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OUR

INSECT FOES

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How to Deal With.

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POPULAR GARDENING AND FRUIT GROWING.

THIS is a monthly journal devoted to all branches of practical horticulture, and alike useful to those who garden for profit or for pleasure. In character it is bright, terse and readable, great pains being taken by its managers to have every article in its columns directly useful and instructive. It is profusely illustrated, in this respect standing unequaled by any other periodical of its class in the world.

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POPULAR GARDENING AND FRUIT GROWING,
BUFFALO, N. Y.

OUR INSECT FOES;

HOW TO DEAL WITH.

INTRODUCTION.

ACCORDING to the census of 1880 it is computed that the aggregate losses from injurious insects in the United States equals *two hundred millions of dollars a year*, while able economic entomologists are not wanting who place the loss at least one-half higher. It is estimated that the Apple Worm or Codling Moth alone has in recent years destroyed nearly one-half of the Apple crop of the country, representing to our fruit growers a loss that runs high into millions of dollars yearly.

But along with the marked increase of injurious insects in late years, there has happily been increased activity also on the part of cultivators and of the National and State Governments, in devising means and remedies for successfully destroying the former. And with excellent results too, for it is most gratifying to note that at the present time hardly a single formidable insect enemy to the horticulturist exists but that there is also some simple remedy known for its destruction, or at least for greatly lessening the force of its damaging attacks.

It is for the purpose of bringing before the cultivators of the country at this time a summing up of the most approved methods for dealing with our more prominent insect enemies that the present treatise has been published.

In its preparation I have been fortunate in receiving valued help from Prof. A. J. Cook, of the Michigan Agricultural College, (Agricultural College P. O., Michigan), a gentleman, whose close study and many experiments in the field of our insect foes, as well as in that of the Honey Bee, has made his name widely famous; and also from

D. B. Wier, of Lacon, Ill. Mention is also gratefully made of the works of such eminent entomologists as Prof. J. A. Lintner, of Albany, N. Y., Prof. C. V. Riley, Washington, D. C., and of those of Dr. Harris ; besides of the assistance of other practical cultivators and observers. Together, it is believed that the collection of remedies brought within the following pages, possess such value as will enable every cultivator of trees, plants, and flowers to very successfully cope with the multiple foe.

In conclusion, however, let the fact be impressed that no insect remedy can prove successful unless it be applied promptly at the proper time, hence it is urged that whatever is done in the war against this enemy be done early, vigorously, and with all due persistence.

BUFFALO, N. Y., February 1, 1887.

ELIAS A. LONG,
*Editor of Popular Gardening and
Fruit Growing.*

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POPULAR GARDENING PUB. CO.

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Alum Water. See Remedy 5.

Ants. (*Formica*). These very common insects are sometimes troublesome not only from their manner of throwing up hills, but also through being destructive to vegetation.

Remedy 1. Trapping with Sunken Bottle in Hills. The advantage of this course is that no injury can possibly result to the roots of adjacent plants, as is the case when scalding remedies are applied. The mouth of the bottle should be even with the surface of the hill, and it should be partly filled with sweetened water.

Rem. 2. Trapping with Sponge. Obtain pieces of coarse sponge. Dip them in sweetened water and place on old dishes where the Ants abound. When they are black with Ants throw them into boiling water, afterwards washing them out and renewing the process till the colony is destroyed.

Rem. 3. Fresh Bones.

By laying these where Ants are troublesome they will quickly gather on them. When these are black dip in scalding water, repeating the operation.

Rem. 4. Molasses and Poison. Place a dish containing some molasses in which a small quantity of arsenical poison or cyanide of potassium has been mixed; or the same may be spread on trees, fences, leaves, and other frequented places.

Rem. 5. Destroying in Nest. Apply boiling water, hot alum water (prepared by dissolving one pound of common alum in three gallons of rain water, and heating) or soluble phenyle water, (prepared by dissolving three spoonfuls of fluid to four gallons of water) freely to the nest.

Aphis or Plant Lice. It is probable that every kind of tree, shrub, flowering plant and herb has some species of louse of the family of Aphididæ infesting it. The common Green, Black and Blue Lice which trouble our house, greenhouse and garden

Fig. 2. *Aphis or Plant Louse Greatly enlarged; an Ant "milking" the same.*

plants, those of similar colors infesting the Apple, Cherry and other fruit trees, besides numerous ornamental trees and shrubs, afford familiar examples. The past year or two has found the kinds which trouble fruit trees, and especially the Apple, unusually prevalent in many sections, causing on the whole immense damage.

Rem. 6. Kerosene Emulsion. It is fully proven that the kerosene soap and mixture when rightly applied will surely kill plant lice. I (Professor Cook) use one quart of soft soap, one pint of kerosene oil, and two quarts of water. These are mixed and stirred until a permanent union is formed. One quarter pound of whale oil soap may replace the soft soap. A good way to mix them is to use a good force pump, and force the liquid back into the vessel containing it. This

Fig. 3. The Hose in the tree top. Applying the kerosene emulsion or other poisons.

stirs the mixture so violently that a permanent mixture is soon formed. This liquid is then diluted with four gallons of water. To use this it should be applied by the use of a good spray nozzle, and powerful force pump, which I have found the best for all purposes.

This throws a fine spray with great force, and thus is very sure to touch all lice, and yet is so dilute that the plants are not injured, and the fine spray insures economy as well as safety. Of course it goes without saying that the leaves, especially when they roll up, as they often do in such plants as the Snowball, if attacked by the lice, are a serious obstacle in the way of making this application. The liquid must touch every louse. This is more likely when applied with great force as suggested above. Yet even then, though every pains be taken, the lice will not all be reached. The past spring we found that the young lice on the buds, and even the eggs, just before hatching, were alike susceptible to this treatment. At this time there was no foliage to interfere, and so it was not difficult to make very thorough work. I recommend, especially to nurserymen, that they learn to detect the little dark eggs which are usually spread thickly in and about

the buds, where they were placed by the mother louse the previous fall, and if they are found very common, that he apply the kerosene mixture early, just as the buds are swelling preparatory to bursting.

Rem. 7. Coal Tar Fumes. Mr. Crane, a successful fruit grower of Lockport, N.Y., states that he has found the burning of a wad of rags attached to a pole and coated with coal tar, a safe and complete remedy for the Aphis. Plum trees that were black with this pest were, by a few applications, perfectly cleaned. The wad should be burned underneath and not too near the foliage.

Rem. 8. Tobacco Water, Dust, etc. For use on a small scale as about Roses, Geraniums, Salvias, Verbenas, Chrysanthemums, flowering shrubs, etc., the old remedy of whale oil soap and tobacco water, or the more recent and more convenient one of sprinkling the affected parts with tobacco dust, are effective.

Rem. 9. Fumigation with Tobacco. For dealing with this pest in the greenhouse fumigation with tobacco is almost universally practiced. This consists in burning dampened tobacco stems from the cigar maker's two or three times a week in all greenhouses during the season, to serve both as a remedy and a preventive. One pound for each five hundred feet of glass will usually suffice. A simple way of using the tobacco is to place the above quantity on a handful of lighted shavings, either on the floor or in a fumigator made for the purpose, which will cause a dense smoke. On a cement floor the fire needs no attention, as it quickly dies out, but with a wooden one or with wood near by, care will be required to protect it with sheets of metal or otherwise.

Fig. 4. The Daisy Pump; for throwing Liquids.

Rem. 10. Nicotyl. In the greenhouse and window garden, as well as under low bushes outdoors, Nicotyl vapor, produced by steeping tobacco, stems in water and causing the latter to evapor-

ate, or by simply scattering moistened tobacco stems between the plants, is one of the most simple and complete remedies known for these insects. The vaporizer shown in Fig. 21 is a capital thing where special regard to neatness is required in the use of the tobacco liquid, but it is no better than a lamp set under a shallow pan.

Rem. 11. Paraffine Oil. When young Larches, Pines, or other plants are infested, by watering them at intervals of three or four days for about three weeks with diluted paraffine in the proportion of a wineglassful to a watering can of water, they may be saved and restored to health.

Rem. 12. Hot Water. To submerge affected plants or branches in water of a temperature of about 125° or 130° will kill Aphis.

Rem. 13. Colonizing the Lady-bug. The common Lady-bug (see Fig. 18) (Coccinellidae) is an insectivorous beetle that destroys the Aphis with avidity. By encouraging the presence of this insect on house and other plants, the lice may be completely kept down.

Rem. 14. Promoting Growth. It should perhaps be stated that plant lice, as well as all other insects, are always more troublesome on plants or trees in an enfeebled condition than on others. Any course that tends to promote vigor will be helpful in withstanding their attacks.

Apple Worm or Codling Moth. (*Carpocapsa pomonella* Linn). For this most injurious insect a very complete remedy is now in use, one easy of application, and which, if

Fig. 5. The Codling Moth, (perfect insect of Apple Worm).

Fig. 6. The young Apple Worm working in towards the core.

rightly used, will result in saving at least seventy per cent of the Apples commonly lost by its ravages. The remedy is the arsenical poison found in both of those well known insecticides, Paris Green and Lon-

don Purple. Referring to the use in detail of these remedies, Professor A. J. Cook gives the following:

Rem. 15. Liquid Arsenical Poisons—London Purple or Paris Green. The best remedy for the Codling Moth is to use either London Purple or

Fig. 7. Worm of Codling Moth in the matured Apple.

Paris Green. The remedy is not only efficient, but is also easy of application, and not expensive. I have now tried this thoroughly for six years, and in each and every case have been more than pleased with its excellence. I know of no one who has tried it in vain. The past season has shown that in using Paris Green or London Purple—the last seems preferable, as it is cheaper, more readily mixed, and very effective—one pound to one hundred (100) gallons of water is quite strong enough. It is best to wet the powder thoroughly and make a paste before putting it into the vessel of water, that it may all mix, and not form lumps. It is best to apply the mixture as soon as the blossoms fall, and again in three weeks, in case of any heavy rain. Usually I have found one thorough application, made early, so effective that I have wondered whether it was best or necessary to make more than one. I do think, however, that it must be early. In May and June the calyx of the Apple is

up, (see Fig. 6) and so the poison is retained sufficiently long to kill most all of the insects. For a few trees we may use a pail, and a hand force pump, always keeping the liquid well stirred. One common pail of liquid will suffice for the largest tree. A teaspoonful of the poison is enough in a pailful of water. For a large orchard common barrels should be used, and drawn in a wagon. I prefer to have the barrels stand on end, with a close movable float, with two holes through it, one for the pipe or hose from the pump, and the other for a stirrer. If very large orchards are to be treated a good force pump should be fastened to the barrel. In western New York the handle of the pump is connected with the wagon wheel so that no hand power is required other than to drive the team and manage the pipe which carries the spray. The spray may be caused by a fine perforated nozzle or a cyclone nozzle. The finer it is the less liquid will be required. In treating an orchard the great point is to be thorough. If a still day can be had I would drive on a very fast walk and drive through the orchard twice in each space, first north and south, then east and west, so as to go on all sides of each tree. This makes very thorough work. A stop-cock so arranged as to permit the instant change of water from the hose so that it will flow into the barrel or tank in case of vacancy of trees in the row is often convenient. Hardly any one thing on the farm will pay better than this spraying Apple trees with the arsenites. As to the danger of using, this amounts to nothing provided the spraying is done before the Apples have begun to hang downward.

Apple Maggot. This maggot, which mostly infests fall Apples, but occasionally attacks winter fruit, is much to be dreaded. It is now a fruit enemy from New England to Wisconsin. From the fact that it tunnels Apples through and through and thus utterly ruins the fruit which it attacks, makes it more damaging in some respects than even the Codling Moth. Should it become as common as the Codling Moth, and should it attack winter fruit generally, it would indeed be a serious pest. Like the Codling Moth, it causes the fruit to fall to

the earth. In September and October the insect leaves the Apple and passes into the earth to pupate.

Rem. 16. Feeding the Fruit. Feed all the affected Apples in early September. An enter-

Fig. 8. *Asparagus* infested with the *Asparagus Beetle* in its different stages. See Remedies 17 to 19.

prising Michigan farmer, at my (Professor Cook) suggestion, made full use of this remedy, after suffering seriously for two years. He has apparently exterminated the pest.

Arsenical Poisons. See Rem's. 15, 43, 84, 108.

Asparagus Beetle. This is becoming very troublesome in some parts of the country in

its grub or larva state, not only eating through the stems of the plants, but also destroying the leaves and seeds. See Fig. 8.

Rem. 17. Dusting with air-slacked lime on a quiet morning while the dew is on the plants.

Rem. 18. Cutting the Stalks. Those infested should be carefully cut out and carried away and burned.

Rem. 19. Fowls. Employing a flock to feed on the beetles.

Aster Root Louse. See Aphis or Lice.

Bag or Basket Worm. This species, which proves not only a serious depredator to shade and fruit trees, but especially to the Arbor Vitæ in some places, appears to be on

ing on a leaf, at once begins to gnaw it, and construct a portable case or bag in which to live.

Rem. 20. Hand Picking the Bags. The best method of arresting the depredations of this insect is to collect the cases when they have attained a size to permit of their easy discovery, and crush or burn them. This is a very effectual method, for as the female has not the power of flight, being without wings, and never leaves its case even for the deposit of its eggs, a tree which has once been cleared of the bags can only become re-infested from contact of its branches with another infested tree, or from such a proximity to it that the intermediate space of ground could be traversed by caterpillars driven to migration for their food.

Rem. 21. Arsenical Poisons. Undoubtedly either of the arsenical insecticides (which see) applied to their food-plants would destroy the young larvæ.

Bagging Grapes. See Remedy 78.

Baits of Potatoes, etc. See Remedy 153.

Bands on Trees. See Remedies 39, 45.

Bark Lice or Coccus (Coccidæ). A common class of insects, varying very much in form and which are injurious to many trees, shrubs, and plants, hardy and tender. A familiar form of the genus is represented in the numerous scale insects that infest the bark of Apple, Peach, Elm and many other trees, as well as that of greenhouse and indoor plants. Of these insects in this scaly stage some of them are oval with slightly convex scales, others are decidedly convex, and either formed like a boat turned bottom side upwards, or are globular or kidney-shaped. Another form is found in the white scale on Ivy, Oleander, Orange and similar leaves. Still others, while in a younger stage of growth are mealy, hairy or woolly, of which the well-known Mealy Bug of our greenhouses and window gardens forms a good illustration. The insects live by inserting their beaks into the bark or leaves and draw from the cellular substance the

Fig. 9. Bag Worm. A, full grown larva with bag. B, C, follicle and puparium cut open to show eggs. D, young larva with their conical upright coverings.

the increase, and should be carefully looked after. During winter their dependent sacks or bags (See Figure 9) may be seen hanging on the twigs of the trees. As early as May of the next season the eggs on the bags hatch into small active larvæ, which crawl-

sap that nourishes them. Concerning the Bark Lice or Coccus on Apple trees, the young shoots of which in many cases are completely covered with them, Professor Cook says he has known whole orchards to languish because of this pest. The young lice appear about two or three weeks after the Apple blossoms fall, insert their little beaks—really suction pumps—and soon suck the sap and vigor from the trees. By August the full formed scale is seen, under which are stored 80 or more small white eggs which will hatch the following June.

Rem. 22. Carbolic Acid and Soft Soap. A strong solution of soft soap is the old and reliable remedy. Professor Cook has improved on this by the addition of crude carbolic acid, making the mixture as follows: One quart of soft soap to two gallons of water heated to the boiling point, when one pint of crude carbolic acid is added, stirring the solution well at the same time. This should be applied early in June, and again some months later, with a cloth or scrubbing brush, to all affected parts.

Rem. 23. Whiskey for Meaty Bugs and Others. Applied to the insects with a brush, this is an effective remedy. Alcohol diluted with a little water answers the same end.

Rem. 24. Fir-tree Oil. This is one of the most recent and highly praised remedies for all species of Coccus. The oil is mixed with water at the rate of one fourth pint of the former to two and a half gallons of water and syringed over the plants about once a week. For strong-growing Dracenas, Crotons, etc., a somewhat larger proportion of the oil might be used.

Rem. 25. Pyrethrum Tea or Decoction. Prof. E. W. Hilgard found that a tea simply prepared from the unground flowers of Pyrethrum, when sprayed from a fine rose, to be efficient even against the armored scale-bug of the Orange and Lemon, which fell off in two or three days after the application, while the young brood are almost instantly killed. The tea should be made with briskly boiling water covered over closely to prevent evaporation, but not boiled, as that would seriously impair its strength.

Rem. 26. Fish brine. This article has proved

effective, the oil with which it is charged doubtless penetrating the scale and killing the eggs beneath.

Bean Weevil (*Bruchus obsoletus*). This insect is becoming quite troublesome in some sections. As the beetles do not all emerge from the beans until spring, they are liable to be planted in the seed and the evil thereby be continued and increased.

Rem. 27. Keeping over the Seed. If the beans intended for seed be tightly tied up in stout paper bags and be kept until the second year, there will then be no living beetles within them, and they will be equally valuable for seed. If, however, they have been badly perforated they should not be used for planting, as many of them would not germinate. For other remedies see Pea Weevil.

Bisulphide of Carbon. See Remedies 102, 115, 120.

Birds that Destroy Insects. (28) Besides the kinds named under remedies 41, 46, 47, 96, as destructive to certain pests, the following are to be classed among the most helpful kinds in the general warfare against insects: Robins (cut, and other earth worms) Swallows, Night Hawks, Purple Martins, (moth-Catcher) Pewees, (striped Cucumber bugs) Wood Thrush and Wrens, (cut worms) Cat Birds, (tent caterpillar) Meadow Larks, Woodpeckers, Crows, (wireworms) Blue-throated Buntings, (canker worms) Black, red-winged birds, Jays, Doves and Pigeons, Chippys, (strawberry pests) Quails, (chinch bugs, locusts) Whip-Poor-Wills, (moths) Hawks, except Cooper's, all night birds, Owls, etc., Tanagers and black-winged summer Red birds, (curculios) Nut Crackers, Fly Catchers, Chimney Swifts, Indigo Bird, Chipping and Song Sparrows, Black Birds, Mocking Birds, Titmouses, Vireas, Orchard Orioles.

Blister Beetles. Of these there are a number of species, known as the Ash-gray, the Margined, the Striped, etc.

Rem. 29. Beating Down. This should be done into a pan of water, soap suds or oil.

Borers. (See *Peach Borers*, *Currant Borers*, and *Sugar Maple Borers*.) There are three species of beetles that do serious injury to all parts of our country by boring into the Apple and other trees. The big or flat-headed borer, which cuts out a wide space just under the bark on the southwest side of the tree, and in case of small trees entirely girdling the trunk, and two species of beautiful longicorn or long horned beetles, *Saperda candida* and *Saperda cretata*, which bore through and through, and keep feeding for three years. The first of these three work only one year, and seem most destructive to trees that are not quite up to the standard in vigor. Thus newly set trees are specially susceptible to the attack of this beetle. All three of these insects lay their eggs in June and July, and all may be best treated in the same way and at the same time.

Rem. 30. Preventing Egg-laying. My experience has met with excellent success by use of soft soap. I rub the trunk and main branches with this, early in June, and again three or four weeks later. If I can make but one application, I use the crude carbolic acid and soft soap remedy No. 22. With this, and ungloved hands, and uncovered arms, I, by use of a cloth, rub the whole trunk and large limbs of the tree, using care not to sprinkle the foliage. In case the acid is very strong it might kill the foliage. This is applied to the trees two weeks after the blossoms fall.—PROFESSOR COOK.

Rem. 31. Probing for the Borers. See 103.

Rem. 32. Coal Tar Paper—Bands of paper thoroughly saturated with coal tar, and eighteen inches wide, tacked around the base of trees troubled by the Root Borer have proved successful.

Rem. 34. Coal Tar Direct—Mr. Chas. E. Thesher, of Shawnee Co., Kansas, recently wrote to the *Prairie Farmer* as follows: "I have lost one orchard by the Round-headed Borers. In another orchard I am having better luck, keeping them

out with coal tar. I apply with a brush to the tree up 18 inches, after first looking for any borers then in the tree. It has no bad effect. As the tree grew, open spaces of new bark appeared up and down the trunk. Next year I filled these up. That year the bark under the tar loosened more or less, exposing healthy new bark. Next year I scraped off the rough loose scales and put on a new coat. That, or *something else*, has kept out borers. Any way it don't kill the trees."

Buhach. See *Pyrethrum*.

Cabbage Maggots or Club Root. See *Mag-gots*.

Cabbage Worm. (*Pieris raphæ*). This worm, produced from the eggs of the white Rape Butterfly, represented by Figure 10, is a most injurious pest to Cabbage in most places, and especially in small gardens.

Fig. 10. *Butterfly of the Cabbage Worm.*
Remedies 35 and 38.

They come in two broods, the first Butterflies being seen in May, the second in August, and the progeny of the latter causes the most trouble. Either the same or else a very similar worm also devours the Mignonette and some other plants.

Rem. 35. Pyrethrum or Buhach—Liquid Form. A tablespoonful of the pure powder to two gallons of water, applying it by sprinkling with a watering pot, or better yet, by force with a pump. Here, as in all cases where we use liquids to destroy insects, especially if as in this case it kills by contact, we must apply with great force, so that the liquid will spatter everywhere and so touch every insect.

Rem. 36. Pyrethrum—Dry Form. One part of the dry powder mixed with forty parts of finely sifted wood ashes, dusting this over the Cabbages. If the mixture is prepared a day or two before using, keeping it in a perfectly tight vessel in the meantime, it will have even a better effect than when used freshly mixed.

Rem. 37. Hot Water. Sprinkle the plants with hot water with the aid of a watering can and hose.

Rem. 38. Quassia Water. An infusion of one pound of Quassia to one third barrel of water is recommended for killing the Caterpillars and preventing subsequent attacks. The same remedy has been used with success for plant lice and other insects.

Canker Worm of the Apple, Elm, and Some Other Trees. (*Anisopteryx vernata* Peck.)—While this insect is not of frequent occurrence outside of the New England States, it is of the utmost importance to fruit growers and others that it be not permitted to increase and extend until it shall become established. Its sluggish wingless female moths rise from the ground and creep slowly up the trunks of Apple, Elm, and less abundantly many other trees, chiefly in March, but also later, and somewhat in the fall, laying their eggs in clusters on the bark, these being secured by a grayish varnish. The eggs usually hatch about the time the Red Currant is in blossom, and the Apple leaves begin to grow. The little worms attack the tender leaves near by, first piercing them with small holes, which later become larger and more irregular, and at last nearly all parts but the midrib and veins will be consumed. When young they are generally of a blackish or dusty brown color, with a yellowish stripe on each side. When fully grown, at which time they measure one inch or less in length, they usually assume an ash color on the back, and black on the sides, below which the pale yellowish line remains. They vary in color somewhat, however, being at times found of a dull greenish yellow, or of a clay color, and even green.

Rem. 39. Banding. Banding the trees with strips of heavy paper or cloth, coated with tar or printer's ink, early in the spring, to prevent the ascent of the wingless females, is an old and effective remedy. It has been found that the residuum of kerosene oil is one of the best remedies that can be used on bands, it being both cheaper and lasts longer (about six days) than ink or tar. The latter articles must be frequently renewed. Traps made of tin and muslin to prevent the ascent of the worms are also in use.

Rem. 40. Arsenical Poisons. The spraying recommended in Remedy 15 for the Codling Moth on Apple trees answers at the same time to destroy the young Canker Worms. On Elm and other trees this same remedy may be applied for its destruction.

Rem. 41. Birds. The Cedar bird devours large numbers of Canker worms; a hundred caterpillars have been found in the stomach of one of these. Next in usefulness according to Dr. Lintner, come the Indigo bird, the Chickadee, the black billed Cuckoo, Yellow Bird, the Summer Warbler, the rose-breasted Grosbeak, the Blue Bird, the King Bird and the Robin, in the order named.

Rem. 42. Swine. By allowing swine to run in the orchards in the spring many will be destroyed.

Carbolic Acid. See Remedies 22, 159.

Caterpillars. The remarks which here follow will apply to most kinds of Caterpillars that infest fruit and shade trees, shrubs,

Fig. 11. Caterpillar of White Tussock Moth, Rem. 43, 47.

etc. But to the well-known Caterpillar of the white-marked Tussock Moth (*Orgyia leucostigma*), and which is shown feeding on a leaf in figure 11, special attention is here called. It is more commonly familiar

in the cities than elsewhere, owing to its depredations, often severe on street and other shade trees, and calling for the common but questionable remedy of cotton bands about the trunks. In color it presents the rich and varying diversity of cream yellow, (sometimes changing to white), velvety black and brownish spots, stripes and brush-like hairs, with a coral red head. There are also two long plumes of black hair rising from the head and a similar one from the last dorsal joint.

Rem. 43. Arsenical Poisons. Same as 15. "London purple, as already shown," says Professor Riley, in a recent report, "is perhaps preferable to white arsenic or Paris green, in that it is not so liable to burn the leaves, while its color enables one to readily distinguish poisoned from non-poisoned trees. Moreover it is very cheap. From one-quarter to three-quarters of a pound of this substance and three quarts of cheap or damaged flour, to render the mixture adhesive and to lessen the tendency of the poison to burn the leaves, should be used to a barrel of water. The greater quantity of the poison may prove too strong for delicate young trees, and it will be best for general application to make the amount from three-eighths to one-half pound to the barrel. An apparatus for applying can be readily constructed, such as has been used on the grounds of the Department. It should consist of a water tank mounted on a cart and furnished with a strong force pump, operated by one man and furnished with two sets of rubber tubing, each supported by a bamboo extension pole (Figure 3), with a cyclone nozzle at tip. With such an apparatus as this three men could drive along the streets and thoroughly spray two trees simultaneously; while if it were found advisable, four independent tubes and four men to work them could be employed, with a sufficiently powerful pump, and thus expedite the work.

Rem. 44. Destruction of the Orgyia Eggs. This, Prof. Lintner suggests, may be accomplished to a great extent with moderate labor. During June and later, and especially late in fall and during winter, the egg-masses may be seen as glistening, slightly woven white objects, becom-

ing weather-worn after long exposure, and often occurring in patches of a dozen or more. They may be met on the trunks or larger branches of trees—a favorite location being where limbs are cut—in the corners of angles about fences, under window sills, etc. Children prove ready collectors for a small reward. Those out of arm's reach can be removed with a scraper prepared for the purpose. To show how effective may be this means of preventing the Caterpillar's appearance, it may be said that over 700 eggs of these have been counted in a single egg-mass.

Rem. 45. Cotton Bands. The indiscriminate use of these, says our able State Entomologist, Prof. J. A. Lintner, in his last report, must be condemned for the Orgyia. They may be of service, and they may be decidedly objectionable, from the fact that the attack, in almost every instance, proceeds from the eggs deposited the preceding year upon the tree. If, therefore, Remedy 43 could be applied with the certainty that no egg clusters are upon the tree, then a band applied would prevent any wandering Caterpillars from ascending its trunk. But with the eggs or the young larvæ being already upon the tree, the band will prove a positive evil, in preventing migration to other feeding ground. The barriers, too, prevent the mature Caterpillars from descending to the rougher bark of the lower part of the trunk, in the crevices of which they prefer to build their cocoons, and would confine them to the tree, where it would be difficult to discover the egg-clusters, and destroy them.

Rem. 46. War Upon the English Sparrows. Our troublesome English sparrows not only decline to eat this Caterpillar, but by force of numbers and their pugnacious dispositions they drive away the few birds that would feed upon them. Of such, according to Prof. Lintner, there are but the four named under Remedy 47.

Rem. 47. Birds. Of these but four species that destroy this Caterpillar are known, namely: the Robin, the Baltimore Oriole, the black-billed Cuckoo, and the yellow-billed Cuckoo.

Celery Fly. For preventing the ravages of this pest the following remedies may be of use:

Rem. 48. Soluble Phenyle. By syringing the

plants with a very dilute mixture of this drug, and water, the insect may be checked.

Rem. 49. Gas Lime. This applied freshly in the autumn to the ground to be planted the next year, incorporating it a few inches deep, will kill the pupæ of the fly.

Celery Worm. Treat as directed for Cabbage Worm or for Spingies, which see.

Cherry and Pear Tree Slug. The Cherry and Pear tree slug is two brooded. The black flies come in May, lay eggs on the

Fig. 12. *Cherry and Pear Tree Slugs at Work*, Remedies 45, 47.

leaves of the trees, and the larvæ or slugs, which are brown and slimy, feed upon the cuticle of the leaves. A second brood comes in September.

Rem. 50. Road Dust, Ashes, or Air-Slaked Lime.—I know (Professor Cook) by actual trial that road dust thrown on to these slugs will sometimes drive them all from the trees. I also know that at other times it will apparently do little or no good. Whether this arises from the varying character of the earth or a different condition of the insect, I do not know.

Rem. 51. Pyrethrum or Bubach—Same as Remedy 36. We have used, always with perfect satisfaction, using a Woodason dust bellows.

Rem. 52. Liquid Hellebore. One pound of Hellebore powder to twenty-five or thirty gallons of water, finely sprayed over the affected trees or bushes, is one of the best and most easily applied remedies. The Hellebore kills not only by contact but also by being eaten. Hence Professor Lintner finds that the addition of a small

quantity of flour to the water gives it greater adhesiveness and worth, over a longer period.

Rem. 53. Kerosene Emulsion. Same as 6.

Cherry Worm. See Curculio.

Chrysanthemum Lice. See Aphis, or Plant Lice.

Coccus. See Bark Lice, or Coccus.

Coal Tar. See Remedies 7, 32, 137.

Codling Moth. See Apple Worm.

Corn or Boll Worm. (*Heliothis armigera*).

This pest, so destructive to the Cotton and Corn-fields of the Southern States, has in recent years made its appearance as an injurious insect in the North. Figure 14 represents the worm at about its ordinary size. It not only attacks growing Corn, devouring the soft kernels in patches, but also bores into the fruit and stems of the Tomato; it eats into the pods of Peas and Beans, and burrows into Squashes, Peppers, Pumpkins, as well as into the stem of Gladiolus, etc.

Rem. 54. Hand-picking. Experience in the South has shown that if the first brood of the Caterpillars are collected and destroyed their ravages may be controlled. Their presence can be discovered either when at work on the surface, or else, as in the case of Corn, by the holes eaten into the husks.

Fig. 14. *The Corn or Boll Worm.*

Rem. 55. Attracting by Odors and Drowning. Where the insect occurs abundantly it is very successfully dealt with by attracting the moth to a mixture of molasses and vinegar. The odor, it is said, will draw them quite a distance, and in their attempts to feed they readily become caught and drown.

Copperas or Blue Vitriol Water. (56). A solution of Blue Vitriol (Sulphate of Copper) in the proportion of one ounce to a pail

of water, will serve to kill many kinds of grubs, maggots, etc., in the soil, and of small caterpillars on plants.

Cucumber Beetle. (*Diabrotica vittata*.) This is a well-known small striped beetle that troubles Cucumbers, Squashes, and Melons, making its appearance as soon as the leaves begin to expand, and a number of broods are produced during the course of the season. It is to the young plants that the insect is most injurious, and the great secret in dealing with it is to begin the treatment positively in advance of the insect's appearance.

Rem. 57. Plaster or Ashes, etc., and Kerosene. To two quarts of plaster, wood ashes, or flour of bone, add one tablespoonful of kerosene, rubbing the mixture between the hands until the oil is well distributed. Sift or hand sprinkle this over the plants as soon as the first leaves appear, repeating it a few times until all are through the ground, and also later if this be required.

Rem. 58. Arsenical Poisons (which see.) Applying a little when the vines are dry.

Curculio, or Weevil, of the Plum, Apricot, Cherry, etc. (*Conotrachelus*). This is the greatest enemy of the Plum and some other stone fruits, while also affecting the Apple and other kinds. Within a few years especially serious damage has been done to Apples. Its attacks are followed by great deformity in the fruit. The Apples are often stung many times and become so gnarled, distorted, and scarred as to be wholly worthless. From observations made the past season, I believe the Apples will suffer attack very rarely

Fig. 14. Curculio Beetle stinging a Plum previous to laying its eggs.

if Plum trees are scattered liberally among the Apple trees. In this case the Weevils will attack their favorite, the Plum, and so

the Apples will go free. If this prove invariably true, as it has in several cases which have come under my observation the past season, then it will pay doubly well to plant the Plum trees. The Plums will protect the Apples, and by jarring, the Plums may be saved and the fruit grower will secure good crops of both fruits. Dr. Harris says that the Cherry Worm, which is very common in this fruit, is identical with the Plum Curculio, but unlike the effects of the insect on the Plum, it does not cause the Cherry to drop prematurely to the ground.

Rem. 59. Jarring Process. This is a simple and adequate remedy within the means of every-

Fig. 15. Popular Gardening's Non-Patented Curculio Catcher.

one's employing. It consists of spreading cloth sheets, or frames of some form covered with cloth, under the tree, jarring the tree sharply by striking on an inserted spike or on the stump of a lower limb removed for the purpose. An excellent device of our own for this purpose is illustrated in Fig. 15. The cloth at the near end of the frame is attached to a single light strip of board, while at the center of the entire area it is divided into two parts, the further end of each being attached to a short cross piece, which in turn is supported by one arm of a light frame, as shown in the figure. The two further cross pieces are one foot apart at B to admit of bringing

the frame under the tree, with its center and main cross arm resting against the trunk during the jarring. A flap of cloth, A, extends from one of the projecting parts to the other, to be raised and again let down in adjusting the frame. Concerning the jarring operation, this should be begun as soon as the insect commences its work, which is soon after the fruit is set. The work of the insect may easily be detected by the small crescent-shaped mark that is left on the fruit. The jarring process need not necessarily be performed early in the morning while the dew is on, or late in the afternoon. The insect will not so readily let go its hold, as when it is actually at work, and this is not until the dew has dried off and the atmosphere has become warm. The number of times that an orchard should be gone over depends upon the varieties. Those that become hard and downy soon, like Richmond, Lombard, Reine Claude, etc., require much less jarring than large, smooth kinds like Pond Seedling, Yellow Egg, Coe's Golden Drop, etc. It should be repeated daily for one week, and then at intervals of a day or so between, so long as the insect remains at work.

Rem. 60. Poisoning by using the arsenical poison of number 15, spraying the trees, Weir says: First, just before the blossom buds open; second, two weeks after the petals fall. If a weak, soapy kerosene emulsion is used at this spraying to mix the poisons in, it will also destroy the leaf lice, aphides, bugs and all other insects injurious to the fruit and foliage; and then a third spraying about June 10th, and your fruit is safe.

Rem. 61. Planting Wild Plums. These Plums planted en masse in sufficient quantity on a place will gather unto themselves all the Plum Curculios on the place and so protect all other fruits from its ravages. And being on them the female naturally lays her eggs in the fruit, few of which ever hatch, and so few reach maturity in this fruit. The extensive planting of the same on a place will alone well nigh exterminate the pest.—WIER.

Currant Borer. This little Caterpillar, for it is really the larva of a beautiful little blue moth, is becoming more and more common. The moth lays the eggs on the canes of the Currant in June, and the larva

as soon as the egg hatches enters the stalk, and not only hollows it out, but kills it outright. I (Professor Cook) know a certain region in Michigan where these little pests have ruined every Currant plantation except a few that have been carefully looked after.

Rem. 62. Removing Affected Parts. Cut all such off late in the fall or early in the spring and burn them. As the borers are now in the stems they are also burned. The diseased canes can easily be told by their dead or dying tips. Such treatment is the price of the Currant bushes wherever they are attacked by these insects.

Currant and Gooseberry Slug or Worm. (*Nematus ventricosus*.) This voracious insect differs from the Cherry slug. The flies are yellow, not black. The slugs are green, or green dotted with black, and not brown. They feed on the Gooseberry or Currant, and eat the leaf entire, instead of merely removing the cuticle. It is so readily dealt with by the timely application of remedies that there can be no possible excuse for the shocking damage often seen done to these useful fruits about town and country homes.

Rem. 63. Powdered Hellebore. Hellebore the best of known remedies and a perfectly effectual one. Properly applied no harm can possibly result from it. It should, according to Prof. Lintner, be used in the following manner. Early in the spring, as soon as the leaves of the Currant have fully put forth, watch for the first indications of the hatching and commencement of the young larvæ. You have only to look for these on the *lowest leaves of the bushes near the ground*. The indications will be numerous *small holes eaten into the leaves*. Sprinkle powdered Hellebore over these leaves, renewing it if washed away by rain, and the desired end is accomplished. If the Hellebore remains upon the leaves during the time that larvæ are hatching all will be killed, and none will remain for subsequent spreading over the leaves and for the need of future attention. If the first brood of worms is thus destroyed there will be few if any to form a second brood in June.

Rem. 64. Hand Pinching. Some find it convenient to watch for the first eaten leaves, and to pinch them off by hand and destroy them. The eggs are always to be found conspicuously arranged in rows upon the veins of the under side of the leaves.

Rem. 65. Nicotyl. Laying some refuse tobacco stems from the cigarmaker's in the center of each bush about May 1st, or mulching the bushes with tobacco stems, or these mixed with strawy manure, afford a complete remedy.

Rem. 66. Dusting with Soot. This has recently been recommended as being equally as destructive to this worm as is Hellebore.

Cut-Worms. (*Agrotis*, etc.) Of these destructive worms, which have the habit of leaving their places of concealment in the soil at night, coming to the surface and cutting off almost every kind of newly set vegetable and flowering plants, there are now known to be many species. Those of the genus *Agrotis*, being mostly thick, greasy-looking Caterpillars of some shade of gray, brown or green, variously marked, are the best known and well to be looked upon with dread.

Rem. 67. Poisoning. Put a teaspoonful of Paris green or London purple in two gallons of water, and sprinkle handfuls of grass, or green sods, which can then be scattered throughout the patch, walking crossways of the harrow marks. By doing this towards evening after the last harrowing, during the night the cut worms that are deprived of their food will be out looking for fresh pastures and will appropriate of the prepared bait, the smallest particle of the poison of which will kill. If the worms are very troublesome, the remedy can be repeated, it being easily applied.

Fig. 16. Cut Worms turned away. Remedy 68.

Rem. 68. Shielding the Stem. By encircling each plant that is set with a bit of tar paper, or even other paper, as shown in Figure 16, the ravages of the worm may be prevented. The paper should extend upwards several inches from a point just beneath the surface of the soil.

Rem. 69. Fall Plowing and Digging.

Rem. 70. Hunting and Killing. By closely examining the surface of the soil in the morning, in the vicinity of their spoils, their place of retreat may usually be discovered, and the worms be killed.

Earth or Angle Worm. This common red worm, found in all soils, is harmless so far as eating the plants is concerned, but does damage by feeding on the nutriment of the soil and otherwise doing it injury.

Rem. 71. Lime Water easily kills this worm, the caustic of the lime acting fatally on its cuticle. One peck of lime to a barrel of water will make the needed solution, allowing this to settle and watering the plants once thoroughly with the clear water.

Elm-leaf Beetle. The worm and larvæ of this pest has now become widely extended, doing great injury to the Elm trees of our cities. It is shown at work in the accompanying engraving, and its presence is soon apparent by the blighted appearance of the trees.

Rem. 72. Arsenical Poisons. Same as 43, which should be applied for the first early in June, and again a few weeks later, if it seems necessary.

Fir Tree Oil. See Remedy 24, 149.

Fish Brine. See Remedy 26.

Flea Beetles. (*Haltica*.) As soon as the Cabbage, Radish, Turnip, Ten Week Stocks, and some other plants show their first leaves in the spring they are liable to be visited by the Black or Striped Flea Beetle. These minute beetles soon do great injury to the young plants if not checked. They are so shy in their habits that it is quite difficult to get a view of them, but their presence may always be known by the spotted appearance

of the leaves. The Grape-vine Flea Beetle is a near relative, varying in color from steel blue to metallic green and purple.

Fig. 17. Imported Elm Beetle. A, eggs; b, larvæ feeding; c, adult; d, beetle enlarged; e, eggs enlarged.

Rem. 73. Poisoning. The surest way to destroy them is by using Paris green or London purple mixed with land plaster, flour, dry leached ashes, etc., one part of the poison to fifty of the plaster. If the plants can be dusted in the morning so much the better, but I generally do it when I first see the insects at work, which is in the heat of the day. One application usually suffices.—*R. J. Coryell.*

Rem. 74. Dusting with Lime, Ashes, etc. This common, simple remedy, if not so positive as the last, yet proves very effective if persistently applied.

Rem. 69. Domesticating Toads. The large common toad is a most successful nocturnal collector

of beetles and other forms of insects, and its presence in the garden and greenhouse should be constantly encouraged. The stomach of one examined was found to be nearly full of flea-beetles of a species abounding on Cabbages and Turnips in a garden. The toad is not partial to any one kind of insect, however, but devours all kinds with avidity and in immense numbers.

Fir Saw-fly. See Saw-flies.

Flour. See use of in Remedies 43, 73, 108.

Fowls. (76.) Under Remedies 19, 79, etc., some reference is made to these, to which may be added that Turkeys, Ducks and Geese are devourers of great quantities of insects. We have known of a garden being kept entirely clean of these by permitting a small flock of Ducks to make it their home. They do not scratch like chickens. Muscovy Ducks are objectionable, for they consume buds also. Young Turkeys are voracious consumers of insects.

Gall Flies and their Grubs. Excrescences of various kinds known as Galls and produced by the deposit of eggs of insects in the bark or leaves of plants may often be seen. What is commonly known as the Oak Apple is caused by a Gall Fly. When cut longitudinally the Gall is seen to inclose a great number of granules, each containing a minute larva. The Rose Gall, frequently seen as rather a handsome globular excrescence on the branches of Wild Rose bushes, is the work of another Gall Fly. The Elm, Beech, and other trees, besides many other forms of growth, frequently show Galls of some kinds, either on the twigs, leaves, or roots.

Rem. 77. Removal and Burning. The only remedy is to cut off the excrescences as soon as they are observed, and putting them into the fire.

Gas Lime. See Remedy 49.

Gooseberry Slug. See Currant Slug.

Grape Berry Moth Larva. This worm attacks the young berries about July 1, showing its presence by a discoloration at the

point of entrance. It generally eats out the interior of the berry, and if the fruit is disturbed the worm wriggles out and lets itself to the ground by means of its silken thread.

Rem. 78. Bagging the Clusters. The course is a most simple one. Common light manilla bags, the size known as two pound bags, are usually employed. These are slipped on over each cluster of the fruit and secured somewhat loosely by pins or a loop of wire or thread. If the stem of the cluster is brought against one end of the opening a single pin to a bag will answer, if in the middle, to have the paper bear evenly on all sides, then several pins or stitches are needed. A small slit should also be made in the bottom of each bag, to allow escape for any water that may enter into it along the stem. From 500 to 1000 bags can be put on in a day by one person, and costing from $\frac{1}{2}$ to 1 cent per pound of fruit. Bagging also serves as a prevention of mildew and rot, and protection from birds, fowls, etc. The time to bag the fruit is as soon as it is well set.

Grape Leaf Hopper. (*Erythroneura vitis*.) This active little insect, often erroneously called Thrips, is one of the most troublesome known to the Grape grower. It is hardly above an eighth of an inch long; it jumps with great vigor, and dodges around quickly with a sidewise motion when approached. It congregates in great numbers on the underside of the leaves, where it sucks up the sap, causing numerous brown spots and often killing the leaves. Of this insect there are several species, differing only in color.

Rem. 79. Torch Remedy. Pass between the rows with a strong torch at night, one person to carry the torch and one on each side to slightly shake the trellise for starting them towards the flame. They fly readily to the light and being small are at once destroyed.

Rem. 80. Kerosene Emulsion. Same as 6.

Rem. 81. Cleanliness. As they pass the winter under leaves, loose bark of the stakes, etc. Cleanliness in removing and burning the leaves in the fall, as well as cleaning away all lodging places, is of the first importance.

Grape-vine Flea-beetles. See Flea-beetles.

Grape Curculio (*Cecliocles inaequalis*.) The larva of this curculio infests the Grape in June and July, causing a little black hole in the skin and a discoloration of the berry immediately around it. This Curculio is small and inconspicuous, being of a black color, with a grayish tint. It is very bad some years and in others scarcely noticeable.

Rem. 82. Jarring and Removing Berries. All infested berries should, from time to time, as they are noticed, be collected and destroyed, and the beetle may be jarred down on sheets, as with the Plum Curculio.

Rem. 83. Bagging the Clusters. Same as Remedy 78.

Grasshoppers. A remedy that gives promise of being a most excellent one for this well-known pest comes from the Pacific Coast, having first been published in the Pacific Rural Press as follows:

Rem. 84. Mash of Bran and other Ingredients. The mash consists of four parts of bran, one part of sugar and one and one-half parts of arsenic, to which is added a sufficient quantity of water to make a wet mash. Mix the arsenic thoroughly with the bran; put the sugar in the water and stir until the sugar is dissolved. Then pour this sugar-water into the bran and arsenic and stir thoroughly. A common washtubful of this mash is sufficient for about five acres of Grape-vines. Throw about a teaspoonful of the mixture beneath each vine infested, and in a short time the Grasshoppers will leave the vine and commence feeding on the bran, and in a few hours will be found to be dead. The mixture costs from thirty-five to forty cents per acre of vineyard. Mid-klings or shorts have been used in the place of bran, but are not so desirable.

Grape-vine Fidia. (*Fidia viticida*.) This beetle, often confused with the Rose bug (See Fig. 25), which it somewhat resembles, being rather shorter and broader, is in many places very injurious. It comes around during June and July, inflicting damage by riddling the leaves, sometimes if very numerous so that they are but mere shreds.

Rem. 85. Jarring. Same as No. 59. The least jar is sufficient to cause the insects to fall.

Rem. 86. Fowls. By starting a flock of fowls in the vineyard, having one boy go ahead to shake the infested vines, and another behind the fowls, vineyards have been completely cleaned of the pest.

Grape-vine Worms. See Spingies.

Green Fly or Lice. See Aphids.

Grubs, White. See May-bugs.

Hellebore. See Remedies 52, 63, 127.

Honeysuckle Sawfly. See Sawflies.

Hot Water Remedy. See Remedies 5, 12, 37, 154.

Household Insects. See Pyrethrum; also Remedies 2 to 4. It may be added that as a remedy to be applied on living creatures a mixture of crude petroleum and lard will kill all insects.

Insect Powder. See Pyrethrum.

Jarring. See Remedy 59, 75.

Kerosene. See Remedies 6, 57.

Lady Bug. See Remedy 13 and Fig. 18.

Leaf Crumplers. (*Phycis indigenella*.) A conspicuous pest of various fruit trees and widely distributed. Its presence is at once known by its work of bringing a considerable mass of leaves together, (which soon turn brown), and attaching them to each other and to the twigs by means of silken threads. The brown, wrinkled worm is within. The next season young worms appear from the mass and feed on the new crop of leaves.

Rem. 87. Gathering the masses and burning them.

Leaf Skeletonizers. Under this head might be brought a number of insects, including Slugs, that feed on the parenchyma of the upper surface of the leaves. They may be destroyed by remedies 6 and 43, according to their habits.

Leaf Rollers. There are many Caterpillars that curl or fold up the edges of the leaves of plants, securing both habitations and food to the insects. In the case of the Grape-vine Leaf Roller, Verbena Leaf Roller and others, the worm is of a grass-green color,

Fig. 18. Lady Bug and Larva.

very active, wriggling, jumping and jerking either way at every touch.

Rem. 88. Crushing. The most simple method to destroy the worms is by crushing them suddenly within the leaf with the hand.

Rem. 89. Fall Burning of Dead Leaves. As the last brood hibernates in the chrysalis state within fallen leaves, much may be done, especially in the case of the Grape and other fruits towards checking the ravages of this worm by raking up and burning the leaves in the fall.

Lime, Ashes, Lime Water, etc. See Remedies 17, 50, 71, 74, 131.

London Purple. (90.) This insecticide, which has assumed so much importance to plant cultivators, is a refuse material obtained in the manufacture of aniline dyes, heretofore worthless. It appears to be mainly an arsenite of lime. Its efficacy in the destruction of insects seems to be about equal to that of Paris green, although it does not act upon insect life quite so rapidly. Its cost is also less. See Remedy 108; also, 15, 43, 67.

Lye Solution. See Remedy 116.

Maple Borer. See Sugar Maple Borer.

Maple-tree Scale. See Bark Lice.

Maggots of the Cabbage, Onion and Radish Flies. (*Anthomyia*.) These terrible and widespread destroyers are very hard to combat, and so are among our worst insect pests. The little flies, which look like small house flies, lay their white eggs at the base of the plants. The little conical maggots groove and deface the Radishes and utterly destroy the Onions and Cabbages by tunneling to underground stems, causing club-root. While the kerosene and soap mixture and bisulphide of carbon will surely kill if they reach the insects, they are not satisfactory in real practice. Owing to difference in soil, and the speed with which the Maggot enters the plants, such remedies are not practical. I have found as yet no satisfactory insecticide to destroy these insects.—PROFESSOR COOK.

Fig. 19. Eggs of the Onion Fly; Onion Maggot at work.

Rem. 91. Covering the Beds. For the Radish Maggot I know of no sure way except to keep the beds of early Radishes entirely covered with thin cloth.—PROFESSOR COOK.

Rem. 92. Change of Location. For Onions and Cabbage a frequent change in the location of the beds serves the best. We have found now for two years that a removal of our beds one-half mile with an intervening orchard has saved our Cabbages. If the same insect attacks both Onion and Cabbage, as I believe is true, then we must move the location of both vegetables at the same time.—PROFESSOR COOK.

Rem. 93. Destroying Affected Onions. In case of an attack all affected plants should at once be taken up by means of a broad-bladed knife to lift the larvæ, and then promptly burning and otherwise purifying the soil and other matter lifted.

Rem. 94. Preventing Club-root. Experiments of the Eastern growers show that a liberal dressing of lime and gas-lime to the soil, and harrowed in, acts as a preventive to Club-root and also kills the Maggot.—CORYELL.

May-bugs or May-beetles and their Larva. (*Lachnosterna*.) Of this well-known pest, both the beetles in their winged state and its larva, the White Grub, are often to a very injurious degree destructive to vegetation; the former injuring the leaves and growth above ground, the latter the root.

Indeed, in some seasons May-bugs have been so numerous as to devour the leaves of fruit and forest trees and shrubs with an avidity not much less than the Locust. They are partial to the leaves of the Cherry.

Rem. 95. Jarring for May-bugs. Same as 54.

Rem. 96. Crows. These destroy many of the perfect insects, as well as the Grubs.

Rem. 97. Artificial Breeding Places. Some such made by covering piles of fresh cow-dung with fine earth about the month of May will attract the Beetles, as depositing places for their eggs. As these hatch before winter, by then turning over the heaps and spreading them out so the material will lay loosely and not more than

six inches deep, doing this as the earth is about to freeze up, all will be killed by freezing.

Rem. 98. *Deep plowing* of infested lands in the fall.

Rem. 99. *Swine* will root up and destroy the grubs if turned upon infested land.

Melon Vine Borer. See Squash Vine Borer.

Mignonette Worm. See Cabbage Worm.

Molasses and Poison. See Remedy 4.

Mustard Water. See Remedy 160.

Nicotyl. See Remedies 10, 65 and Fig. 21.

Onion Fly and Maggot. See Maggots.

Paraffine Oil. See Remedies 11, 155.

Paris Green. See Remedies 15, 43, 67.

Petroleum Crude. See Household Insects.

Pine Tree Sawfly. See Sawflies.

Pea Bug or Weevil.

This is the well-known bug found in Peas, and which, by the time it is of full growth has consumed a large portion of the grain, to the great impairment of its value both for food and seed.

Rem. 100. *Soluble Phenyle.* Miss Omerod, the accomplished English entomologist, reports that by sowing the Peas along with coal ashes (sand should do as well) saturated with a tablespoonful of phenyle to a gallon of water, the ashes left covered several days before use to become thoroughly charged with the smell, the attack of weevil was prevented on the new crop.

Rem. 101. *Turpentine.* Peas that have been stung may be rendered bugless by placing them as soon as gathered in jars or other tight vessels adding as much as a teaspoonful of turpentine

to each jar. This will kill the immature bugs very soon.

Rem. 102. *Bisulphide of Carbon.* For treating Peas on a large scale it is usual to submit them to the heavy fumes of bisulphide of carbon, an abominable smelling but destructive drug.

Peach Tree Borer. This is a most destructive insect when allowed to increase for a few years without molestation, and their multiplication should be prevented by all possible means. The eggs are deposited in summer on the base of the trunk, near the collar, where the bark is soft. There they are hatched and bore their way under the bark of the tree, either in the stem or roots, or both, producing an effusion of gum.

Rem. 103. *Probing the Borer.—Ashes and Lime.* Bank up the soil around the stem firmly eight to twelve inches directly after blooming, taking it away in the middle of the following August, and trace the grub through its holes in the tree and kill it; then place a shovelful or two of wood ashes around the base. Wood ashes or slaked lime may be applied every spring and at the end of summer may be scattered about the tree, both of these articles forming an excellent dressing for the Peach. See 31, 143.

Pear Slug. See Cherry and Pear Slugs.

Phenyle, Soluble. See Remedies 5, 100.

Pine Bark Chermes. The appearance of this insect on Pine trees of several kinds is known by little patches of a white wool-like substance adhering to the bark. The insect is found beneath this substance which serves as a covering.

Rem. 104. *Crushing with a Brush and Cloth.* By using a stiff brush on the branches and a strip of cloth to draw repeatedly backward and forward through the axils of the branches, the insects can easily be killed.

Rem. 105. *Whale Oil Soap.* A solution formed with a quarter of a pound of soap to a gallon of water and applied with a force pump would destroy the insect.

Plant Lice. See Aphis.

Plaster and Plaster of Paris. See Remedies 50, 73, 108.

Fig. 21. A Nicotyl Vaporizer.

Potato Beetle. This insect is now too well known to require any description.

Rem. 106. Early Poisoning. To poison the adults when first they appear and before the Potatoes are up is an effectual way of preventing a large share of later trouble. By simply slicing Potatoes thinly and dipping the pieces into Paris green water, and then scattering these about the field, the task is done.

Rem. 107. Arsenical Poison No. 15, 43. Applying for a few plants with a whisk, or for more with a fine watering pot or force pump, taking care not to deluge the plants, but only to cover with a light spray.

Rem. 108. Arsenical Poison, Dry Forms. This may be prepared either from Paris green or London purple, both of which appear to be of about equal efficiency. The latter is the cheapest and it has the advantage of being more readily seen on the plants, but it does not accomplish its work so rapidly, for often its effects are not apparent until the second or third day after its application. Used in a dry form the best results have been obtained when cheap flour has been used to dilute it, although road dust, land plaster, plaster of Paris, etc., are employed for this purpose also. The advantage in using flour is that the compound seems to adhere better to the leaves of plants and to be more readily eaten than are the mineral and other substances. Potato leaves will safely bear the poison as slightly diluted as ten or twelve pounds of flour to one pound of Paris green or London purple. Some other vegetation will show injury to the leaves, unless twenty pounds of flour be used with one pound of Paris green, while of this poison even thirty pounds of flour to one of the pure drug will destroy a large proportion of insect pests. In actual use London purple seems less liable to injure the leaves of many plants than Paris green. When the purple is prepared of the strength of one pound of poison to ten of flour it will injure only delicate vegetation. The latter reduced with even seventy pounds of flour will be found to kill nearly all leaf-eating larvæ. For general use the preparation of London purple recommended and which has given the best practical results, is one pound of the purple to forty of flour. In using land plaster and plaster of Paris, instead of flour about 150 pounds of the former

should be used to each pound of poison. Dry road dust at the rate of one and one-half bushels to one pound of poison, and of ashes two bushels to the pound, have been found to be in about the right proportion for effectually destroying the Potato bug and its larva. In all cases the materials must be thoroughly mixed and should be applied in early morning while the leaves are wet with dew, that it may adhere the better. A simple mode is to tie a muslin bag containing the powder to the end of a stick and shaking it over the plants. A rather better method is that of a tin dusting box having a cover and a finely perforated bottom, or one consisting of light wire gauze or thin muslin turned up over the end and bound on, and the box attached to a handle about three feet long. By then walking along with the box turned over the plants and supported with one hand, tapping it with a small stick in the other hand, the powder can be uniformly distributed. In case the growth of vines nearly cover the ground the plaster or ashes mixture can be sown broadcast over five or so rows at once with economy of labor. Care should in all cases be taken to keep to the wind ward of the plants to be dusted, in order that the poison may not be breathed.

Rem. 109. Prepared remedies, such as Slug Shot.

Potato Worm. See Spingies and their larva.

Probing. See Remedies 31, 134, 143.

Promoting Growth as a Remedy. See Rem. 14.

Pumpkin Vine Borer. See Squash Vine Borer.

Pyrethrum or Dalmation Insect Powder, "Bu-hach." (110.) This remarkable vegetable insecticide consisting of the finely pulverized flowers of *Pyrethrum cinerariæfolium*, (Another form is known as Persian Insect Powder, from *Pyrethrum roseum* and *P. carneum*), has the peculiar property of not being injurious to human beings, but strangely enough kills most kinds of insects or spore-breathing creatures. On such the powder appears to have the effect of produc-

ing a paralysis, from which they rarely recover, although life may linger for several days. The powder is now produced on a large scale in California. Pains should be taken to use the article fresh and pure, and to keep it in air-tight bottles or boxes, for its active principle is volatile and it loses its strength unless care is taken to keep it in air-tight receptacles. This powder is the insect powder of the stores, but in that form it is apt to be weak from

Fig. 22. The Red Spider greatly magnified.

adulteration, or age and exposure. This has become almost the universal, as it is a most safe and effective remedy against all household insect pests as flies, mosquitos, roaches, bed-bugs, etc., all of which it kills, if applied to them in a closed room, by means of a small bellows box or otherwise. See Remedies 25, 36, 51.

Quadruped Foes to Insects.
111. Remedies 42 and 91 refer to the usefulness of Swine as devourers of insects. To the Swine may be added the Skunk and the Raccoon, neither of which, however, is to be recommended without a qualifying clause. The Skunk, while feeding almost wholly on insects, is disposed to attack the chicken roosts and nests,—shut him out from these and he is a harmless and most helpful agent in the insect war. Raccoons devour great numbers of grubs and other worms in the spring, but they have a great fondness for the

Green Corn crop also later in the season.

Quassia Water. See Remedy 38.

Quince Curculio. See Curculio of the Plum, etc.

Radish Fly and Maggot. See Maggots.

Raspberry Saw-fly. See Saw-flies.

Raspberry Slugs and Worms. See Slugs.

Red Spider. (*Acarus tellarius*.) This well known minute insect pest is one that is peculiar to dry and warm conditions of the atmosphere. It is not only troublesome on window and greenhouse plants, but often in dry weather greatly so to garden plants and trees. The insects, generally in large numbers, attack plants when they are in a weakened state, from want of sufficient water or other causes, spinning webs over the under side of the leaves, and sucking out the sap. They are not spiders at all, as may be seen by the greatly magnified repre-

Fig. 23. Plant inclined for Syringing the underside of the leaves.

Fig. 24. Cloth Shield having draw string in edge; to be placed over pot.

TREATING POT PLANTS FOR RED SPIDER. REMEDY 110.

sentation of one in Figure 22, but belong to the family of mites.

Rem. 112. Water and Moisture. These pro-

vided with persistence are complete specifics. As the insects exist on the underside of the leaves, the best way to destroy them is by repeated forcible syringing. In the case of pot plants there is some danger of getting too much water to the soil and roots, hence the methods of preventing this suggested by Figures 23 and 24 are useful. With garden plants there is little danger of excessive moisture at the root from syringing.

Rem. 113. Sulphur. Where plants are confined, as in a greenhouse, the fumes of sulphur are also employed as a remedy. This, however, must be applied with caution, as excessive fumes will also kill the plants. A safe course is to put flowers of sulphur on tin or iron plates and set in the sun near or under the plants. Applying a wash of sulphur mixed with guano or lime and water to the hot-water pipes is another common mode of applying sulphur.

Road Dust. See Remedies 50, 108, 57, 131.

Root Aphis or Lice. These are species of Aphides which, instead of feeding on the leaves and shoots of plants, attack the roots, hence are not to be directly treated by the remedies for Aphis or Plant Lice, which see. Undoubtedly the most important insect of this class is the Phylloxera or Grape-root Louse, which has in recent years spread with such wonderful rapidity throughout the vineyards of Europe. In France a prize of \$60,000 has been offered in vain by the government for an effectual means for destroying it. It was first detected in this country about 1855, but happily is not seriously injurious to native American Grapes. The varieties of Root Lice we are more interested in are those which attack the Apple, Peach, and many other plants, including those of the flower garden and greenhouse, feeding underground on their roots.

Rem. 114. Salt Water, Soap Suds. Dr. Harris has found that in the case of hardy plants watering with salt water was useful in destroying root lice, but tender herbaceous plants would suffer from the same treatment; these, however, he has assisted against the injuries of the pests by free and frequent watering with soap suds.

Rem. 115. Bisulphide of Carbon. This material was first brought into use in France. It was applied by puncturing the soil two or three feet deep under a tree or vine, or, if these were large, making holes four feet apart each way, into each of which an ounce and a half or two ounces of the bisulphide was poured. Very good results attended its use in this manner. This drug, however, as Prof. Saunders suggests, has its drawbacks, namely, it has an abominable smell, it is explosive if brought near a light, its fumes are heavy and poisonous and it is too expensive to be employed on a large scale.

Rem. 116. Wood Ash Lye. Mr. Deming, of the Missouri Horticultural Society, says he eradicates the pest by sprinkling with wood-ash lye.

Rose Beetle, Chafer or Bug. (*Macrodactylus subspinosus*.) This insect, shown in Fig. 25, is one of the greatest pests known to the gardener. It devours buds, blossoms, young fruit, and leaves. Not only does the Rose

Fig. 25. Rose Beetle, Chafer or Bug. Remedies 117, 120.

Fig. 26. Rose Saw-fly (perfect insect of Rose-slug) enlarged. Remedies 126 to 131.

suffer badly from its depredations, but entire crops of Peaches, Grapes, Apples, Cherries, vegetables, etc., have been blasted by the same insect. They seem to have a special fondness for the Ox-eye or Field Daisy; it is a pity they do not confine their attentions to that weed. They are of a grayish or ashen yellow color. Their time of attack continues for a month or more from the blossoming of garden Roses.

Rem. 117. Jarring and Burning. Same as 59.

Rem. 118. Hand Picking and Burning. This is the most common remedy for small bushes and not so serious as it might seem. Gather them early in the morning by picking or brushing into

a vessel of water. Afterwards they should be burned or destroyed with kerosene,

Rem. 119. Planting Clinton Grape-vines. It has been found that this insect shows a decided preference for the Clinton and its close allies, over all other varieties of the vine. It is therefore suggested that in vineyards, as the beetles must be gathered by jarring or hand picking, this variety be planted for bringing the work of gathering them within a smaller compass.

Rem. 120. Bisulphide of Carbon. It is stated from a reliable source that small vials containing a few drops each of this liquid tied among the bushes or vines affected, at intervals of a foot or two, the liquid being renewed occasionally, protected them entirely, while those beyond were badly eaten by the beetles.

Rose Gall. See Gall Flies and their Grubs.

Rose-leaf Hopper. (*Tettigonia rosæ*.) This little white hopper, often mistaken for Thrips, lives, it is believed, exclusively on the leaves of Roses, and is very injurious to them. Swarms of the perfect insect may be found in various stages of growth in the leaves throughout the summer, and even on indoor plants.

Rem. 121. Whale Oil Soap. Same as Rem. 123.

Rem. 122. Nicotyl Vapor. Same as Remedies 10, 65.

Rem. 123. Infusion of Tobacco. Pour boiling water over cheap Tobacco or Tobacco stems so as to cover completely and leave it standing over night. Dilute for using with four or five times the quantity of water and apply with a syringe or force pump, taking care to distribute it also over the underside of the leaves. The application, like most other liquid applications to leaves for the prevention of insect injuries, should be made in the evening or early in the morning. It should be first applied early in the season before the injuries are very apparent and as soon as the young larvæ, looking like little white specks, can be discovered upon the underside of the leaves. As often as may be needed, in order to check the attack, the showering with the infusion should be repeated.

Rose Midges and their Maggots. One of the most destructive pests that growers have to deal with, especially in forcing the Rose, is this minute Fly, which attacks the flower buds and from which the Maggots, found usually in large numbers under the outer petals of the buds, come. These are not more than 1-16 in. long, and seem to have a strong desire to eat to the center of the bud as quickly as possible.

Rem. 124. Fumigation with Tobacco. For Roses under glass the best remedy is to fumigate for 6 or 8 evenings very strongly with tobacco in the usual way, so as to effectually kill the fly, and cut off all the buds and burn them. Continue this treatment for 3 or 4 weeks. If the Roses should be outside it is more difficult to get rid of this pest.

Rem. 125. Slug Shot for Outdoor Roses. Repeated applications of Slug Shot is a great help, but the crop of flowers that are affected must be cut off and burned, whether outdoor or in. A good plan is to go carefully over every plant and take off every flower and burn them, then apply Slug Shot. In every case it is a most troublesome pest to get rid off, but by persistent effort it can be done.

Rose Slug and Rose Saw-fly. (*Selandria rosæ*.) These pernicious vermin are known to all Rose growers. The Rose Saw-fly, shown greatly enlarged in Fig. 26, is a shiny black insect which appears in the latter part of May and up to about June 15th, and also again in August, the female laying its eggs in incisions made with its saw obliquely into the skin of the leaf. The young, which appear in from ten to fifteen days, are the greenish almost transparent Slugs that are frequently met in such great numbers feeding on Rose bushes until the whole foliage looks as if scorched by fire.

Rem. 126. Tobacco. Same as 65.

Rem. 127. Hellchore, Dry. Promptly dust the powdered drug lightly over the affected bushes by the use of a tin can with a piece of muslin tied

over the end; the foliage should be moist at the time. Professor Lintner suggests that before using Hellebore its strength should be tested by applying a small pinch to the nostrils. If it fails to produce a tingling sensation it should be rejected as comparatively worthless.

Rem. 128. Whale Oil or Other Soap Suds. Whale oil soap dissolved in water in the proportion of two pounds of the former to fifteen gallons of water, adding also a double handful of salt, and with this wetting the foliage affected. Ordinary soap used instead of the other makes nearly as good a remedy.

Rem. 129. Paris Green Solution. Same as 15.

Rem. 130. Kerosene Emulsion. Same as 6.

Rem. 131. Dust. Dry air-slaked lime, plaster of Paris, wood ashes, or even road dust, if regularly and repeatedly applied, will destroy the slugs.

Salt Water. See Remedy 114.

Saw-flies and their Larva. There are numerous species of Saw Flies, and which, both in their perfect state as flies and in the larva state as slugs, live almost entirely on vegetable food. (See Rose Slug and Rose Saw-fly, Cherry and Pear Slug.) The name of the class is derived from an ingeniously contrived saw or saws with which the female is provided and with which she saws slits in the stems and leaves of plants, wherein the eggs are dropped and hatched.

Rem. 132. Hellebore, Dry and Liquid. Same as Remedies 52, 63, 127.

Skunks. See Quadruped Foes.

Slug Shot. See Remedies 109, 125.

Snails. These are often bothersome both to the indoor and outdoor gardener, while sometimes they prove to be terribly destructive. What makes the matter of their attacks worse is that they do their work under the cover of night, hence much mischief is often done before the real cause is understood.

Rem. 133. A Search at Night. A night search with the light of a lantern after a shower of rain,

or in the greenhouse any night, will afford the best opportunity for catching large numbers of snails and slugs. They can then be put into a strong salt bath, where they will speedily die, or, the fowls in a confined run will be very grateful if they are thrown to them in their prison.

Rem. 134. Trapping. The only sure method of dealing effectually with these pests is to lay traps. Pieces of Orange peel, if laid on the ground, may be examined in the morning with a fair chance of rewarding the searcher, for the slug is so fond of Orange peel that instead of returning to its home at daybreak it clings to the peel, and may be found underneath gorged with much over-feeding. Pieces of board placed firmly in the ground are good traps, as these keep the soil moist and slugs and snails love moisture and take refuge under them.

Rem. 135. Paraffin Oil Solution. Apply a weak solution of Paraffin oil and water,—about one wine-glassful of oil to four gallons of water,—and the solution applied through a syringe to the plants; at the same time the surrounding surface of the soil must be moistened. The time to apply the solution is in the evening.

Soap Suds. See Remedies 6, 22, 114, 128.

Soluble Phenyle. See Remedy 100.

Soot Dusting. See Remedy 66.

Sphinges and their Larva. In the winged state the true Sphinges are known by the name of Humming-bird Moths, or Hawk Moths, being large Moths that are familiar by their flying during the twilight with swiftness from flower to flower, and hovering in the air like a Humming Bird. The worm of one of the species is the large green Caterpillar which infests the plants of the Potato and Tomato. This insect is often of a most repulsive size, being as thick as the fore-finger, and three inches or more in length. It is capable of doing great injury to the plant. Other species of these worms, varying somewhat in size and form, trouble Grape-vines and various other plants and trees.

Rem. 136. Picking with Tweezers. This appears to be the only remedy. A pair of tweezers easily made by anyone out of a piece of band iron is shown in the accompanying engraving. The worms may be fed to swine or be killed with kerosene.

Squash Vine Borers. (*Melitia curcubitæ* Harris.) This worm, which seems to be on the increase and in some seasons is very bad,

Fig. 27. Hand Tweezers for gathering repulsive insects. Made of ordinary band iron. Remedies 136, 142.

works in the vine mostly near the root, often causing the plant, after it is nearly grown and set with fruit, to suddenly wither and die. Upwards of a hundred Borers have been taken from a single vine.

Rem. 137. Coal Tar. Placing Corn cobs dipped in coal tar among the plants about the first of July is known to greatly lessen the attacks by borers.

Rem. 138. Cutting Out. This, on a small scale, is a successful remedy. In practice one may soon become quite expert in discovering the location of the borers and digging them out with a knife point.

Rem. 139. Layering. A Mr. Milton, in the Ohio Farmer, says that the best remedy he has found for this pest is to go through the patch with a hoe when the vines have attained a length of two or three feet and throw a large hoe-ful of earth on the first or second joint from the hill. The vine will form new roots from this joint, which will enable it to perfect its fruit should the borer kill the old root.

Squash Bug, Black. (*Anasa tristis* de Geer.) About the last of June throughout the North these troublesome bugs appear on Squash-vines and lay their patches of eggs,

which soon develop into troublesome broods. A most striking characteristic of the insect is its offensive odor when handled or crushed. As the eggs are not all laid at one time, the young appear in successive broods.

Rem. 140. Plaster and Kerosene. Same as 57.

Rem. 141. Trapping. By laying shingles about the hills the bugs, after feeding in the night, may be found collected on the underside of such. Proceeding to the patch early in the morning with a pail containing some kerosene, the shingles should be gently raised and the insects jarred or brushed into the kerosene, returning the shingles again for successive catches later.

Rem. 142. Picking with Tweezers. Same as Remedy 136.

Strawberry Worm. Apply Remedy 52.

Strawberry-Crown Borer. This is an insect first described by Prof. Riley in 1871, and which is not much known outside of the Mississippi Valley. It bores down through the crown of the Strawberry plant into the pith. We have heard of no effective remedy. The plants that are injured should certainly be removed and burned.

Sugar Maple Borer. Of late years this insect has become comparatively abundant as a destroyer of highly valued Maples. Its attack is usually made on perfectly healthy trees. In its simplest form it reveals itself by the bark parting longitudinally and breaking away, disclosing a narrow strip of the wood some five or six inches in length. On the surface of the wood can be seen the furrow of the grub, increasing in its dimensions as it descends and at the lower end entering into the trunk of the tree, or more often winds horizontally about half way around the trunk before entering. With numerous borers at work the circulation of the tree is cut off and it dies.

Rem. 143. Killing Young Larva.—Probing. Professor Lintner is of the opinion that the best method of dealing with this pernicious borer

would be to watch for the commencement of the operations and kill the young larvæ. The eggs are laid in July and August. It is said that the place where the egg has been deposited upon the bark of the trunk may be detected "by a rusty discoloration of the bark about the size of a cent; and especially by the frass or castings which, to the length of an inch or more, are attached like a broken corkscrew to the bark." The larvæ upon hatching burrow upward, remaining in the bark until the following spring, when they burrow into the solid wood. At this season of the year [October] the larvæ may be found beneath or not far from these discolored spots of egg deposits. If by cutting into these the burrow is found to have extended too far to follow it with the knife without injury to the tree, a flexible wire may be used as a probe for reaching and destroying it, as is done for the notorious Apple-tree borer, *Saperda candida* Fabr.

Sulphur. See Remedy 113.

Sulphuric Acid Water. (144.) This made in the proportion of one part of the acid to fifty parts of water is an effective and safe insecticide to be used on hardy plants.

Swine. See Quadruped Foes to Insects.

Thousand-Legged Worms. These are often confused with the Wire Worms, (which see) and from which they differ considerably. They live on Potatoes, Radishes, Carrots, and decaying vegetables, and have also been accused of destroying the plants of Cucumbers, Strawberries, etc.

Rem. 145. Gas Lime. Same as Remedy 49.

Rem. 146. Trapping and Scalding. By laying boards about the garden in the evening they will accumulate under these in numbers, and in the morning can be collected and scalded.

Thrips. Minute insects varying in size from that hardly perceptible to the naked eye to the size of a Plant Louse, and varying in color from whitish yellow to dark brown. It is an active, jumping insect, and when once it gets a foothold is very destructive. As it luxuriates in close, shady places it is

generally found where plants are unduly crowded and neglected as to ventilation and syringing. (See Grape Leaf Hopper.)

Rem. 147. Nicotyl. Same as No. 10, 65.

Rem. 148. Fumigation with Tobacco. Same as Remedy 9.

Rem. 149. Fir Tree Oil. Same as Remedy 24.

Tent-Caterpillar on Apple. **Rem. (150.) Hand Picking the Eggs.** The eggs of these Caterpillars appear in the shape of rings on the small twigs,

Fig. 28. Thrip very much enlarged.

and are coated with a varnish-like substance. A sharp eye run over the branches in the winter or early spring when bare of foliage will show them, and then they should be removed and burned.

Rem. 151. Gathering the Webs. With a forked stick the webs may readily be gathered in the spring, when they are small, by twisting them on the stick.

Rem. 152. Torch Remedy. Same as Remedies 7, 79, 158.

Tobacco Insecticide. See Remedies 8, 9, 10, 123, 124, and Nicotyl.

Tobacco Worm. See Sphinges.

Tomato Worm. See Sphinges.

Torch Remedy. See Remedies 7, 79, 155.

Trapping Insects. See Remedies 134, 146.

Turpentine. See Remedy 101.

Weevil. See Curculio.

Web Worm, Fall. (*Hyphantria cunea*.) This insect is attracting increasing attention by its great injury in defoliating both fruit and shade trees, shrubs, etc., in many instances not a vestige of foliage remaining. Its name indicates the season when its webs are most

numerous. Not only do they leave signs of their presence in the denuded trees, but such are also disfigured by old and new webs made by the Caterpillars, in which bits of leaves and leaf stems, as well as the dried frass has collected, producing a very disagreeable sight.

Rem. 153. Arsenical Poisons. Same as *Rem. 43.*

Rem. 154. Pruning and Burning. On the first appearance of the webs they should be looked

Fig. 30. Fall Web Worm, the dark form, there being also a light one. Remedies 153, 155.

for with care and should be cut off or burned off, and if cut off should be burned at once.

Rem. 155. Torch Remedy. A little thorough work with some simple torch at the right time will in nearly every case obviate the necessity of any other treatment later. A campaign torch mounted on a long pole is one of the best implements for the purpose. The best substitute for this is perhaps a piece of porous brick prepared as suggested by Mayor Key, of Washington. Take a piece of soft brick, commonly termed salmon brick, trim it to an egg shape; then take two soft wires, cross them over this brick, wrapping them together around the opposite side so as to firmly secure it; now tie this end to a long stick, such as the boys get at the planing mills, by wrapping around it; then soak the brick in coal-oil, light it with a match, and you are armed with the cheapest weapon known to science. Holding this brick torch under the nests will precipitate all the worms on one or two trees at least from one soaking of the brick, and it can be repeated as often as necessary.

Whale Oil Soap. See Remedies 6, 105, 114.

Whiskey. See Remedy 23.

Wire Worms. These are the hard, flattish, smooth-skinned, mostly light-colored, larva of the Elaters or Snapping Beetle, but the name Wire Worm is often wrongfully applied to the dark-colored, cylindrical Thousand-legged Worm, (which see). They feed on roots of herbaceous plants, and on Potatoes, Carrots, etc., and are often very injurious. In the Beetle state they devour flowers and the tender leaves of plants.

Rem. 156. Baiting. This method consists in burying sliced Potatoes or other vegetables beneath the ground in gardens, upon the end of a stick for convenience of examination. The slices should be examined every morning and the insects collected and destroyed.

Woolly Aphis. These are not true Aphis or plant lice, but are known as *Schizoneura larigera*. There are two forms of the insect, one being usually found on the limbs and trunk of young trees in masses of a white, woolly substance, the other attacking the

Fig. 29. The Woolly Aphis. A, root affected by the Aphis; b, the Aphis greatly enlarged; c, the Fly greatly enlarged. Remedies 157, 158.

roots, giving them a knotty appearance, as at *a* in the annexed engraving. At *b* in the same engraving is shown a greatly enlarged representation of the young insect, with the natural size indicated, and *c* is the same of the insect in its fly state. The eggs are laid in autumn on the bark and remain in this condition through the winter. Young nursery trees are often infested with this insect.

Rem. 157. Hot Water for the Root Form. Mr. Saunders, in his work on Insects Injurious to Fruits, observes that the most successful means yet devised for destroying these root-lice, is the use of scalding hot water, freely poured around the roots of the tree. If the trees are remaining in the soil, the roots may be laid bare, and the water used nearly boiling, without injury; but where they have been taken up for the purpose of transplanting, and are to be dipped in the hot water, the temperature should not exceed 150° Fahr.,—under these circumstances, from 120° to 150° would suffice for the purpose. A mulch placed around the trees for some time previous to treatment has been found useful in bringing the lice to the surface, where they can be more readily reached by the hot water.

Rem. 158. Kerosene Emulsion. Same as Remedies 6, 57. Prof. Forbes has recommended that

the roots of infested nursery trees be “puddled” with the kerosene emulsion before sending out, and that if the lice are seen upon the trunks, these be also treated with the emulsion, applying with a brush, sponge or cloth.

Worms in Pots. Sometimes a little white worm, entirely distinct from the Earth or Angle Worm elsewhere referred to, proves troublesome in plant pots. The following remedies may be counted upon as being effective in their destruction.

Rem. 159. Carbolic Acid Solution. Add one teaspoonful of carbolic acid to one quart of water and with this water the plants.

Rem. 160. Mustard Water. Stir a tablespoonful of sharp Mustard in a gallon of water, repeating the stirring at intervals for a day, then soak the soil with the water.

SOME INTERESTING NOTES ON INSECTS

—AND—

INSECT COLLECTING.

THE word insect, which was derived from the Latin, means cut or notched, referring to the characteristic of this group of creatures found in the cross-lines or incisions that mark the body. Between these cross-lines are the segments or rings, consisting of numerous jointed pieces, more or less movable on each other.

ORGANISM. Insects, according to Dr. Harris in his standard treatise on this subject, have a very small brain, and, instead of a spinal marrow, a kind of knotted cord, extending from the brain to the hinder extremity; and numerous small whitish threads, which are the nerves, spread from the brain and knots in various directions.

Two long air-pipes, within their bodies, together with an immense number of smaller pipes, supply the want of lungs, and carry the air to every part.

Insects do not breathe through their mouths, but through little holes, called spiracles, generally nine in number, along each side of the body. Some, however, have

the breathing-holes placed in the hinder extremity, and a few young water-insects breathe by means of gills.

The heart is a long tube, divided into several chambers, lying under the skin of the back, having little holes on each side for the admission of the juices of the body, which are prevented from escaping again by valves or clappers, formed to close the holes within. The blood, which is a colorless or yellow fluid, does not circulate in proper arteries and veins; but is driven from the fore part of the heart into the head, and thence escapes into the body, where it is mingled with the nutritive juices that filter through the sides of the intestines, and the mingled fluid penetrates the crevices among the flesh and other internal parts, flowing along the sides of the air-pipes, whereby it receives from the air that influence which renders it more fitted to nourish the frame and better maintain life.

In winged or adult insects, two of the transverse incisions with which they are marked are deeper than the rest, so that the body seems to consist of three principal portions, the first whereof is the *head*, the second or middle portion the *thorax*, or chest, and the third or hindmost the *abdomen*, or hind-body.

The eyes of adult insects, though apparently two in number, are compound, each consisting of a great number of single eyes closely united together, and incapable of being rolled in their sockets. Such also are the eyes of the larvæ, and of the active pupæ of those insects that undergo an imperfect transformation. Moreover, many winged insects have one, two or three little single eyes, placed near each other on the crown of the head, and called *ocelli*, or eyelets. The eyes of grubs, caterpillars, and of other completely transforming larvæ, are not compound, but consist of five or six eyelets clustered together, without touch-

ing, on each side of the head; some, however, such as maggots, are totally blind.

Near to the eyes are two jointed members, named *antennæ*, corresponding, for the most part, in situation, with the ears of other animals, and supposed to be connected with the sense of hearing, of touch, or of both united. The antennæ are very short in larvæ, and of various sizes and forms in other insects.

The mouth of some insects is made for biting or chewing, that of others for taking the food only by suction.

REPRODUCTION. Insects, contrary to the supposition of some, are never spontaneously generated from putrid animals or vegetable matter, but are produced from eggs. A few, such as some plant-lice, do not lay their eggs, but retain them within their bodies till the young are ready to escape. Others invariably lay their eggs where their young; as soon as they are hatched, will find a plentiful supply of food immediately within their reach.

CHANGE OR TRANSFORMATION. There are three periods in the life of an insect, more or less distinctly marked by corresponding changes in the form, powers and habit.

First or Infant Period. In the first, or period of infancy, an insect is technically called a *larva*, a word signifying a mask, because therein its future form is more or less masked or concealed. This name is not only applied to grubs, caterpillars, and maggots, and to other insects that undergo a complete transformation, but also to young and wingless grasshoppers and bugs, and indeed to all young insects before the wings begin to appear. In this first period, which is generally much the longest, insects are always wingless, pass most of their time in eating, grow rapidly, and usually cast off their skins repeatedly.

The second period—wherein those insects that undergo a partial transformation re-

tain their activity and their appetite for food, continue to grow, and acquire the rudiments of wings, while others, at this age, entirely lose their larva form, take no food, and remain at rest in a deathlike sleep—is called the *pupa* state. The pupæ from caterpillars, however, are more commonly called chrysalids, because some of them, as the name implies, are gilt or adorned with golden spots; and grubs, after their first transformation, are often named nymphs, for what reason does not appear.

Adult Period. At the end of the second period, insects again shed their skins and come forth fully grown, and (with few exceptions) provided with wings. Thus they enter upon their last, or adult state, where-in they no longer increase in size, and during which they provide for a continuation of their kind. This period usually lasts only a short time, for most insects die immediately after their eggs are laid, bees, wasps and ants affording some familiar exceptions.

CLASSIFICATION. To facilitate the study of the myriads of insects in existence, some kind of a classification was found necessary, and that referred to below and relating to the four great divisions or orders is the one very generally adopted by naturalists. The basis of this classification is founded upon the structure of the mouth in the adult state, the number and nature of the wings, and the transformations.

1. COLEOPTERA (embracing the *Beetles*). ADULTS with *jaws*, two thick *wing-covers* meeting in a straight line on the top of the back, and two filmy *wings*, which are folded transversely. *Transformation* complete. LARVÆ, called grubs, generally provided with six *true legs*, and sometimes also with a terminal *prop-leg*; more rarely without legs. PUPA with the wings and the legs distinct and unconfined.

2. ORTHOPTERA (*Cockroaches, Crickets, Grasshoppers, &c.*) ADULTS with *jaws*, two rather thick and opaque *upper wings*, overlapping a little on the back, and two larger, *thin wings*,

which are folded in plaits like a fan. *Transformation* partial. LARVÆ and PUPÆ active, but wanting wings.

3. HEMIPTERA (*Bugs, Locusts, Plant-lice, &c.*) ADULTS with a horny *beak for suction*, four *wings*, whereof the uppermost are generally thick at the base, with thinner extremities, which lie flat, and cross each other on the top of the back, or are of uniform thickness throughout, and slope at the sides like a roof. *Transformation* partial. LARVÆ and PUPÆ nearly like the adult insect, but wanting wings.

4. NEUROPTERA (*Dragon-flies, Lace-winged flies, May-flies, Ant-lion, Day-fly, White Ants, &c.*) ADULTS with *jaws*, four netted *wings*, of which the hinder ones are the largest, and no sting or piercer. *Transformation* complete, or partial. LARVA and PUPA various.

5. LEPIDOPTERA (*Butterflies and Moths*). ADULTS with spiral *sucking-tube*; *wings* four, covered with branny scales. *Transformation* complete. The LARVÆ are caterpillars, and have six *true legs*, and from four to ten fleshy *prop-legs*. PUPA with the cases of the *wings* and of the *legs* indistinct, and soldered to the breast.

6. HYMENOPTERA (*Saw-flies, Ants, Wasps, Bees, &c.*) ADULTS with *jaws*, four veined *wings*, in most species the hinder pair being the smallest, and a *piercer or sting* at the extremity of the abdomen. *Transformation* complete. LARVÆ mostly maggot-like, or slug-like; of some, caterpillar-like. PUPÆ with the legs and wings unconfined.

7. DIPTERA (*Mosquitoes, Gnats, Flies, &c.*) ADULTS with a horny or fleshy *proboscis*, two *wings* only, and two knobbed threads, called balancers or poisers, behind the wings. *Transformation* complete. The LARVÆ are maggots, without feet, and with the breathing-holes generally in the hinder extremity of the body. PUPÆ mostly encased in the dried skin of the larvæ, sometimes, however, naked, in which case the *wings* and the *legs* are visible, and are found to be more or less free and unconfined.

INSECT COLLECTING. Few occupations are more pleasant and instructive, especially to the cultivators of plants and trees, than the making of a collection of insects. The first thing needed for the business is a net

made of mosquito netting in the form of a short bag, and which must be attached at its edges to a ring (say of wire, or a Willow twig) to be about twelve inches in diameter, and this to a short handle. A butterfly or moth caught and you give the net a twist so that the insect cannot fly away.

To catch moths, which fly mainly at night, set a little lantern out-of-doors near a cup of cheap, strong-smelling molasses, and with net in hand capture them as they appear drawn to the sweets. Collect also by putting caterpillars and the leaves on which you find them into a box, with netting top, and letting them spin cocoons, or grow hard and dry. Cocoons or chrysalids found on bushes, fences etc., may similarly be boxed.

TO KILL THE INSECTS. Provide three bottles of different sizes, into each of which place some cyanide of potassium for poisoning the insects by placing them in the bottles. Attach a small lump of the cyanide to each bottle bottom by pouring over it a mixture of plaster of Paris and water to harden and hold it fast. The bottles should be large mouthed and have ground glass stoppers; any druggist can furnish such. Another excellent way of killing is to have a small vial of chloroform or ether, if of which a small drop is applied to the head of an insect it will succumb at once.

COLLECTING BOX. Such a one should be provided in which to pin the insects after they have been caught and killed. If possible a thin sheet of cork, or even sliced bottle corks, should be glued to the bottom to hold the pins. So-called entomologist's pins are to be preferred to ordinary pins.

LABELING. As the insects are put into the case they should be numbered by writing on a round piece of paper that is placed on the pin which is thrust through the insect. Then catalogue the numbers of the insects with the name of each, location and date of collecting and any other remarks.

Most insects should at all stages be pinned through the middle of thorax (the part back of the head); hard-shelled beetles through the middle of the right wing.

PREPARATION. To properly get butterflies in shape a pressing board is necessary. This is made of two pieces of common siding about a foot long, placing the thin edges toward each other, leaving a space between them wide enough to admit the body of the insect, and nailing the pieces carefully to a cross-piece at each end. Then with the insects in this opening, spread the wings and stick a needle in the board to hold each in place until a small strip of card-board can be placed over the wings on each side and fastened down with pins. Care must be taken not to rub the scales off the wings. If the legs are cramped under the body, draw them out and extend them as they appear when the insect is walking. By a little practice you will be able to get them prepared in good condition. The insects should be left on the pressing board for one or two weeks.

THE CABINET. For temporary use a good insect case may be made from a confectionary or other light wooden box. Cover the inside with strips of white paper and paste strips of cork over the bottom, over which a bottom of thin white pasteboard should be placed. Pin the larger insects directly to the bottom. Very small ones should be glued to small, triangular pieces of card-board, through one end of which the pins are passed. Try and get the insects as near the same height on the pins as possible.

For a permanent case it will be necessary to employ a cabinet maker to make this, as it must be nearly air-tight, in order to keep live insects from destroying the specimens. The best size is 14 by 10 inches, and 3½ inches deep. If of this size, insects can be put in at both the top and bottom, thus saving room.

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TO DESTROY THE CODLING MOTH.

PROFESSOR A. J. COOK, of the Michigan Agricultural College, has conferred a lasting boon on American fruit growers in his bulletin on the Codling Moth, or nasty, filthy Apple Worm. Those who have tried the method he recommends declare it is invaluable; that by it they are enabled to raise Apple crops with scarcely a wormy one in the lot. It is simply to spray the trees just at the close of blossoming time with London Purple or Paris Green, dissolved in water. These preparations containing arsenic. The spraying is done by a force pump and barrel, which is hauled through the orchard. An Iowa farmer named John Dixon discovered the method many years ago. He used the white arsenic. But this is more dangerous than the other preparations, because it is so apt to be mistaken for something else. Professor Cook gives illustrations and description of the Codling Moth, as follows:

A Codling Moth and Worm.

The Moth, F and G, is accurately represented in the picture in form and size. The main color is gray, flecked with darker dots and bars, and with a characteristic copper colored spot at the end of its front wings. This spot will always enable one to distinguish this Moth. Every Apple grower should put wormy Apples in a small box and rear the Moths, that there may be no doubt about the species. In May, about two weeks after the blossoms appear, the female Moth commences to lay eggs in the calyx of the blossom B. These soon hatch, when the minute larva (shown half grown, E) eats into the Apple and feeds upon the pulp around the core, filling the space with its fecal filth.

These spring Moths continue to come from cellar or Apple house until July. I have taken such Moths July 4th on the screen of my cellar window.

The whitish larvæ attain their full growth in about four weeks. This period will be lengthened by cold

and shortened by heat. When mature the larvæ leaves the Apple, which may have fallen to the ground, and seeks a secluded place in which to spin its cocoon (I) and pupate. The pupa or chrysalis (D) is much like those of other Moths. The pupæ of the June and July larvæ are found in the cocoons soon after the latter are formed, while those of the autumn larvæ do not pupate till spring, but pass the winter as larvæ in the cocoons. The eggs of the second brood are laid in July, August and September. The larvæ feed in autumn and often till in mid-winter, while as just stated, they do not pupate till spring.

Professor Cook prefers London Purple to Paris Green, because it is cheaper and easier to mix in the water. The mixture is as follows: I mix the powder one pound to fifty gallons of water. It is best to wet the powder thoroughly and make a paste before putting into the vessel of water, that it may all mix, and not form lumps. For a few trees we may use a pail and the Champion Force Pump, manufactured by the Field Force Pump Company, at Lockport, N. Y. For large orchards, use "Field's Farmers' Force Pump," manufactured by the same company. Always keep the liquid well stirred. One pail of the liquid will do for the largest tree. A teaspoonful of the poison is enough for a pailful of water. For a large orchard a common barrel should be used, drawn in a wagon. I prefer to have the barrel stand on end, with a close movable float with two holes through it, one for the pipe or hose from the pump, and the other for a stirrer. If very large orchards are to be treated, a good force pump should be fastened to the barrel. In Western New York the handle of the pump is attached to the wagon wheel, so that no hand power is required other than to drive the team and manage the pipe that carries the spray. This apparatus is also manufactured by the Field Force Pump Company, at Lockport, N. Y. The spray may be caused by a fine perforated nozzle, or a "BOSS" nozzle. The finer it is the less liquid will be required. The important thing is to scatter the spray on all the fruit, and get just as little on as possible. The larva is killed by eating the poison, and we find that the faintest trace suffices for the purpose. Again, the poison should be applied early, by the time the fruit is the size of a pea. I have found one such application to work wonders. There is no doubt but that the first application, followed by one or two others at intervals of two or three weeks, would be more thorough, yet I have found one application, made early, so effective that I have wondered whether it was best or necessary to make more than one application. I do think, however, that it must be early. In May or June the calyx of the Apple is up and so the poison is retained sufficiently long to kill most all of the insects.

The terrible Canker Worm and the destructive Tent Caterpillar, as well as the Plum Gouger, which makes such sad havoc in Wisconsin with the Apple crop, will very likely find their death warrants in this remedy.

The danger from this practice I have found to be nothing at all. The microscope and chemical analysis have both shown that all the poison has been removed long before we wish to eat the fruit. The wind no less than the rain helps to effect this removal, as I have shown by putting the poison on plants sheltered from all rains. Of course we should not turn stock into an orchard till a heavy rain has washed the poison from all herbage under the trees.

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