedy for the evil will be found in the rigid enforcement of the law. No amount of arguing will stop the yellows. Fire is the only recourse.

Most of the laws aimed against peach yellows have serious defects. The most glaring of these is the fact that the owner of the trees has no appeal from the decision of the commissioners who are appointed to examine the orchards. There is always danger that incompetent or careless men may be appointed to the commissionerships, whose rulings may not be acceptable even to the best disposed citizens. The disease is so obscure that only the most careful and judicious men should be selected to diagnose it, and even at the best, there are men in almost every community who object to the destruction of their trees. Lack of confidence in the commissioners has been the most serious obstacle to the execution of the New York law, and it was at the bottom of the suit which occurred in Niagara County in 1889. There is a feeling also that the work of the commissioners in cutting trees is the invasion of a man's property without due process of law. All this is remedied in the Connecticut law—which is the best of all yellows laws—for the owner may appeal from the findings of the commissioner to the State board of agriculture, which "shall appoint a committee of three experts, which committee shall not include the person who, acting as commissioner or deputy, ordered such tree or fruit destroyed, and the decision of such committee shall be final."

Another difficulty with the laws is the danger that political considerations will prevail in the appointment of the commissioners. This danger is imminent whenever the commissioners are appointed by any officer or board which is itself a political appointment or creation. The difficulty can be averted only when the commissioners are created by a non-political board or office, as in Connecticut.

Other hindrances against the efficient operation of yellows laws are the inadequate pay given the commissioners—often rendering the appointment of thoroughly competent men impossible—and the lack of any general office or officer who shall keep records of the spread and control of the disease. This latter omission is serious, from the fact that it is only by a



study of careful statistics extending over a series of years that the progress of the disease can be accurately known and the effectiveness of remedial laws adequately measured. This important statistical feature has been embodied in the Connecticut law, and the yellows commissioner reports that in the year 1893 official examinations were made of 283,782 trees, of which 28,647 were condemned.

The full text of the Connecticut yellows law is as follows:

SECTION 1. The State board of agriculture shall, within thirty days from the passage of this act, appoint a commissioner on peach yellows, to hold office during the pleasure of said board. Said commissioner may, with the approval of said board and under the provisions of this act, adopt and carry out such plans as may be deemed necessary for the eradication of the disease, common to peach trees, known as peach yellows.

SEC. 2. At all joint meetings of said board and said commissioner, for the purpose of conference, the commissioner shall receive pay from the board for his expenses only. Said commissioner may, with the approval of said board, appoint one or more deputies in each county; and when employed in the performance of duties imposed by this act, said commissioner and his deputies shall receive from the State, upon presentation to the comptroller of bills duly sworn to, audited by the auditing committee of the board of agriculture, and approved by the governor, five dollars per day and their expenses.

SEC. 3. Any peach, almond, apricot, or nectarine tree diseased by the yellows, and all fruit from any such diseased tree, is hereby declared a public nuisance, and it shall be the duty of said commissioner or any deputy, under such regulations as the State board of agriculture may adopt or approve of, to order such trees or such fruit destroyed, and upon the failure of the owner to obey such order, to destroy such trees or fruit, and no damage shall be paid to such owner on account of such destruction.

SEC. 4. Any person may, when ordered to destroy any tree or fruit condemned by the said commissioner or deputy, appeal to the State board of agriculture, and said board shall appoint a committee of three experts, which committee shall not include the person who, acting as commissioner or deputy, ordered such tree or fruit destroyed, and the decision of such committee shall be final.

SEC. 5. Any person who shall, while such an appeal is pending, sell any tree from a nursery where there are found to be diseased trees, or any fruit from such tree, or who shall, without such appeal, or after such final decision, refuse to destroy such tree or fruit, shall be fined not less than one hundred or more than five hundred dollars.

SEC. 6. Any person that shall knowingly buy for the purpose of selling, or shall sell, or offer for sale, any fruit from such diseased trees, shall be fined not less than ten nor more than one hundred dollars.

SEC. 7. For the purpose of investigation or for the purpose of destroying trees or fruit known to be diseased, the said commissioner and his deputies may enter any premises; and any person who shall prevent or attempt to prevent such entry shall be punished by a fine of not less than ten or more than one hundred dollars, or imprisoned in a common jail not less than ten nor more than sixty days, or both.

SEC. 8. Prosecutions for violation of this act may be brought before justices of the peace, or any city, borough, town police, or common pleas court having criminal jurisdiction, by any prosecuting officer, or by the commissioner of peach yellows, or any of his deputies, and for such purpose said commissioner and his deputies shall have all the power of grand jurors.

SEC. 9. This act shall take effect upon its passage.

#### YELLOWS BREVITIES.

Yellows is a distinct disease. It attacks peach trees of all ages and in all conditions of vigor, seeming to have a preference for those which are thrifty. It is incurable, and its termination is always fatal.

The disease sometimes attacks the almond, apricot and Japanese plum.

Yellows has been recognized for about a century. It is peculiar to North America, and is generally distributed north of the Carolinas and east of the Mississippi.

It is communicable from tree to tree. The means of communication is unknown, but it is not spread through the soil, it does not originate in the roots, it is evidently not conveyed from flower to flower, and it is probably not transferred by means of pruning tools.

The cause of the disease is wholly unknown. Almost every ascribed cause has been disproved upon careful investigation.

It has no uniform preference for varieties, soils, climate, nor methods of propagation or cultivation.

No fertilization of the soil will cure the disease or check its spread.

The one unmistakable symptom of yellows is the red spotted character of the fruit. The flesh is commonly marked by red lines or splashes beneath the spots. These peaches generally ripen prematurely, and in the second year they are usually smaller and often more fuzzy than the normal fruit. The second symptom to appear—or the first in trees not in fruit—is the “tip” growth. This is a short growth starting from the upper or terminal buds, usually late in the season, and is characterized by narrow stiff yellowish small leaves which stand at nearly right angles to the shoot. Sometimes these tips appear late in autumn, after the leaves have fallen, or in spring before normal growth begins. They are often first seen upon the ends of watersprouts. This “tip” growth is sometimes little pronounced, and then only a practiced eye will detect it.

The third mark of the disease is the pushing out of slender stiff-leaved yellowish shoots from the body of the tree or the sides of the large limbs. In pronounced cases, or when the tree is about to die, these shoots may branch into close bunchy tufts. These symptoms are frequently wholly absent in this State throughout the entire course of the disease.

In its final stage, the disease is marked by small and slender growth of all new wood, small, narrow, yellow or reddish foliage, and occasionally by a great profusion of slender and branchy growths in the center of the tree.

As a rule, yellows trees die in five or six years from the first visible attack.

The yellow and stunted condition following neglect or the work of borers—both of the common borer and the pin hole borer—is often mistaken for yellows.

Extirpation of all affected trees—root and branch—is the only method of keeping the disease at bay. This work should be prosecuted vigorously and systematically and with the full support of the entire community.

Trees may be set in the very places from which yellows trees have just been removed, with entire safety.

The disease is readily communicated to nursery stock by affected buds, even by buds from those branches of affected trees which do not yet show any signs of the yellows.

Pits from affected trees—when visible—may be expected to propagate disease.

#### CYPRIPEDIUM CYRIS.

A BOLD hybrid, with heavy claret-colored spots on a greenish ground; the dorsals have a white margin and a green ground, with an abundance of spots; petals green, shading to rose, and also heavily spotted; lips deep rosy purple. F.C.C. R.H.S., November 13, Norman Cookson, Esq., Wylam-on-Tyne.—We give an engraving from the Gardeners' Magazine.

#### VEGETABLE WAXES.

THE principal centers of vegetable waxes (China, Japan, and Central America) annually export very large quantities of these products, which are now used in a large number of industries.

The port of Ichang alone, in China, exported in 1889 more than 1,600,000 pounds of insect wax, of a value of \$500,000. The export of Japan wax, which began hardly thirty-five years ago, is estimated to-day at several million pounds.

The wax trade distinguishes ten kinds of vegetable waxes, including the products known as vegetable tallow, viz.:

Carnauba or Brazilian Wax.—This wax coats the leaves of the wax palm (*Copernicia cerifera*) tree, widely distributed through Brazil and Paraguay. It is a singular tree, whose naked trunk often attains a height of 50 ft., with wide palmate leaves. The wax exudes upon the surface of the latter in small scales that may be detached through a friction of the dry leaves. This,



CYPRIPEDIUM CYRIS.

however, is not the way in which the wax is collected. The young leaves are cut off, dried, bruised in a mortar, and the wax is extracted by fusion. Carnauba wax comes in hard, brittle masses of a greenish yellow color. Its specific weight is about 0.999, and its melting point is from 83° to 84° C.

In the country of its production it is melted with tallow and used for making candles. In Europe and the United States large quantities of it are used for the manufacture of varnishes, oil cloth, and impermeable fabrics. It is employed also for hardening beeswax, varnishing and polishing cabinet work, floors, etc., and as an insulator for electric conductors.

Chinese Insect Wax or Pe-la.—According to a United States consular report, the principal center of production of this wax is the province of Sze-Chuen, and especially the valley of Tchien-schan and the banks of the river An-ning.

The tree upon which the larva of the wax insect develops, and the Chinese name of which signifies “ever green,” is covered with thick, opposite, oblong-oval, persistent leaves.

In spring, the branches and branchlets become covered with small pea-shaped excrescences or galls, that are filled with a farinaceous mass formed by the larvæ of the wax insect (*Coccus pela*). These galls are gathered toward the end of April and sent to the prefecture of Chia-Ting in packages of about 15 ounces each. They are preserved as much as possible from the heat, in order to prevent the premature hatching of the insects, which, a few hours after their metamorphosis, try to escape through the fissures in the packages. In the vicinity of Chia-Ting there is a plain covered with knotty trunks from 4 to 12 ft. in height. At this epoch of the year, these trunks put forth numerous branches. This tree is probably the Chinese ash. The natives call it paila-shu, or “wax tree.” The larvæ, to the number of from 20 to 30 in a package, are fastened under the leaves of this tree. Here the insect hatches out and remains stationary for a fortnight, after which it spreads over the branches and branchlets, upon which the females arrange the cocoons which the males are to cover with a protective coating of wax. The first appearance of the wax at the lower part of the branches resembles a deposit of light snow, but the layer soon increases in thickness and finally covers the branches with a uniform coating. Three months after the putting of the larvæ in place, the manufacture of the wax is considered as finished. The branches are then cut off and boiled in water. Each

pound of larvæ produces from 4 to 5 pounds of wax. The wax, which is brown, is melted and run into moulds. At Shanghai, the great market for insect wax, the refined product is quoted, on an average, at 50 cents a pound.

Insect wax is the object of a very large trade in China. Only a small part of the crop is exported, the greater part being used in the country for forming a but slightly fusible coating for tallow candles. It is used also for finishing silk and for polishing laces and stones.

For some years past, this wax has found favor in some foreign markets, especially in those of the United States.

Japanese Wax.—This wax is extracted from the *Rhus succedanea*, a tree somewhat resembling the European elder, and which attains a height of about 40 ft. It produces fruit of a greenish brown color, of the size of cherries, from which the wax is extracted. The fruit ripens in October and is collected in large wooden receptacles, in which it is decorticated by pounding it with wooden clubs. The kernel, which is bean-shaped, is exceedingly hard, of a dark yellow color and soapy to the touch. These kernels are softened by steam and expressed.

The crude wax is in masses of a blue green, and is employed in the country for different purposes, principally for the manufacture of candles. For export, it is refined by boiling it with the lye of ashes until it is melted. It is then poured into cold water, where it hardens in small shells that are exposed to the sun for a fortnight in order to bleach it.

Thus refined, the Japanese wax presents a close resemblance to white beeswax in color, consistence, and fracture, all characters that would permit of confounding it with the latter. But there is one character in which it differs: while beeswax, when melted, emits an agreeable aromatic odor, the Japanese wax under the same circumstances disengages a repulsive odor of fat.

It is prepared for export in the form of large rectangular blocks, weighing 140 pounds each.

The fresh fracture of the refined wax is white, sometimes marbled with light greenish yellow. The ordinary qualities are of a more or less dark yellow color. The recent wax melts toward 42° C., but its melting point gradually rises to 52–53° C. It is a little heavier than water. It is very soluble in alcohol at a temperature of 97°, from which it separates almost wholly upon cooling. Warm ether dissolves it in abundance, and from this, upon cooling, it separates in flakes or granules.

The preparation of this wax is one of the principal industries of Kinsin. The best product is manufactured at Kumamoto, but it is not commercial, it being reserved for the uses of the imperial court. The most esteemed commercial sort is prepared in the province of Hizan, and is shipped from Osaka to London.

Kaga Wax.—This wax is the product of the *Cinnamomum pedunculatum*. It is softer than the Japanese wax, and but little of it is met with in the European markets. The same is the case with the Ibota wax, the formation of which is due to the puncture, by an insect, of the bark of *Ligustrum ibota*. It is a very fine and white wax, exclusively consumed in Japan.

Candleberry or Myrtle Wax.—This product is obtained from plants of the genus *Myrtus*, which are widely distributed over the temperate regions of both hemispheres; in North and South America, Europe, Cape of Good Hope, Northern India, China, and Japan. The plants are mainly shrubs. The fruits are nuts covered with a waxy, resinous secretion, separated from the drupes by boiling them in water, skimming the wax from the surface, and then straining it through a coarse cloth in order to free it from impurities. *Myrica cerifera* and *M. carolinensis* are North American species, the last named of which is said to be the more valuable of the two. These plants yield wax of a greenish yellow color and of a finer consistence than beeswax, the production being at the rate of one pound of wax to four pounds of drupes. Candles manufactured from it diffuse an agreeable odor when burning, and even after extinction. There are several species of the genus found in Southern Africa, the wax from which is an article of export.

Palm Wax of New Granada.—The wax palm of New Granada (*Ceroxylon andicola*) grows in great abundance in the elevated regions on the chain of mountains that separate the rivers Magdalena and Cauca. The trunk of this palm is of great height and is covered with a coating of resin-like wax, which gives it a whitish, marble-like appearance. The wax is gathered by felling the plant and scraping the trunk with a blunt instrument, the average yield being twenty-five pounds to the tree. It is then melted and run into calabashes, in which state it forms an article of commerce among the inhabitants. It is much used for manufacturing candles, for which purpose it is mixed with tallow, since it burns too rapidly when used alone.

Stillingia Tallow.—The tallow tree of China (*Stillingia sebifera*), which has been naturalized in India and the warmer parts of America, bears fruits which are about half an inch in diameter and contain three seeds thickly coated with a fatty substance which yields a sort of tallow. This is obtained by steaming the seeds and then bruising them sufficiently to loosen the fat without breaking them. The fat is afterward made into large cakes and pressed in a wedge press, when the pure tallow exudes in a liquid state and soon hardens into a white brittle mass. This product is extensively used in China for making candles, but, as the latter get soft in hot weather, they generally receive a coating of the insect wax mentioned above.

Other vegetable waxes are yielded by the white gourd of India (*Benincasa cerifera*), the dwarf birch (*Betula nana*), a species of fig (*Ficus cerifera*), the wax tree of the Cordilleras (*Elæagia utilis*), etc.—Abstract from *Moniteur Scientifique*.

#### MADAGASCAR PIASSAVA.

(*Dictyosperma fibrosum*, Wright.)

FOR nearly twenty years a fiber closely resembling Brazilian piassava (described in *Kew Bulletin*, 1889, pp. 237–242) has been obtained from the island of Madagascar. It was moderately long, of a rich brown color, and evidently obtained from the stem of a palm as ordinary piassava. The quantity produced was never very large, and in the early stages of the enter-