

## THE ASPARAGUS BEETLES.

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### GENERAL REMARKS.

Asparagus was introduced into this country with the early settlers from Europe, and is credited with having been cultivated here for two hundred years before being troubled with insects.

A number of species of native American insects have been observed to feed upon this plant, but none, so far as we know, have become sufficiently attached to it to cause serious injury. Few of our edible plants, in short, down to the time of the civil war have enjoyed such immunity from the ravages of insects. (Fig. 84.)

In the Old World two insects, called asparagus beetles, have been known as enemies of the asparagus since early times. In the year 1862 one of these insects, known to science as *Crioceris asparagi*, and which may be called the common asparagus beetle, was the occasion of considerable alarm on asparagus farms in Queens County, N. Y., where it threatened to destroy this, one of the most valuable crops grown on Long Island. Subsequent inquiry, brought about chiefly through the efforts of Dr. Asa Fitch, then official entomologist of the New York State Agricultural Society, developed the fact that the species had



FIG. 84.—Spray of asparagus, with common asparagus beetle in its different stages; asparagus top at right, showing eggs and injury—natural size (original).

begun its destructive work at Astoria, near New York City, in 1860, and it is now conceded that it was introduced in this locality about 1856.<sup>1</sup>

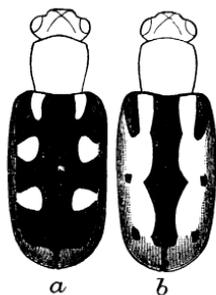
In 1881 another European importation was detected on asparagus near Baltimore, Md. This latter is *Crioceris duodecimpunctata*, commonly called the twelve-spotted asparagus beetle.

#### THE COMMON ASPARAGUS BEETLE.

(*Crioceris asparagi* Linn.)

From the seat of its introduction at Astoria, forty years ago, the asparagus beetle soon spread to the asparagus farms of Queens County, N. Y., and by 1862 it was reported to have occasioned the loss of over a third of the crops of certain localities, such loss being estimated at \$50,000.

The injury inflicted by this insect is due to the work of both adults and larvæ upon the tender shoots, which they render unfit for market early in the season and later destroy by defoliation of the high-grown plants, and particularly seedlings, the roots of which are weakened by having their tops devoured. The larvæ are sometimes so abundant that the black, molasses-like fluid that they emit from their mouths soils the hands of those who are engaged in bunching the stalks for market, and again the eggs are laid upon the stalks in such numbers that these latter are rendered unsightly and even slippery by their presence. Larvæ, as well as beetles, attack the tenderest portions of the plants, but the latter gnaw with seemingly equal relish the epidermis, or rind, of the stems. The beetles are also accused of gnawing young shoots beneath the surface, causing them to become woody and crooked in growth.



F. G. 85.—*Crioceris asparagi*: a, dark form of beetle; b, light form—enlarged (original).

A correspondent of the Department, Mr. William H. Hunt, an extensive asparagus grower at Concord, one of the leading towns in the cultivation of this crop in Massachusetts, writes that it is in establishing new beds that the greatest trouble and expense are incurred. The plant must grow a year as seedling and two more in the beds before being cut for table use, and during these three years it is constantly exposed to the attacks of this insect. Careful growers protect their beds, but careless growers, after cultivating a bed for one or two years,

<sup>1</sup>The capture of this species was recorded early in the present century in Pennsylvania—presumably near Hanover—and again in the vicinity of Chicago and Rock Island, Ill., about ten years after the discovery on Long Island, but, as the insect died out in these localities, these were obviously independent importations, and can not be considered introductions as the word is used of plants and animals, since the species did not obtain a permanent foothold.

become discouraged and plow it up and plant something else. Mr. Hunt states that five such instances have occurred in his neighborhood.

The adult beetle is a most beautiful creature, slender and graceful in form, blue-black in color, with red thorax, and lemon-yellow and dark-blue elytra or wing covers, with reddish border. A common form of elytral ornamentation in the latitude of the District of Columbia is illustrated at fig. 86, *a*. Farther north the prevailing form is darker, the lighter coloring sometimes showing only as a reddish border and six small submarginal yellow spots. (See fig. 85, *a*.) An extreme light form not uncommon in the southern range of the insect is shown by the same figure, *b*, for comparison. Its length is a trifle less than one-fourth of an inch.

#### DISTRIBUTION, PRESENT AND FUTURE.

From the scene of its first colonization in Queens County, the insect migrated to the other truck-growing portions of Long Island, and may now be found at Cutchogue, toward the eastern end of the island. It soon reached southern Connecticut, and has now extended its range northward through that State and Massachusetts to the State line of New Hampshire. Southward, it has traveled through New Jersey, where it was first noticed in 1868, eastern Pennsylvania, Delaware, and Maryland to southern Virginia.

Its distribution by natural means has been mainly by the flight of the adult beetles. Undoubtedly, also, the beetles have been transported from place to place by water, both up and down stream by rising and falling tide, as the fact that it has not until recently deviated far from the immediate neighborhood of the seacoast and of large water courses near the coast bears abundant testimony.

Another reason for the present prevalence of this species in these localities is that asparagus was originally a maritime plant and has escaped from cultivation and grown most luxuriantly in the vicinity of large bodies of water. It is well known that it is usually upon wild plants that the insect first makes its appearance in new localities. There is evidence also that its dissemination may be effected by what Dr. Howard, who has made a special study of the distribution of this and other imported insect pests, has termed a "commercial jump," either by commerce in propagating roots, among which the insect may be present either as hibernating beetles or as pupæ, or by the accidental carriage of the beetles on railroad trains or boats.

Only by some such artificial means of distribution has it in later years found its way to northwestern New York, in four counties between Rome and Buffalo, and to Ohio, where it now occupies a similar territory of four counties between Cleveland and the Pennsylvania State line. During the past summer Dr. Howard traced its course along the Hudson River above Albany. Inquiry instituted by Mr. F. M. Webster concerning the Ohio occurrence disclosed the fact that the plants in one locality were brought from New York. Its presence in

eastern Massachusetts in like manner may be due to direct shipments of roots from infested localities to Boston and vicinity.

It is noticeable that its inland spread, except in the neighborhood of water, has been extremely limited. It is present now in what is known as the Upper Austral life zone, although in certain points in New England it has located in what is considered the Transition zone. Its course up the Hudson River lies within a rather narrow strip of Upper Austral, and its location in the vicinity of Mechanicsville, about twenty miles north of Albany, marks its present most northern location. In all probability it is destined in time to overspread the entire Upper Austral zone and to make its way to some extent into neighboring areas in which it may find conditions for its continuance.

Through inquiry conducted during the years 1895 and 1896 by Dr. Howard the distribution of this species in Massachusetts, though wide, is found to be local. In New Hampshire it has been recorded from Nashua and Portsmouth. The species is reported also from Barrington, R. I., and is well established in Connecticut. It is possible that in a few years it may be able to encroach slightly upon the bordering States of Vermont in the vicinity of the Connecticut River Valley and Maine, near the New Hampshire seaboard. It is generally distributed through New Jersey, Delaware, and Maryland, and in southeastern Pennsylvania near the Delaware River. It is still local in New York and Ohio, but we may expect within a few years to hear of its invading other portions of those States lying within the Upper Austral zone; also Canada, of which there is a strip of Upper Austral bordering the northern shore of Lake Erie, and later Indiana, Illinois, and Kentucky and farther west.

#### HABITS AND LIFE HISTORY.

The insect passes the winter in the beetle state under convenient shelter, such as piles of rubbish, sticks, or stones, or under the loose bark of trees and fence posts. Toward the end of April or early in May, according to locality, or at the season for cutting the asparagus for market, the beetles issue from their hibernating quarters and lay the eggs for the first brood.

The egg is very large in proportion to the beetle, being nearly a sixteenth of an inch in length, and of the elongate-oval form illustrated at fig. 86, *b*. It is nearly three times as long as wide and of a dark-brown color. The eggs are deposited endwise upon the stem or foliage and in early spring on the developing stalks, usually in rows of from two to six or seven.

In from three to eight days the eggs hatch, the young larvæ, commonly called "grubs" or "worms," presenting the appearance indicated in fig. 86, *c*. The head of the newly hatched larva is large, black, and bead-like, its body is gray, and its three pairs of legs black. It at once begins to feed, and is from ten days to a fortnight, according to Fitch and others, in attaining full growth. When full grown

it appears as in fig. 86, *d*. It is soft and fleshy, much wrinkled, and of a dark gray or olive color, sometimes light, but not infrequently very dark. The head is shining black, as are also the six legs. Each segment is provided with a pair of foot-like tubercles, which, with the anal proleg, assist it in crawling and in clinging to the plant. The mature larva enters the earth, and here, within a little rounded, dirt-covered cocoon which it forms, the pupa state is assumed. The pupa is yellowish in color, and its appearance is sufficiently shown by the illustration (fig. 86, *e*). In from five to eight or more days the adult beetle is produced, which in due time issues from the ground in search of food and for a suitable place for the continuance of the species.

## THE LIFE CYCLE.

Of the duration of the life cycle, Fitch has remarked that it is about thirty days from the time the egg is laid until the insect grows to

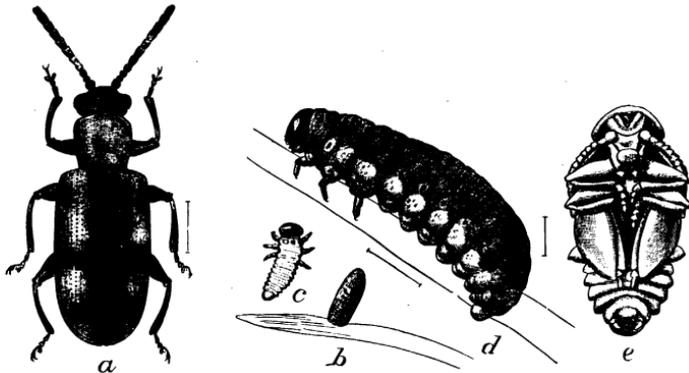


FIG. 86.—*Crioceris asparagi*: *a*, beetle; *b*, egg; *c*, newly hatched larva; *d*, full-grown larva; *e*, pupa—all enlarged (original).

maturity and comes out in its perfect form, but that the time will be shorter in the hottest part of the season in July and August than in the cooler days of May and June. These periods are for Long Island, New York.

During a hot spell in midsummer the minimum period of ovulation and of the pupa stage was observed by the writer at this Department. Eggs that were laid on the 5th of August hatched on the 8th of that month, or in three days. A larva transformed to pupa on August 4 and to adult August 9, or in five days. Allowing ten days as the minimum credited period of the larval stage, a day or two for the larva to enter the ground and form its cocoon, and two or three days more for the beetle to mature and leave the earth, the insect is again ready to attack its food plant and to continue the reproduction of its kind in about three weeks from the time that the egg is laid.

This may fairly be taken to represent the minimum midsummer life-cycle period of the species in the District of Columbia and southward.

In the colder climate of New England and in spring and summer weather the development from egg to beetle will require from four to perhaps seven weeks. The hibernating beetles appear here as early as April, and beetles of a later brood have been observed in abundance in October as far north as northern Connecticut. In its northern range two and perhaps three broods are usually produced, and farther south there is a possibility of four or five generations each year.

## NATURAL CHECKS.

For some reason writers on economic entomology have overlooked the fact that the common asparagus beetle has very efficient natural checks, in the shape of predaceous insects of many kinds, which prey upon its larvæ and assist very materially in preventing the undue increase of this and other injurious species.

Beyond the reported statement that in 1863 "a small, shining, black parasitic fly"<sup>1</sup> destroyed great numbers of asparagus beetle larvæ on Long Island, New York, no parasitic or predaceous insect enemies were known in this country until 1896.

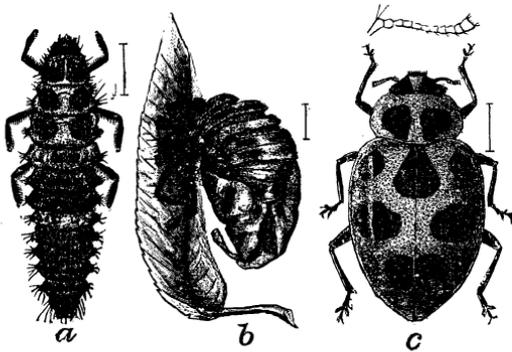


FIG. 87.—*Megilla maculata*: a, larva; b, empty pupal skin; c, beetle with enlarged antenna above—all enlarged (original).

The work of investigating predaceous enemies was continued for only a brief season the past summer and observations were confined to the country within a few miles of the city of Washington.

Of the many predatory insects observed on in-

festated asparagus plants, a few are deserving of special mention. One of the most efficient of these is the spotted ladybird (*Megilla maculata* De G.). It was present in all the asparagus beds examined, its larvæ appearing to have no other occupation than that of devouring those of asparagus beetles. This insect in its several stages is represented in the illustration (fig. 87). The adult beetle is rose colored, with numerous black spots.

The spined soldier bug (*Podisus spinosus* Dall.) and the bordered soldier bug (*Stiretrus anchorago* Fab.) are also active destroyers of asparagus beetle larvæ, which they attack and kill by impaling them upon their long proboscides and sucking out their juices. The latter species is illustrated at fig. 88. Certain species of wasps and small dragon flies also prey upon the asparagus beetle grubs. Two of the

<sup>1</sup> Possibly *Myobia pumilla* Macq., which is known as a parasite of *Crioceris asparagi* in Europe.

most abundant of these are *Polistes pallipes* St. Farg. and *Agrion positum* Hagen. The method of procedure of these latter insects is to hover about the infested plants until a larva is descried, when it is pounced upon and carried away.

Asparagus beetles are very susceptible to sudden changes of temperature, and it has been noticed by one of our correspondents, Mr. C. W. Prescott, of Concord, Mass., that immense numbers of the hibernating beetles are killed in winter during severely cold spells following "open" weather, millions of their dead bodies being found under bark and in other hiding places.

The intense heat that prevailed at times during the summer of 1896, especially during the first two weeks of August, though conducive to the undue propagation of some species of insects, had the opposite effect upon certain species that feed in the larval condition freely exposed upon the plants. Upon the Department grounds and elsewhere in the vicinity this was particularly noticeable in the case

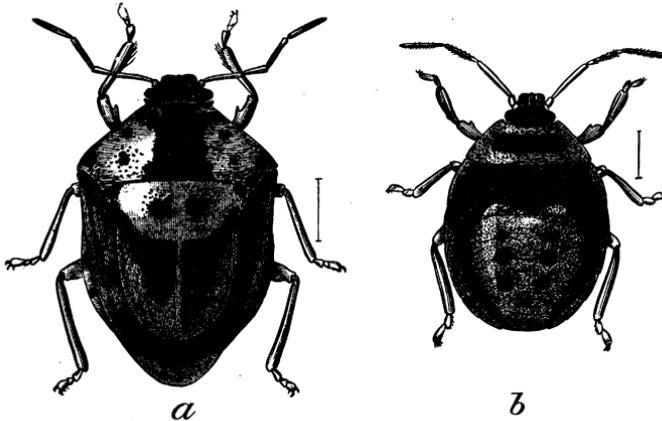


FIG. 88.—*Stiretrus anchorago*: a, adult bug; b, nymph—both enlarged five times (original).

of the larvæ of *Crioceris asparagi*. Their eggs also seemed to be dried up by the heat. What with their natural enemies and the heat, scarcely a beetle or larva of either species was to be found about Washington, D. C., after the last of August, though frequent search was made in the neighborhood.

#### REMEDIES.

Fortunately, the common asparagus beetle is not difficult of control, and under ordinary circumstances may be held in restraint by the simplest means.

Vincent Kollar, who wrote of this insect in 1837, said: "The only means of destruction is picking off and killing the beetles and larvæ." Fitch's only recommendation was the employment of domestic fowls for the purpose.

While hand picking is undoubtedly of some value in small beds,

and is still in use to some extent, it must of necessity give way to more approved methods for the vast myriads of the beetles that concentrate their forces upon the large areas that are devoted to this crop in the suburbs of our large cities. Chickens and ducks are efficient destroyers of asparagus beetles, and as they do no injury to the plant their services are still in requisition for this purpose at the present day.

An excellent practice that is in high favor among prominent asparagus growers is to cut down all plants, including seedlings and volunteer growth, in early spring, so as to force the parent beetles to deposit their eggs upon new shoots, which are then cut every few days before the eggs have time to hatch for the first new brood.

Other measures that have been employed with advantage consist in cutting down the seed stems after the crop has been harvested, and again once or twice during the cutting season, or in permitting a portion of the shoots to grow and serve as lures for the beetles. Here they may be killed with insecticides, or the plants, after they become covered with eggs, may be cut down and burned, and other shoots be allowed to grow up as decoys. The trap plants should be destroyed as often as once a week.

With concerted action on the part of growers in following out any of these last methods the insects should be held in check, at least in a region where the plant does not grow wild in too great profusion. Where this is not practicable, the insecticides must be brought into service. It is well in any case to employ the insecticides after the cutting season, since if the insects are destroyed at this time their numbers will be lessened for the next year.

One of the best remedies against the larvæ is fresh, air-slaked lime, dusted on the plants in the early morning while the dew is on. It quickly destroys all the grubs with which it comes in contact.

Pyrethrum is credited with being a useful remedy, and quite recently Professor Klein,<sup>1</sup> director of the experiment station at Karlsruhe, Baden, has reported that a mixture of soft soap, quassia decoction, and water (about equal parts of the first two to five of the last named) is effective against the larvæ, but these remedies will hardly commend themselves for extensive use until they have been thoroughly tested on a large scale.

The arsenites, applied dry in powder mixed with flour, as for potato beetles, answer equally well; they possess the advantage of destroying beetles as well as grubs, and are of value upon plants that are not being cut for food. Some of our correspondents use a mixture of paris green and air-slaked lime, or plaster, 2 pounds of the former to a barrel of the latter. It should be borne in mind that to produce satisfactory results the lime or arsenite must be applied at frequent intervals, or as often as the larvæ reappear on the beds.

A simple and inexpensive method of killing the larvæ in hot weather

<sup>1</sup>Berichte d. Grossh. Bad. Landw.-Bot. Versuchsanstalt z. Karlsruhe, 1896.

is to beat or brush them from the plants with a stick so that they will drop to the bare ground. The larvæ are delicate creatures, and, as they crawl very slowly, few are able to regain the shelter of the plants, but die when exposed to the heated earth.

#### THE TWELVE-SPOTTED ASPARAGUS BEETLE.

(*Crioceris duodecimpunctata* Linn.)

A much rarer, and consequently less injurious, species than the preceding, at the present time, is the twelve-spotted asparagus beetle. It is generally distributed in Europe, where it is apparently native, and, although common, is not especially destructive.

Like the commoner species, it lives exclusively on asparagus, and the chief damage it does is due to the depredations of the hibernated beetles in early spring upon the young and edible asparagus shoots. Later generations attack the foliage, living, for at least a considerable portion of the larval stage, within the ripening berries.

#### INTRODUCTION AND SPREAD IN THE UNITED STATES.

The presence of this insect in America, as has been stated, was first discovered in 1881, and in the vicinity of Baltimore, Md. Dr. Otto Lugger, to whom this discovery is due, informs the writer that this beetle was noticed in considerable numbers from the first, showing that it had probably been introduced several years earlier. At that time it occurred quite locally, having been found only at the mouth of the Furnace Branch of the Patapsco River at a point a few miles south of Baltimore. It was then to be seen only on volunteer asparagus growing on the salty margin of this river, although beds of cultivated asparagus were plentiful in the immediate vicinity. Two years later the late Dr. Riley, then Entomologist of the Department of Agriculture, remarked that it had recently proved even more troublesome than the common asparagus species.

Assuming Baltimore to have been the original center of distribution, the twelve-spotted asparagus beetle has been traced southward through Anne Arundel and Prince George counties to the District of Columbia, where it was detected five years from the time of its first discovery. In 1892 it was reported to have appeared in considerable numbers on asparagus stalks that had been cut down upon a farm in Carroll County, Md. The same year Dr. J. B. Smith, entomologist of the New Jersey Agricultural Experiment Station, announced its appearance in Gloucester County, in southern New Jersey, and in the following year it was found in Cumberland and Camden counties of the same State.

To have reached these points the insect, obviously, had traversed the intervening country, comprising Harford, Cecil, and Kent counties in Maryland, the northern half of Delaware, and Salem County, N. J. It was also found to have reached Virginia, near Washington.

In 1894 it had extended northward to Burlington County, N. J., and westward to Philadelphia County, in Pennsylvania. The same year it was detected in Queen Anne County, Md.

The past year (1896) it was found to have established itself in Charles County, Md., and to have penetrated as far south in Virginia as Westmoreland County.

In May, 1896, a serious invasion was reported in Prince George County, Md., where the beetles attacked the young shoots, gnawing off the heads as soon as they showed above ground, thus entirely unfitting the crop for marketable purposes. As in most other cases of the reported presence of this insect, it was accompanied by the common asparagus beetle, which was first to appear on the beds, but soon gave way to the twelve-spotted species. During that year a number of new localities were added, including Westmoreland County in Virginia, the southernmost locality at present known for the species.

In addition to the above, we have a brief record, that of Dr. J. A. Lintner, who mentioned the occurrence of this insect in asparagus beds in Monroe County, N. Y., in 1894. This is at a point near Rochester, in the northwestern part of the State, and not far from Lake Ontario. Its remoteness from other known localities of the insect leads naturally to the conclusion that this must have been an independent or at least an artificial introduction, therefore a second center for its further distribution. It seems hardly probable, however, that the species will spread from this point with the same degree of rapidity that it has done from Baltimore, as it has here reached the northernmost limit of the Upper Austral life zone, and its progress in following this life zone would be southwest, whereas from Baltimore it spread in all directions.

To the above must be added the finding of the species by Mr. M. H. Beckwith, at Millsboro, Del., in the northern portion of that State.

#### PRESENT AND PROBABLE FUTURE DISTRIBUTION.

From available data it is now fairly established that this species is at present distributed throughout the asparagus-growing country in the southern half of New Jersey, the whole of Delaware, nearly the entire State of Maryland, the District of Columbia, the southeastern portion of Pennsylvania bordering the State line of New Jersey, and northeastern Virginia in the vicinity of the western shore of the Potomac River.

At first its progress was slow, but within the past few years it has traveled more rapidly. The theory that water has played no small part in spreading the asparagus beetles is exemplified in the case of the present species, as it will be observed that it had spread to Washington, D. C., 35 miles southwest of Baltimore, within five years of its discovery, while its appearance was not noticed at any distance east or north of Baltimore until six years later.

Having a different starting point from *Crioceris asparagi*, this species has nevertheless followed somewhat closely the course of the latter,

particularly southward, along the coast line, rivers, and other water courses, and, like the latter also, it has been slow to spread inland. At its present rate of distribution it has at least as wide a range as the older species was known to have gained in the same number of years after its introduction. Although, as already stated, it is far less injurious than the latter in Europe, and not so abundant in this country, save in a few localities, it would be unsafe to predict its future destructiveness. That it will in time invade the territory now occupied by the common species in the North and West as it has in the South there can be no reasonable doubt; that it is capable of inflicting considerable injury has been proven, but it will be a matter of several years before it can be classed as more than a sporadically injurious species.

## DESCRIPTION, LIFE HISTORY, AND HABITS.

The mature beetle in life rivals *asparagi* in beauty, but may be distinguished by its much broader elytra and its color. The ground color is orange red; each elytron is marked with six black dots, and the knees and a portion of the under surface of the thorax are also marked with black. (See fig. 89, *a*.) The beetle, as it occurs on the plant when in fruit, very closely resembles at a little distance the ripening asparagus berry.

The common asparagus beetle, as is well known, dodges around a stem like a squirrel when disturbed, but the twelve-spotted form appears to trust to flight, taking wing more readily than the other. Both species make a loud creaking sound when handled, by what is called stridulation, produced in the present species by rubbing the tip of the abdomen against the elytra.

The full-grown larva is shown in the illustration at fig. 89, *b*. It measures, when extended, three-tenths of an inch (8 mm.), being of about the same proportions as the larva of the common species, but is readily separable by its ochraceous orange color. The ground color is light yellowish cream with an overlay of ochraceous orange which is most pronounced on the exterior portions of the abdominal segments. The head, with the exception of the mouth-parts, is also ochraceous, the thoracic plate is prominent, divided into two parts, and is of a dark-brown color. Enlarged figures of the second abdominal segment of both species are presented at fig. 89, *c* and *d*, for comparison.

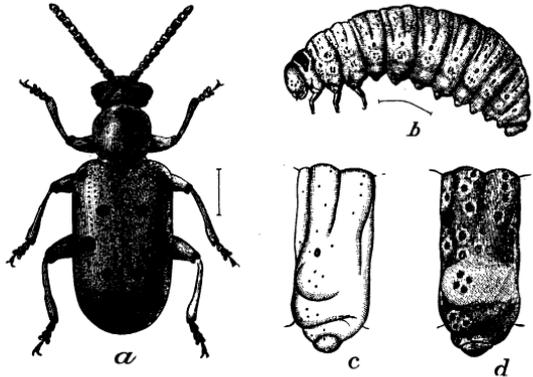


FIG. 89.—*Crioceris 12-punctata*: *a*, beetle; *b*, larva; *c*, second abdominal segment of larva; *d*, same of *C. asparagi*—*a*, *b*, enlarged, *c*, *d*, more enlarged (original).

The life history of the insect is as yet imperfectly understood. The egg has not been found and only a few of the young larvæ have been observed. One of the latter was upon the foliage of the plant; the others, in various stages of growth, occurred in the berries. It might be conjectured that the eggs are deposited, like those of the common species, on leaves and stems, and that the larvæ of at least the first generation feed upon the same portions of the plant, but further observation is necessary to establish this.

The adult beetles feed, like the common species, upon the leaves and epidermis of asparagus stems, and, in confinement at least, also upon the berry.

In Europe the species is stated to be double-brooded, the first generation appearing in April or May, the second in August or September. The larvæ of the later generations feed preferably upon the berries, in which they live singly, introducing themselves into the pulp. The infested fruit reddens prematurely, and the larvæ, when full grown, cut their way out and escape to the ground, which they enter to undergo further transformation. The pupa state is said to require two or three weeks for the first generation and the entire winter for the second. Be this as it may in Europe, it is more probable, from what we know of the common asparagus species and other imported leaf-beetles in this country, that there are here more than two broods annually, at least in the more southern range of the species, and that hibernation takes place in the adult condition.

#### REMEDIES.

Of the efficiency of the remedies indicated for the common asparagus beetle there is ample testimony; that all of these, with the possible exception of caustic lime and other measures that are directed solely against the larvæ on the growing plants, would prove of value against the new species scarcely admits of doubt, but the habit of the larva of the latter of living for at least a considerable portion of its existence within the berry places it for that period beyond the reach of natural enemies and insecticides.

The collection and destruction of the asparagus berries before ripening might be a solution of the problem, but it is questionable if recourse to this measure would be necessary, save in case of an exceptional abundance of the insect.