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BUREAU OF ENTOMOLOGY—CIRCULAR No. 145.

L. O. HOWARD, Entomologist and Chief of Bureau.

THE LARGER CANNA LEAF-ROLLER.

BY

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In Charge of Truck Crop and Stored Product Insect Investigations.

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THE LARGER CANNA LEAF-ROLLER.

(*Calpodes ethlius* Cram.)

By F. H. CHITTENDEN, Sc. D.,
In Charge of Truck Crop and Stored Product Insect Investigations.

RECENT INJURY AND METHOD OF ATTACK.

During the year 1911 the leaf-rolling caterpillar of *Calpodes ethlius* Cram. attracted considerable attention from its abundance in most of the public parks in the District of Columbia, and at West Grove, Pa.; Norfolk, Va.; West Raleigh, N. C.; Memphis, Tenn.; Clinton, Miss.; Birmingham, Ala.; and Orlando, Fla. In earlier years it has ravaged fields of canna in portions of South Carolina and Alabama.

In September, 1904, a lot of specimens was received from Mr. L. H. Read, Fruitdale, Ala., who wrote that thousands of the caterpillars were in the fields and that hand-picking was out of the question. All bronze varieties of canna were injured, including 8 or 10 varieties. Among those most attacked were Mississippi, Mont Blanc, Explorateur Crampbell, and Italia. A few green varieties were somewhat affected, but as a rule were scarcely touched; obviously owing to their thicker and tougher leaves. The caterpillar was observed at work only at night. The same year the species was observed somewhat abundantly at Baton Rouge, La., by Prof. A. L. Quaintance, and sparingly at New Orleans, La., by Prof. E. S. G. Titus. Although only a few instances of severe injury are cited, these are doubtless merely representatives of many which were not reported.

August 27, 1905, the writer observed considerable injury by this caterpillar to many of the decorative canna growing on the grounds of the Department of Agriculture at Washington, D. C., and after-

wards noted similar injury in several of the smaller public parks of this city, showing that the attack was not local, although more severe on the department grounds, which had attracted the butterflies from afar, doubtless owing to the much larger parkage. Caterpillars kept under observation had "spun up" for pupation by September 3, but at this time there were still many young larvæ present in garden plats, and there was evidence that they had been at work at least as late as the middle of August, while the age of the larva indicated that the butterflies had appeared to lay their eggs late in July, but evidently not earlier. The cause of this invasion was apparently that the summer of 1905 was an unusually hot one. Heat favors an increase of insects of this type. Prevailing southerly winds, however, were probably more potent factors in causing this migration from the Gulf region northward, since the summer of 1906 was still warmer, but with much greater humidity, and under these conditions only one pupa was found during that entire year.

FIG. 1.—The larger canna leaf-roller (*Calpodes ethlius*): Full-grown larva. About one-third enlarged. (Original.)

FIG. 2.—Canna leaf showing, at left, injury by an older larva of the larger canna leaf-roller. (Original.)

The attention of the writer was attracted to injury by this species by the large irregular areas which were cut away from the margins of the canna leaves. It was then noticed that the larva (fig. 1) begins operations by cutting a small, more or less oblong strip about one-half inch long from the edge of a leaf and folding it neatly over on the lower surface. (See fig. 2.) Within this flap, which is nearly flat, the larva lives concealed, feeding above and below its retreat. As it increases its growth the larva makes large incisions in the leaf's edge, with a correspondingly large flap (fig. 3). It is not until the larva is considerably larger that it forms large tubular retreats. (See

fig. 4.) Rarely a larva folds a portion of the lower side of a leaf over the upper surface. This operation may vary under different conditions in other localities.

The following year, 1907, this species came under the observation of Mr. H. M. Russell, at Orlando, Fla., on August 24. At this time he found all stages in great abundance on canna, the leaves of which were being cut to pieces. Many plants were stripped of leaves down to the midrib.

A TROPICAL INSECT, KILLED OF BY FROST.

This species and its injuries have been known for many years, yet only one comprehensive article on it has, to our knowledge, appeared in any work on economic entomology,[1] although the insect in its various stages was described in detail by Dr. S. H. Scudder in his Butterflies of the Eastern United States and Canada.[2] The entire appearance of the insect from the larval stage to the adult is indicative of its tropical origin, and it is still somewhat restricted to the South. There is a possibility, however, that it may gradually extend its present distribution if it can obtain a footing in greenhouses where cannas are grown.

FIG. 3.—Canna leaf showing injury by still older larvæ of the larger canna leaf-roller. (Original.)

During 1911, at Washington, D. C., the writer obtained many specimens of rolled-up leaves of canna, some containing pupæ and larvæ, November 1; and later, November 3, after a frost of 28° F., 1 live pupa, 1 dead larva, and 2 dead pupæ were found. This material was placed under the same conditions as those under which it would have remained where found—that is, in the open—but none had transformed to butterflies up to November 22, showing quite conclusively that this material, which was carefully handled, would naturally have died under the circumstances. In the parks, when the cannas were cut, the immature stages in leaves were left for a day or two

[1] Bul. 54, Bur. Ent., U. S. Dept. Agr., pp. 56–58, 1905. Data from this article have been incorporated in the present circular.

[2] Vol. II, pp. 1750–1757, 1889.

and afterwards presumably taken away where they would not have had an opportunity to transform any more than they would have had under the conditions previously mentioned. Several days later, November 27, only one living pupa was found, and this evidenced very little likelihood of ever recovering from the cold, showing conclusively that the species, unless it happens to find some unusually good place for hibernation, is "killed out" by the severe frosts of practically every winter. These conditions may even exist farther southward than the District of Columbia, wherever severe frosts are encountered.

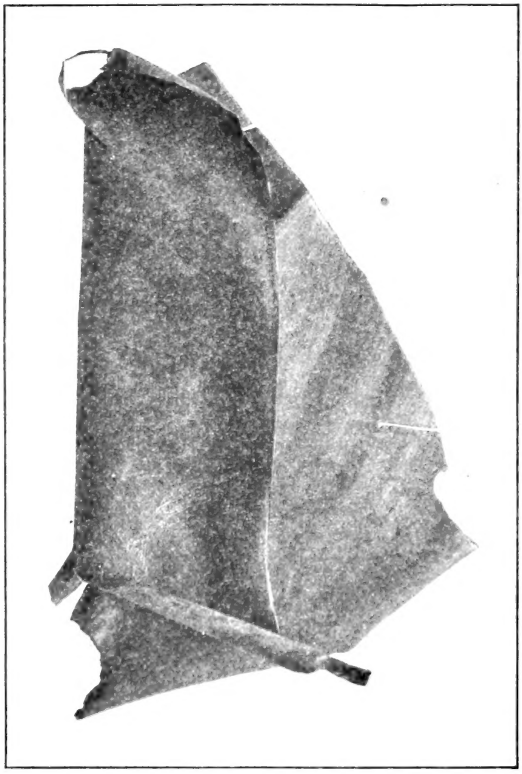

FIG. 4.—Section of canna leaf, showing edge rolled over and fastened by larva of the larger canna leaf-roller. Folded section taken the last of October, showing larger size than in summer. (Original.)

DESCRIPTIVE.

The butterfly.—The parent of this singular leaf-roller is a butterfly belonging to the subfamily Pamphilinæ of the family Hesperiidæ, or skippers. It is one of the larger skippers, with a wing expanse of between 1 and 1¼ inches. The head is very broad, with large eyes, and the body is thick and heavy. The upper surface of the head, thorax, and a portion of the abdomen is thickly covered with long olive hairs. The wings are dark brown, with white semitransparent spots, arranged as in figure 6, *a*, which also shows the location of the masses of yellowish hairs, the contour of the wings, and the structure of the antennæ. The lower surface of the wings is much paler brown, or fulvous, and more nearly uniform in color. The head and body are still paler yellowish. The adult is sometimes called the Brazilian skipper.

The egg is illustrated by Scudder. It is subhemispherical in outline, as viewed from the side, and has a convex base, while the surface is very irregularly reticulated, in most cases pentagonally. The broadest

diameter is 1.25 mm.; height about 0.7 mm. Eggs have not been seen by the writer, and the color does not appear to have been designated.

The larva, or caterpillar, is quite remarkable because of its semi-transparency. Its surface is without hair, and the general color is moderately pale green, with dark-orange subtriangular head, which is marked by a frontal subtriangular space. The thoracic segments are greenish testaceous and more or less tinged with orange, at least in preserved specimens. The remainder of the body is nearly transparent, presenting a view of the vascular and nervous system beneath the skin, as illustrated in figures 1 and 6, *b*. The length of the larva, when full grown, is about $1\frac{3}{4}$ inches, but when fully extended it reaches $2\frac{1}{2}$ inches.

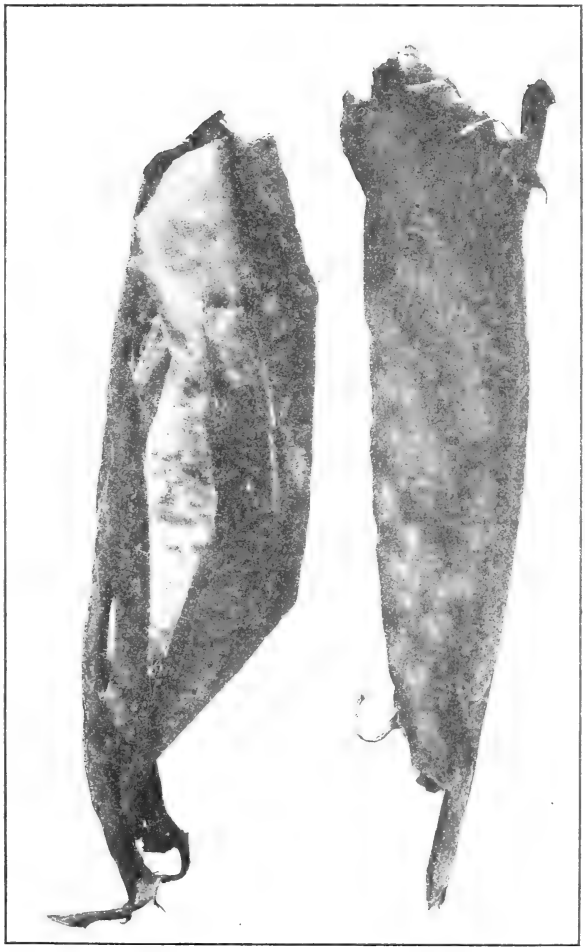

FIG. 5.—Work of larger canna leaf-roller: At right, tubular retreat from which the larva feeds, at left, same, showing pupa within. (Original.)

The pupa is nearly as striking as is the larva. It is of similar pale greenish color and of the appearance shown in figure 6, *c*, *d*. The head is prolonged into a curved process, and the tongue extends in a nearly straight line considerably beyond the prolonged anal tubercle. Without the projections it is nearly as long as the unextended larva.

DISTRIBUTION.

Scudder states that the principal range of this species is from Central America to the northern parts of the South American Continent,

although it inhabits also the extreme Southern States of our Union. So far as can be learned it is known to exist permanently only in the Gulf States, South Carolina, and Porto Rico in our domains. It also inhabits Cuba and Jamaica, however, and in South America occurs as far south as Argentina, where it was years ago reported to be common by Burmeister.

In an earlier article on this species (loc. cit.), Scudder's dictum was followed and the mentioned occurrence of this species at Bay Ridge, Long Island, and at New York City were considered as merely transitory. It is evident that such infestations may occur in the North whenever conditions favor the northward flight of the butterfly. These conditions have been mentioned. It is hardly probable that the insect successfully overwinters in the District of Columbia or

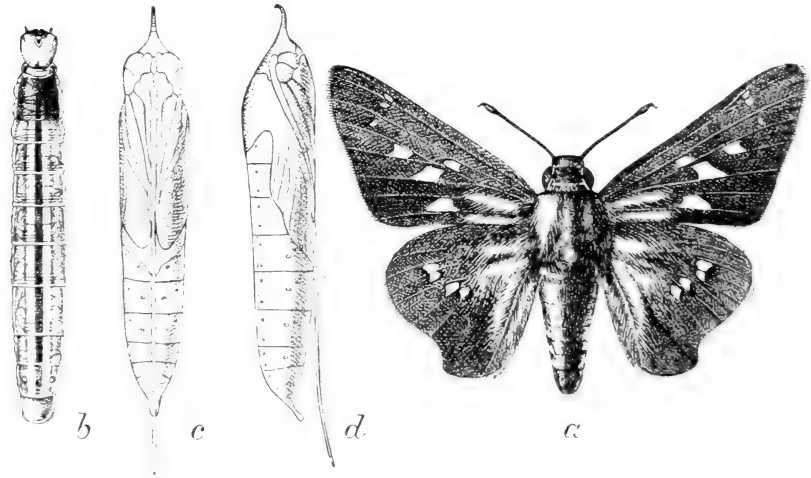

FIG. 6.—The larger canna leaf-roller (*Calpodes ethlius*): *a*, Butterfly; *b*, partly grown larva; *c*, pupa, front view; *d*, pupa, side view. Enlarged. (Original.)

northward, but that it flies in a northerly direction whenever there are favorable conditions for such a flight. Careful search was made by the writer in the parks of New York City in September and October of 1911, as also throughout Long Island to Riverhead, but there was no evidence whatever of the presence of this species in the State of New York that year.

EARLIER ACCOUNTS OF INJURY.

In the records of the Bureau of Entomology we have accounts of injuries and of other observations on this species, as follows: June 7, 1880, we received from Dr. J. H. Mellichamp, Bluffton, S. C., a report that the larva had utterly destroyed some luxuriant plants of *Canna flaccida* in his garden. August 9, 1887, we received from Mr. A. L. Townsend, Bay Ridge, Long Island, report that the species did much

damage to French cannas and to *Caladium esculentum*. In our rearing cages the butterflies hatched June 12 and August 26.

The caterpillars appear to affect only plants of the genus Canna, when these are obtainable, and sometimes they are so abundant as to do much damage, at times utterly destroying luxuriant plants. Dr. H. G. Dyar, of the Bureau of Entomology, mentions a case in which the larvæ were eating the leaves of canna in the grounds of a hotel at Miami, Fla., considerably injuring the appearance of the plants.

LIFE HISTORY AND HABITS.

Eggs are laid singly and separately, sometimes in groups of from five to seven, on the under surface of leaves. According to Miss Helen King[1] they hatch in Texas in six days, while in Florida, according to Wittfeld, they may hatch in four days.

On hatching, the caterpillar, as is common with many species, devours a portion of its eggshell, whereupon, after feeding lightly on a leaf, it folds the latter over and confines it in place with a few stitches of silk, enlarging its retreat as it develops. From the tubular case thus formed it feeds along the edges and retreats within when disturbed. It is careful to eject all excreta and exuviæ, but in spite of its cleanliness the caterpillar is frequently attacked by disease.

Dr. Dyar[2] has ascertained that there are customarily five stages of this larva. The larva, when full grown, develops to a pupa in its resting place, "held by a transverse loop and a band of silk for the cremaster. * * * The cremasterial band is attached at one end to the leaf; at the other to the transverse thread." This accurately describes the pupal case as observed in specimens received at this office.

According to data accumulated by Scudder, the butterfly is on the wing in southern Florida in May, and from eggs laid in the middle of the month the butterflies reappear in the first half of June. In South Carolina the season is a little later, and there mature caterpillars have been observed before the middle of June and fresh butterflies from the 12th of the month to the end. Scudder concludes that there are two generations before midsummer. Judging by recent experience there are likely to be two more generations before cold weather, but we do not know how the winter is passed. The moths from one of these generations appear in the latter part of September.

Of the butterfly Angus has stated that he was attracted to an individual, which he captured near New York City, "by the peculiarity of its movements on the wing; they were very undulating, like those of gnats, as they rose and fell almost perpendicularly and in a very easy manner." Wittfeld adds that one of the favorite times for

[1] Psyche, Vol. III, pp. 322–324, 1882.
[2] Entomological News, vol. 8, pp. 163–165, 1898.

flight of the butterfly in fair weather is after sundown. Miss Helen King describes its motion as "very rapid."

VARIETIES OF CANNA MOST AFFECTED.

The question as to whether dark varieties of canna are more affected by this species than are green ones remains for further investigation. In the District of Columbia the green-foliage varieties which have come under the writer's observations are considerably more affected than the darker ones. When, however, the insect becomes very abundant it attacks all varieties. One correspondent, mentioned on the introductory page, has stated of the occurrence of this species in the Gulf region that it affects more particularly the dark varieties. A leaf showing severe injury by this species of leaf-roller is illustrated in figure 7, and a bed of cannas showing similar injury is shown in figure 8.

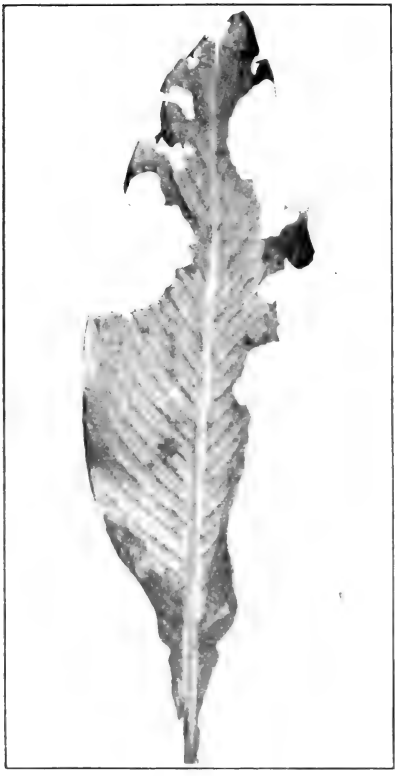

FIG. 7.—Canna leaf, showing advanced injury by larvæ of the larger canna leaf-roller. (Original.)

NATURAL ENEMIES.

In spite of years of experience with this species, neither Mr. Russell nor the writer has been able to observe any form of disease, but Mr. E. G. Smyth, when working under the writer's direction at Diamond Springs, Va., observed two larvæ killed by disease October 8, 1909.

During October, 1907, Mr. Russell found at Orlando, Fla., quite a number of egg parasites. October 12 he found a canna leaf on which were 33 eggs of this species, 5 unhatched, and 2 hatched larvæ; 26 of these eggs had given out parasites through a very minute hole in the side. October 16, 4 unhatched eggs were placed in one vial and 16 in another vial. November 1, while away, the eggs hatched out 20 minute parasites,[1] *Pentarthron minutum* Riley, as identified by Mr. A. A. Girault. In the other vial one larva hatched; the rest gave forth many minute parasites of the same species and one large unidentified parasite.[2] These observations, although few in number, show a high percentage of egg parasitism.

[1] Chittn. No. 2990.

[2] Chittn. No. 2992.

METHODS OF CONTROL.

The rolled-over margins of the leaves of canna caused by this caterpillar can after a time be very readily detected while the larvæ are still young. (See fig. 2.) Later large holes will appear and the rolled-up leaves will be more prominent unless something is done to check the pest. The dark excrement will be found below the infested leaves and will also serve to indicate the presence of the larva, and after opening any of these rolled-over leaves the insect will usually be found therein, or traces of its former presence. All of these facts, together with the large size of the insect itself, permit its control by hand methods. Hand-picking was successfully prac-

FIG. 8.—Bed of cannas showing serious injury by larger canna leaf-roller. Many leaves wilted and dying, or notched, as shown in foreground. Washington, D. C. (Original.)

ticed at Lafayette Square, Washington, D. C., in late July, 1911, and on the Department of Agriculture grounds, by squeezing the leaves with gloved hands. In the former locality the insects were very abundant; in the latter they were so well controlled by hand methods as scarcely to be noticed on the many canna plants which were grown.

The usual arsenicals, such as Paris green and arsenate of lead, with or without Bordeaux mixture, can be used without any real danger of poisoning. Their use is not always desirable, because of the presence of children, who are allowed to roam into yards which

are not protected by gates; but this is not the case with our public parks, where the cannas grow in great profusion and are sufficiently protected by frames and where warning is always given by the officers in charge to keep away from the growing plants. These arsenicals may be used with a knapsack or other hand sprayer in just about the same manner as advised against the Colorado potato beetle in Bureau of Entomology Circular 87, a copy of which may be obtained on application to the Department of Agriculture.

It can not be too strongly emphasized that whatever method is used, whether spraying or hand-picking, should be inaugurated early in the season to prevent serious injury later on.

Approved:

JAMES WILSON,

Secretary of Agriculture.

WASHINGTON, D. C., *December 29, 1911.*

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