Plants That Make Stones

By S. Leonard Bastin

IT is well known that plants are continually taking up various mineral substances from the soil. Most of this matter is spread about in various parts of the organism and is not very apparent to the casual observer. Now and again, at certain points, there will appear an accumulation to such an extent that stones are produced. Thus, occasionally, inside the stems of the bamboo a hard rounded mass is found just at the joints of the cane. These are of a silicious nature, and probably represent an excess of silica taken up by the plant. Even more interesting are the cocoanut stones which can at times be dug out of the endosperm of some kinds of cocoanut. These are usually round but they are sometimes pear-shaped. In color they are white, and not unlike pearls, although not so lustrous. As a rule these stones are about the size of small cherries and they are quite as hard as felspar or opal. On account of the rarity of these cocoanut stones they are very highly valued by the inhabitants of Java and other East Indian islands. It is generally considered that they act as charms against disease. These stones have been carefully examined and they are held to be composed of pure carbonate of lime.

Somewhat similar processes are occasionally present in pomegranates. Apatite has also been discovered in teak wood. The curious water plants called Stoneworts (*Chara*) cover themselves with calcareous deposits. This is so much the case that, as these plants die down each year, the bottom of the pond or lake is appreciably raised by the accumulation of lime, which of course does not vanish with the decay of the stems.

Mobilizing a Lady Bug Army to Fight the Aphis

By Horace E. Thomas

NOW that spring has come and the chill of winter no longer retards the growing grain a strange army is being marshaled forth into the cereal fields of the Pacific northwest. Its divisions, brigades and regiments are composed of lady bugs and they are sent out to attack their natural prey, the aphis.

Scientists have long recognized in the lady bug, lady beetle or lady bird, as it is variously called, a beneficent agency in its disproportionate struggle to exterminate the aphis, or plant louse. Heretofore the bugs have exercised complete freedom in their go-as-you-please efforts to hunt down and devour the aphis. Now, however, the lady bug, which perhaps is least offensive of all the huge bug family, and for which nearly everyone has a sort of friendly feeling, has its campaign mapped out for it and will be sent where it may do the most good by enjoying unlimited gastronomic activity.

The lady bug hibernates in the winter. It is possessed of a tropism that warns it with the approach of cold weather to seek shelter. In colonies numbering a million or more bugs it bivouacs in the mountains and foothills. There, protected by rocks and crevices, it lives safely through the cold weather. When it is aroused from its stupor by the spring sunshine it again makes its way to the lower levels where its favorite food is the aphis, most destructive of grain and vegetable pests. The present effort is to gather the lady bugs from their winter retreats, care for them in artificial storage during the winter and release them in the spring where a plague of aphids is most feared.

So far, scientists agree, the attempt to use the beetles for aphis control is in an experimental stage. By some

The stonewort secrets so much lime that its autumnal decay raises the level of the water bottom

it is believed that the lady bug army will accomplish more toward eradicating the aphis if left to its own devices. Others consider the plan as promising permanent relief to the farmer, at least in some localities. All authorities

Stones laid down in a bamboo stem (left) and in a cocoanut (right)

agree that it is worth trying and are cooperating to make the test complete and decisive. That it is a matter of real importance, as well as interesting as a novelty, will be realized when it is considered that the annual plant destruction by aphids in the Pacific northwest alone entails a loss of from \$10,000,000 to \$20,000,000.

A lady-bug colony, at home for the winter, from which two million bugs had been removed before the picture was taken. At the right, sacks of the bugs prepared for "live storage" in a safe place; above, adult (A) and larva (B) of the aphis-eating lady bug

Nearly 100,000,000 lady bugs will be distributed in the state of Washington this spring. More than 25,000,000 of them have been stored and are ready for release at any time. Caches of the others were located and they are being assembled for distribution when the proper time comes.

Agents of the United States Forest Service have taken the lead in collecting the beetles. The forest ranger has exceptional opportunities to find their caches. When he came upon a colony he reported it to the county agricultural agents, who were cooperating in the work. It was no trick at all to scoop the bugs into sacks and boxes which were to be their new home. The receptacles were partly filled with excelsior which served as a roost and the bugs were stored away to be kept through the winter at as constant a temperature as possible, in the neighborhood of 38 degrees above zero. In one instance an abandoned brewery was their temporary home; another huge colony occupied an apartment in a meat packing plant, which was kept comfortably near the freezing point and where there was no fuel problem to worry them. On bright days they were taken out to sun for a few hours to check any fungus growth that might kill the beetles.

The Bureau of Entomology of the Department of Agriculture, through its station at Forest Grove, Ore., has cooperated in the enterprise to the extent of collecting data and giving advice. Results will be carefully tabulated and a complete survey prepared for publication. The men in the entomological service have been careful not to give too great encouragement to the farmers. That the artificial distribution of lady bugs may be beneficial under certain conditions, they believe; but where the aphis is at its worst they have little hope that beetles can be assembled in sufficient quantities to combat it.

This opinion is shared by Prof. A. C. Lovett, entomologist, of Oregon Agricultural College, who has made a thorough investigation of the lady beetle as a natural foe of the aphis. In normal years, he says, the aphis pest is kept under control by the lady bug and other enemies, such as the syphus fly, the larvae of the lace wing fly and the lampyrid beetle, all of which, including the larvae of the lady bug, devour aphids in great numbers, and a minute wasp that kills them by its sting. The common impression that hot weather kills aphids is a mistake, he adds; the fact is that warm days are favorable to the insects that destroy the aphid. When a few warm spring days are followed by cool, damp days the aphis thrives because its insect enemies are inactive under such conditions.

When there is a real outbreak of aphis, such as practically destroyed the vetch crop of western Oregon in 1918, there is little hope of relief from lady bugs, according to Professor Lovett. "The climatic factor then presented an insurmountable barrier to the successful use of natural enemies," he says, and continues:

"In an experiment carried on last year, 210 pounds of aphids were collected from a 12-acre field of vetch. It was estimated that this constituted 60 per cent of all present. Therefore, on this field there were approximately 350 pounds of plant lice. One gram of aphids were counted, amounting to 513. There would be, then, approximately 254,000 aphids in a pound or 88,900,000 on the 12-acre tract. Figured on this basis 25,000,000 lady bugs would, if devouring their maximum of 200 aphids daily, succeed in controlling the plant lice on 77 acres. When we consider the hundreds of acres of vetch

(Continued on page 522)

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The Future of the Archaeologist in Mesopotamia

(Continued from page 520)

so many and so great that the museums of the whole world could not contain them all. Even in the level plain ancient objects are found whenever the natives dig for water or plow the land, and where none would think of seeking. A Tigris River boatman reached out his oar to push his boat from the shore toward which the current was carrying him. Suddenly he saw a stream of gold flow down to the water's edge. He had hit an earthen pot in which someone a thousand or more years ago had buried his wealth. De Sarce, the French Consular Agent at Busreh, went shooting along the shore of an ancient canal. On the summit of a low unpromising mound, Tello, he saw a large stone statue of an ancient Babylonian king. Later beneath the surface he found a dozen other similar statues, which are now in the Louvre. For this discovery he was raised from the rank of consular agent to that of an ambassador, and was granted a large fortune by the French government. Near the Arab encampment of Ibra is a small mound called Drehem. Once I visited it and decided that it could be nothing but the ruin of a mud fort guarding the canal. A little later the Arabs of the vicinity discovered in that mound several hundred thousand inscribed clay tablets which were written about 2250 B. C. This is the source of many of the small clay tablets in the museums throughout America. At the outbreak of the war some Arabs south of Babylon were digging for bricks in a mound so small and low that the explorer thought it unworthy of notice. In it they discovered more than 20 large clay cylinders, each inscribed with about 140 lines of fine writing by the great Nebuchadnezzar. There he tells how he built the walls of Babylon which were one of the seven wonders of the world, and how he restored the old temple which is sometimes called the Biblical "Tower of Babel." Once while walking over a low mound near Kut-el-Amara on the Tigris I found ancient Parthian copper coins so thickly scattered on the surface that I could not step without treading upon them. They were corroded and worthless, but they indicated what may some day be found down in the protecting clay of that mound. The work of the archaeologist in Mesopotamia has hardly begun—and centuries will pass before it can be completed.

At last the Turkish Empire is breaking up. At least Mesopotamia has been wrested from the obstructive Turks, and this wonderful archaeological field promises to be opened to the explorer. When the British took control of Egypt a new impetus was given to the study of the ancient civilization along the Nile. Instead of obstructing the work of the excavator, they encouraged him in every possible way. Scholars were invited to Egypt, and anyone with the necessary qualifications and means has been permitted to dig wherever he would. In Cairo was constructed a great museum where the scholars from all the world may study every detail of ancient Egyptian life. The Egyptian government has been exceedingly liberal with the excavator, permitting him to take from the country all duplicate objects, or whatever was not desired for the Cairo museum. Thus Egyptian antiquities now form a part of the collection of every museum, and the interest in things Egyptian has become widespread.

What has taken place in Egypt will also take place in Babylonia. Already steps have been taken to promote the explorations of the ruins. An American school of archaeology has been projected for Bagdad. Several expeditions are in formation to go to the most promising of the buried cities. Probably in Bagdad will be erected a great museum where the most valuable of the treasures will be stored and made accessible. The illicit digging by the Arabs will cease, for the traffic in an-

tiquities and the smuggling of them from the country will no longer be possible. The excavator will be allowed a part of his discoveries for his home museum. From the Babylonian and Assyrian records so far discovered we have but faint glimpses of what may yet be found.

Another obstacle in the way of Babylonian exploration work has been the difficulty in reaching the country. No inhabited part of the world has been more inaccessible. The long journey overland from Damascus to Bagdad required nearly a month of the hardest desert travel. The longer way by water from Bombay up the Persian Gulf and the Tigris was so very expensive in both time and money that the tourist never ventured that way. Now Bagdad is all but connected with the Mediterranean by rail, and the journey once requiring a month may be made in less than 48 hours.

Still another obstacle has been the hostility of the native desert tribes. All that will soon pass. The explorer who ventured into the interior, even when guarded by Turkish soldiers, took his life in his hands. Sometimes he had to fight his way or buy his safety with gifts. The expedition to Nippur was broken up by the shooting of an Arab horse thief. The German work at Fara was closed when an Arab workman was killed. Nearly every expedition has cost human life. Now a railroad has been built along the Tigris; other lines will reach into the interior. The desert along the rivers has been irrigated and converted to farms. The face of the European, which many a Mesopotamian Arab had never seen before the war, will be familiar. The native distrust will disappear and the desert will be safe.

The methods of excavation will probably change as European influence spreads over the valley. In the past the work has been carried on in a most primitive manner. The men have been ignorant of any kind of labor. Their tools were crude and of local make. The American pick is too heavy for the Arab to handle. The shovel is a mysterious and complicated instrument, and nothing is more amusing than to watch an Arab in his vain efforts to guide a wheelbarrow. The men work in gangs of nine. The head of the gang is armed with a small one-armed pick, almost a toy, with which he loosens the dirt. With him two men with short-handled triangular hoes scrape the dirt into the baskets, and the other six men, with the baskets of dirt on their hips, slowly dance and sing their way to the dump. The future excavator will adopt more modern methods. The Arabs will be trained for their work. They will use modern implements, and the dirt will be taken to the dump by rail.

A generation ago the study of archaeology was hardly regarded seriously. To delve among the ruins of the past seemed to most people a useless thing to do. The archaeologist was a fossil as old and as dry as the things he would discover. The archaeologist of today is a scientist trained for years by the study of languages, history and art. He is a practical man for he must lead expeditions to dangerous lands and deal with savage tribes. He is no longer the fossil he may once have been. He must have the gift to touch the things long dead, and to make live again the long forgotten civilizations of the remote past. Mesopotamia once more may be developed to feed all the world with grain. No less valuable will be the archaeological discoveries made possible by the British possession of the valley.

Mobilizing a Lady Bug Army to Fight the Aphids

(Continued from page 507)

and the thousands of acres of grain infested with aphids last season, the task before the beneficial forms and the numbers of them required become apparent."

In cool weather, as has been said, the lady bugs are comparatively inactive.

(Continued on page 524)

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Mobilizing a Lady Bug Army to Fight the Aphids

(Continued from page 522)

Reproducing from eggs, they need warm temperatures to develop. The aphid is under no such restrictions. To quote this same authority further:

"During the late autumn sexed forms of aphids occur and eggs are produced. These eggs hatch in the first warm days of spring. The aphids hatching from these eggs mature in about 12 days and are termed 'stem' mothers. They are wingless and have the unusual ability of giving birth to living young without sexual intercourse. They reproduce at the rate of one to seven young per day, the progeny maturing in about 10 days and in their turn giving birth to living young at a similar rate. All the forms occurring during the spring and summer months are these agamic females, capable of producing living young. No true sex forms occur. After a few generations in the spring, both winged and wingless forms occur. The winged forms frequently fly to new fields and set up colonies there."

"In early summer most aphids occupy an 'alternation-of-heat' plant. Migratory winged forms occur and fly to some new host, often entirely unlike the spring host plant. For example, the prune aphid flies to the hop and constitutes the destructive hop aphid. This habit affords protection from their natural enemies. Where colonies are about to be wiped out these migratory forms may set up new colonies in situations where the enemy is absent. About 14 to 16 generations occur during the season. 'Fall migrants' occur in late autumn. These return to the host plant, the species occupied in the spring. Here true sexes are produced and eggs deposited."

From this it may be seen that the men in charge of the lady bug experiment are facing difficulties of considerable magnitude. These difficulties are increased by the fact that when artificially handled there is considerable mortality among the bugs, estimated as high as from 20 to 40 per cent. In spite of this it is hoped that artificial control will prove effective, particularly in the drier climate of eastern Oregon and eastern Washington. Experiments along the same line are being conducted in California by the Horticultural Commission of that state in conjunction with the Bureau of Entomology, and with gratifying results, it is reported.

The experiments that are being made both in California and Washington will be watched with interest by scientists and by farmers who are anxiously awaiting any means of destroying this serious menace to their crops.

A "Super-Charged" Airplane Engine

(Continued from page 512)

proportionately to the air density. The blower comes into operation at a low altitude, and gains speed gradually, until it is operating under full load conditions, at approximately 20,000 feet altitude. The power of the engine, which would be lost through change in atmospheric density, is thereby recovered.

It is interesting to compare the results achieved with this device as against the results without it. The engineers supply the following significant figures:

The engine shown in the illustration on page 512 weighs 480 pounds, and is rated at 210 horse-power at sea-level. At 20,000 feet altitude, this engine normally develops about 100 horse-power. The engine with the super-charge blower weighs 530 pounds and develops 210 horse-power at sea-level. At 20,000 feet altitude, however, the horse-power remains the same, namely, 210.

The Liberty engine develops approximately 400 horse-power at sea-level and weighs 860 pounds. At 20,000 feet, the horse-power developed is less than 200. With the super-charge blower, the weight becomes 910 pounds, and the horse-power at 20,000 feet is maintained at 400.

The superiority of the first engine over the second at 20,000 feet is remarkable and should be noted. The smaller engine develops only one-half the power of the larger at sea-level, but, equipped with the super-charge fan, it develops slightly more power at 20,000 feet. Moreover, the difference in weight is 330 pounds, in favor of the smaller engine. At this altitude the weight per horse-power is 2.5 pounds for the smaller engine and 4.3 pounds for the Liberty engine.

It was a coincidence that within the last few weeks, an item appeared in the newspapers announcing the development in Paris of a similar device, which has been designed by the eminent French engineer, Rateau, so well known for his work in the turbine field. Detailed technical description of this device has not been published, and such information as we have been able to acquire has been gleaned from an illustrated article, which appeared in one of the Paris newspapers.

While there are fundamental differences between the American and Rateau super-charge blowers, the functions of the two are the same, and the general application to the engine of both devices has been accomplished in a somewhat similar manner.

The essential difference between the American and Rateau super-charge blowers appears to be in the method of drive. The American blower is driven mechanically, whereas the Rateau blower is operated by a turbine actuated by the exhaust gases of the engine. From available information, it would seem that the Rateau blower is generally similar to the American blower, consisting of a fan, operating at approximately 30,000 revolutions per minute; the method of mounting and connection to the carburetor is also very similar.

The exhaust turbine drive has received serious study on this side of the water by various engineers, but as yet, the difficulties have not been successfully overcome. The back pressure, which the exhaust turbine imposes on the engine, results in a serious loss of power and economy, and moreover, causes the engine to heat up with resulting valve and piston trouble of the most serious nature. The terrific heat is also very destructive to the turbine.

The development of a successful super-charge blower opens up enormous possibilities in the aircraft field, and it would seem that the future holds much in store for the successful application of such a device to all military and high speed airplanes, designed to operate at high altitudes. The theoretical possibilities of high speed at high altitudes are almost unlimited. In fact, the human element is the only factor that would seem to constrain progress in this direction. It is probable that the development of the super-charge idea will be applied to the human occupants of the plane as well as to the engine, and imagination pictures airplanes of the future proceeding through the upper strata of the atmosphere, 30,000 to 40,000 feet above the earth, at speeds of from 300 to 500 miles per hour.

Pulling the Trigger by Fluid Pressure

(Continued from page 513)

This gear was turned over to a naval lieutenant who made a number of improvements, the finished product being known as the Scarff gear. The idea once in hand, numerous mechanical gears were brought out, but all were handicapped by one great drawback which it seemed impossible to overcome. The timing was a delicate operation, and the adjustments necessarily fine. The mechanical gear, constructed of metal parts, could be timed perfectly on the ground, but the intense cold of the higher altitudes caused the metal to contract, and the timing would be thrown out of adjustment. Furthermore, the very active friction of the working parts caused severe wear, and so tended to nullify the accuracy of operation.

The problem came to the attention of M. Constantinesco, a Rumanian by birth,

(Continued on page 526)