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THE PUSS CATERPILLAR AND THE
EFFECTS OF ITS STING ON MAN.

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There are about 25 species representing about 8 families of lepidopterous larvæ the bodies of which are supplied with urticating hairs or spines which produce more or less painful stings when they come in contact with unprotected portions of the skin of man. Among these *Megalopyge opercularis* S. & A. produces the severest sting of all the forms occurring in the United States. In the South these caterpillars sometimes become so numerous as almost to defoliate shade trees, but their principal claim upon our attention is their sting.

The occurrence of this caterpillar in great abundance during a number of seasons in the last 8 or 10 years has given it considerable notoriety in the South. It has been termed "Italian asp," "possum bug," "puss caterpillar," and, by the Mexicans, "perrito," meaning little dog. Each of these names is assigned on account of some habit or appearance of the caterpillar.

DISTRIBUTION.

The species has a rather wide distribution throughout the Southern States. It has been taken as far north as Virginia, is common in Florida, and is not infrequently met with in the central Southern States, but appears to attain its maximum abundance in Texas, especially from Dallas southward in the central western part of the State. The related species *Lagoa crispata* Packard is very commonly met with throughout the Northern States, but its stinging propensities are not highly developed. The family Megalopygidae is rather large and especially developed in the Tropics, many of the species being fairly large and several possessing urticating bristles.

HOST PLANTS.

Megalopyge opercularis has a rather wide range of host plants. It has been reported by Watson¹ and others as feeding regularly on citrus trees in Florida, and in the writer's work in Texas has been taken commonly on hackberry (*Celtis occidentalis*), elm (*Ulmus*, two or three species), cultivated and wild plum (*Prunus* spp.), sycamore (*Platanus occidentalis*), and oak (*Quercus*, several species), and frequently on rose bushes (*Rosa* spp.). The trees are listed in about the order in which they are preferred by the caterpillars as food.

DESCRIPTION OF STAGES.**THE ADULT.**

Both sexes are yellowish brown, the wings being clothed with rather long wavy hairs, some of which are white, especially along the veins, giving an appearance of silvery streaks. The forewings are strongly marked with dark brown, particularly toward the

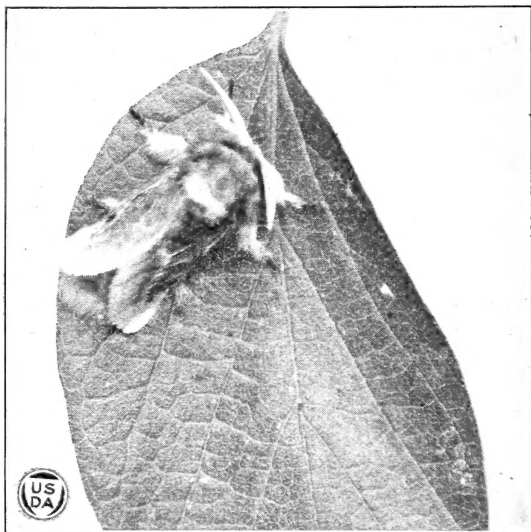


FIG. 1.—Male moth of the puss caterpillar.

anterior border. The wing spread of the female is nearly $1\frac{1}{2}$ inches, and the male is somewhat smaller. The legs are also covered with long hair and the tarsi, being black, contrast rather strongly with the lighter hairs above. (See Figs. 1 and 2.)

THE EGG.

The eggs are pale yellow, elongate oval, the sides nearly parallel for some distance and the ends bluntly rounded. The average length is about 1.2 millimeters and the width 0.6 millimeter. The eggs are laid in rows in the form of an arc, usually 8 to 12 eggs in a row. Sometimes two or three parallel rows about one-fourth of an inch apart are deposited, the female moving forward a little after each row is laid. As the eggs are deposited the tip of the abdomen is swung laterally, the head of the moth serving as a pivot. Occasionally one row of eggs is laid directly on top of another. Nearly always the eggs are well covered with the long yellowish hairs from the abdomen of the moth (Fig. 3), and when the insect has completed oviposition the body is often practically denuded of hair. The head end of the embryo is toward the center of the circle. The eggs are usually deposited on the leaves of trees.

¹ Watson, J. R. Insects of a citrus grove. University of Florida Agricultural Experiment Station Bulletin 148, p. 245-246. June, 1918.

THE LARVA.

The first instar is about 1.5 millimeters long. The color is usually yellowish with a slight reddish tinge. Each of the body segments is provided with protuberances on each side crowned with hairs, some of which are one-half to two-thirds the length of the body, and among these hairs occur rather strong spines. These spines are only slightly developed on the posterior segments. In the second instar the length of the larva is about 2.3 millimeters, the color usually rather uniformly reddish yellow, the greatest width at the anterior thoracic segment and tapering toward the posterior end. The body is fairly well covered with tufts of rather long hairs intermixed with other hairs somewhat wavy and often equal in length to the body. In the third instar the larvæ measure 3.1 millimeters in length. The hairs appear longer, more numerous, and rather lighter in color than in the previous instar. In the fourth instar the larvæ

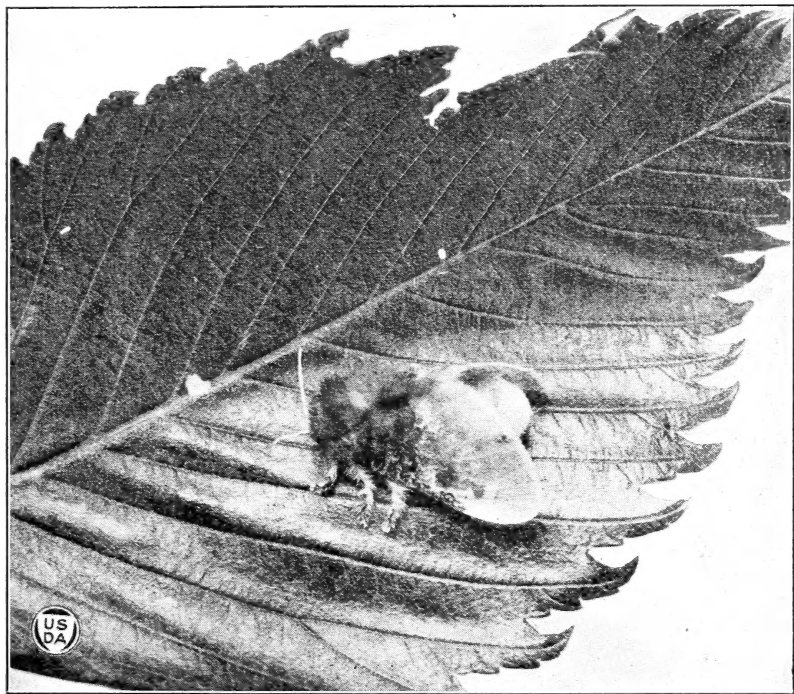


FIG. 2.—Female moth of the puss caterpillar.

measure about 3.6 millimeters in length. The hairs are more thickly set than in earlier stages and are inclined to recurve, especially in the middle of the body, giving a matted or bunched appearance. There is apparently an increase in the number of urticating spines with each molt.

It is believed that there are five or six instars, but owing to high mortality and overlapping the later stages have not been definitely separated. In the last stages the larvæ are well covered with hair, which lies rather flat, extending downward to the surface upon which the insect rests. The larvæ are considerably deeper in the thoracic region and taper toward the posterior end, the hair at that end being tufted to form a sort of tail. (See Fig. 4.) The hairs all arise from rather definite circlets, three rows of which are present on each side, the dorso-lateral ones being the largest. Among the hairs on each of these convex areas are numerous smooth yellowish spines with almost black tips. (See Fig. 5.) The dorso-lateral rows contain from 100 to 125 each, the lateral from 50 to 60, and the ventro-lateral rows 20 to 30 each. Close to the base of the legs and the pseudopods is a row of small folds bearing some hair on their apices, but apparently not provided with spines. The length of the mature larva is about 1 inch.

The color in these later instars is extremely variable, being pale yellow, gray, reddish brown, or mouse color, and some few present mixtures of colors. These colors change with the molts and do not seem to be correlated with age or food plants.

THE COCOON.

The cocoons are spun on the trunk or small branches and occasionally on the leaves of the host trees. The first silken structure (Fig. 6) is elongate oval, and within this is formed the more dense and tough urn-shaped cocoon with its characteristic hump in the middle over the thoracic region and beautifully constructed beveled-edge operculum (Fig. 7). Practically all of the long hairs are shed

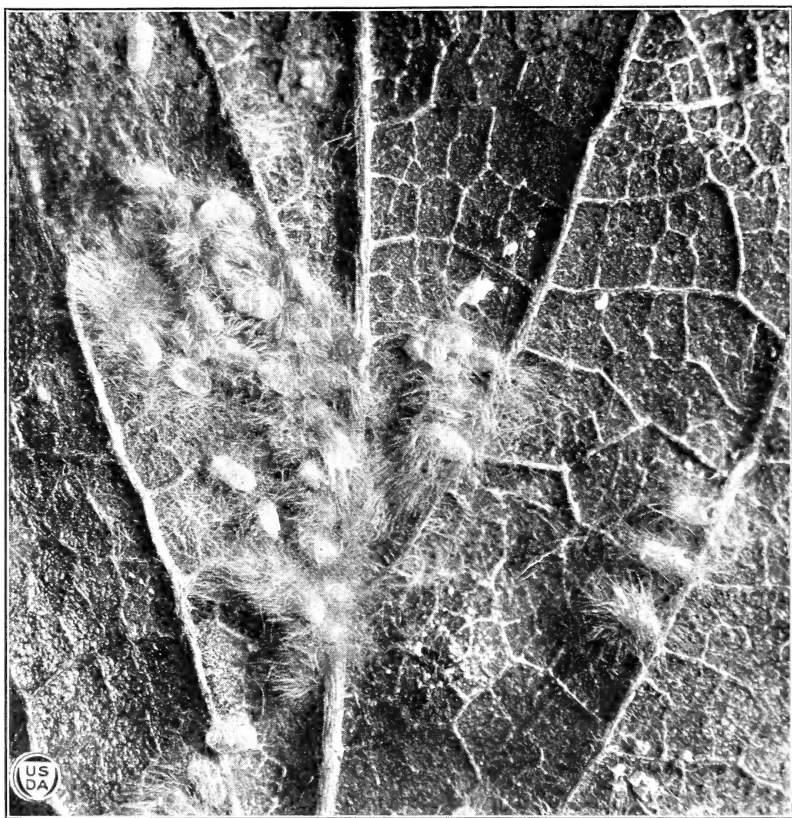


FIG. 3.—Eggs of the puss caterpillar on leaf, covered with hairs from body of moth.

by the larva as it spins and are interwoven with the silk, thus giving the cocoon nearly the same range of color as shown among the caterpillars. The ventral side of the pupa is shown in Figure 8.

LIFE HISTORY AND SEASONAL HISTORY.²

The insect spends the winter in the larva stage within the cocoon. Pupation takes place in the early spring and the adults emerge in April, May, and June. The moths in emerging from the cocoon often leave the exuviae projecting from the operculum (Fig. 9).

² In the life-history work carried out in 1914 the writer was materially assisted by W. E. Dove.

They are comparatively sluggish and usually mate soon after becoming dry. The eggs are usually laid by the females on the leaves nearest at hand. After oviposition there seems to be more tendency for the moths to fly and they are occasionally seen around lights in a city. The females usually begin deposition the day following emergence and will lay many eggs even though not fertilized. No indication of parthenogenesis has been noted. The number of eggs deposited ranges from 300 to over 600. Oviposition is usually completed in 2 or 3 days, but may extend over a period of 7 or 8 days.

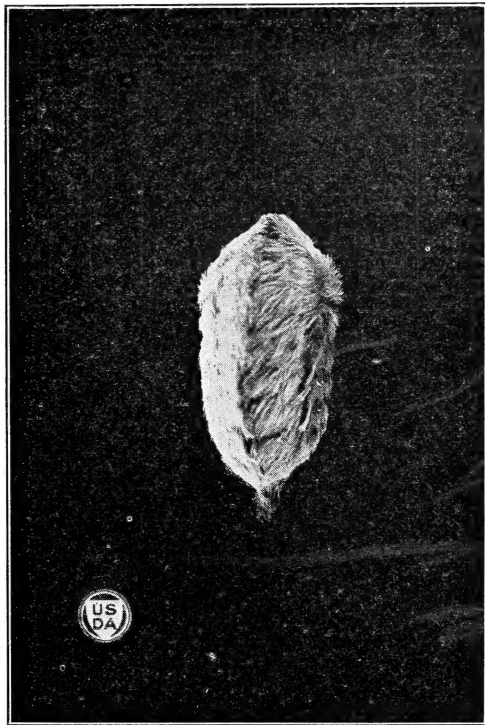


FIG. 4.—Full-grown puss caterpillar.

The females usually die shortly after egg laying ceases and the males live from 4 to 9 days. Oviposition proceeds freely without the moth partaking of food, and it is believed that normally the adults do not feed in nature.

The duration of incubation has been observed to range from 4 to 8 days. The segments of the young larvæ can often be seen through the eggs several hours before hatching begins. In hatching the egg is broken open at the tip by the larva and usually a portion of it is eaten away, thus leaving a ragged end. The young larvæ feed gregariously for several days, the leaves at first being minutely skeletonized as shown in Figure 10. Later, usually in the third instar, the larvæ begin to cut through the entire leaf.

Tables 1 and 2 give some of the data obtained in the study of this insect.

TABLE 1.—*Megalopyge opercularis*: Pupal period, oviposition, and incubation at Dallas, Tex.

Date cocoons were spun or collected.	Period of adult emergence.	Period from spinning or collecting to emergence.	Number of moths.			First oviposition.	First hatching.
			Male.	Fe-male.	Sex not known.		
1914.							
Collected:		<i>Days.</i>					
Aug. 27.....	Aug. 31 to Oct. 7..	4 to 41+....	13	3	12	Sept. 1	Sept. 6
27.....	Sept. 5 to Sept. 6..	9 to 10+....	2	1	0	Sept. 7	
Sept. 19.....	Sept. 21 to July 18.	2 to 302+...	2	1	4		
Dec. 7.....	May 3.....	147+.....		2		May 7	None.
Spun:							
Oct. 20.....	May 5 to May 8...	197 to 200+..		2	2		
29.....	Apr. 24.....	177.....		1			
1916.							
Oct. 31.....	May 30 (before)...	211—.....		1			
1920.							
July 3.....	Aug. 7.....	35.....	1				
20.....	Aug. 17.....	28.....	1				
Collected:							
July 30.....	July 31 to Aug. 18.	1 to 19+....	11	6		Aug. 1	Aug. 7
30.....	July 31 to Aug. 26.	1 to 27+....	6	5		do.....	5
Aug. 4.....	Aug. 6 to Aug. 26..	2 to 22+....	11	8		Aug. 7	

TABLE 2.—*Megalopyge opercularis*: Development of larvæ.

			Earliest and latest dates of molts and minimum length of instars.										All dead.
Date larvæ hatched.	Where kept.	Food.	First ecdysis.	Length of instar.	Second ecdysis.	Length of instar.	Third ecdysis.	Length of instar.	Fourth ecdysis.	Length of instar.			
1914.													
Aug. 30	In laboratory	Hackberry	Sept 8 to Sept. 9.	Days. 9 to 10	Sept 19 to Sept. 21.	Days 10 to 13	Sept. 29	Days 10 to 13			Days.	Oct. 8	
Sept. 19	do.	do.	Sept. 27 to Oct. 1.	8 to 12	Oct. 9.	8 to 12						Oct. 21	
1920.													
Aug. 5	On tree	Plum.	Aug. 10 to Aug. 12	5 to 7	Aug. 16.	4 to 6	Aug. 20.	4				Escaped	
7	In laboratory	Hackberry	do.	3 to 5	Aug. 11 to Aug. 16.	2 to 6	Aug. 19 to Aug. 21.	3 to 7				Aug. 29	
12	On tree.	do.	Aug. 17 to Aug. 20.	5 to 8	Aug. 22.	2 to 5	Aug. 24.	2	Aug. 28.	4		Escaped	
16-17	In laboratory	No food given										Aug. 16	
17	do.	Plum.	Aug. 20 to Aug. 22.	3 to 6	Aug. 24 to Aug. 26.	2 to 6	Aug. 29.	3 to 5				Sept. 14	
21	On tree.	do.	Aug. 20.	3	Aug. 23.	3	Aug. 25.	2	Aug. 28 to Sept. 3.	3 to 9		Sept. 18	
	do.	Hackberry	Aug. 25.	4	Aug. 27 to Aug. 29.	2 to 4	Sept. 1.	3 to 5	Sept. 77.	6?			

The duration of the early instars has been determined rather accurately, as shown in Table 2, but no individuals have been carried completely through their development under close observation. This has been due to the large percentage of mortality from disease, especially when the larvæ are kept in confinement. Development is comparatively slow, and apparently 30 to 60 days are necessary for growth to be completed.

In Dallas the maximum number of grown larvæ of the first generation seem to occur in June and July, and of the second generation in September and October. There has always been more or less overlapping of the two generations, however, and in some strains probably

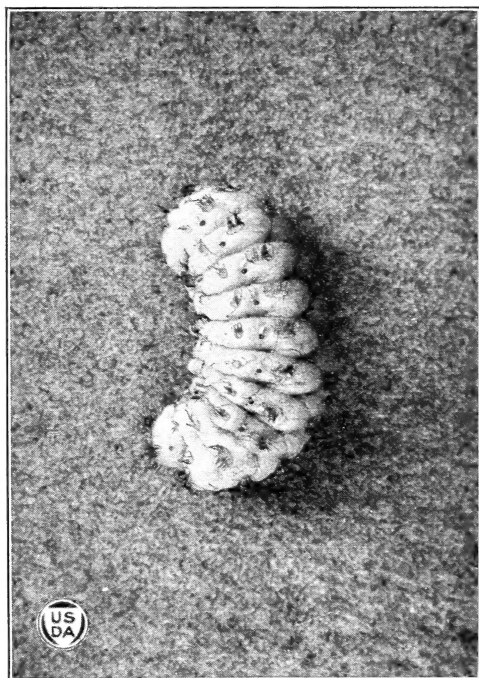


FIG. 5.—Puss caterpillar with most of hairs removed to show clusters of spines.

there is but a single generation in a year. Pupation of the first generation usually begins early in July and extends through the month, and with some individuals much later. The duration of this stage in the first or summer generation ranges from 28 to 41 days (see Table 1). The cocoons of this generation are to be found well scattered over the trees, frequently being attached to the leaves but more commonly to the twigs and branches. The spinning of the cocoons of the second generation begins in September and extends until heavy freezes occur. With this generation there is a marked tendency to spin up on the larger limbs and trunks of trees, and apparently a greater number leave the trees entirely and crawl about in search of suitable places for pupation. The tendency to spin up in crevices and other protected places is much more marked in this than in the summer generation. The crevices in the rough

bark of the hackberry trees are often seen to be filled with cocoons, sometimes thousands of them being present on a single tree. Occasionally they are seen on fences or houses, or on stones around the bases of trees.

INJURIOUSNESS.

As has been stated, the caterpillars can be considered of comparatively little importance as enemies of shade trees, although on

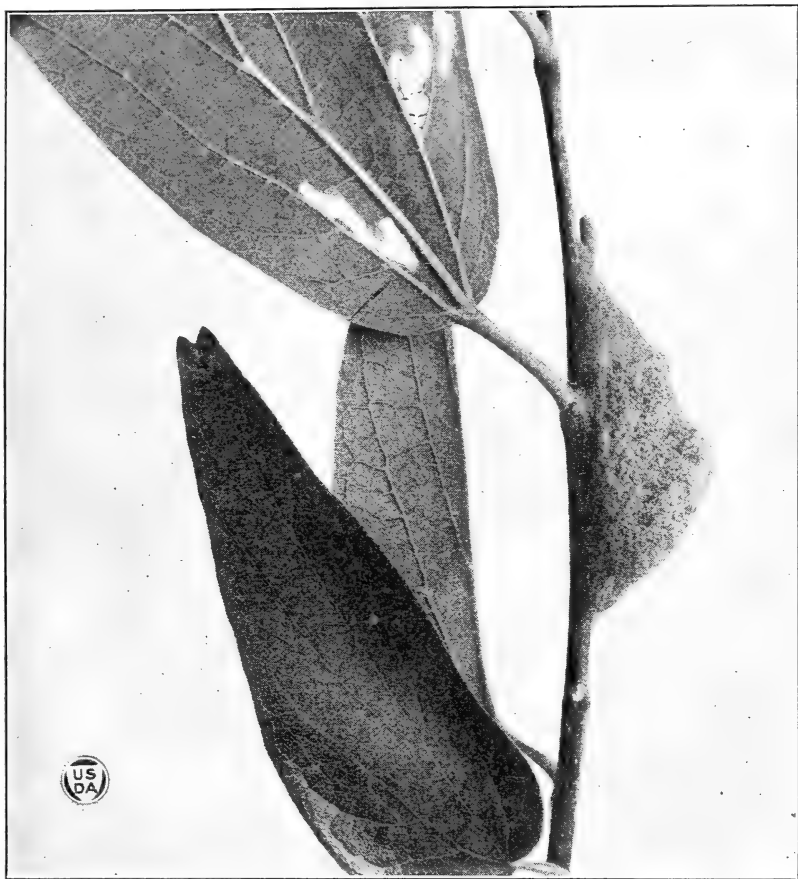


FIG. 6.—Cocoon of puss caterpillar attached to twig, side view.

certain occasions they become so numerous as to defoliate them almost completely. This phase of the injury done by them will not be discussed.

All stages of the caterpillar are capable of stinging. The severity of the sting, however, increases with the size of the caterpillar. Freshly molted skins and recently killed larvæ will produce mild stings and the larvæ after the cocoon is spun are capable of stinging, although the venom appears less toxic. While there is evidently a marked difference in the susceptibility of different persons to the effects of the sting, the general concern and excitement produced by

the occurrence in great numbers of the caterpillars in some of the southern cities is sufficient evidence of the poisonous nature of the insect. In Dallas and other Texas cities hundreds and even thousands of cases of stings have occurred during a single season, and in some cases the fear of the caterpillars became almost a mania owing to the description of the effect of the stings which was passed from one to another. It is possible that the effects of stings may be



FIG. 7.—Cocoon of puss caterpillar opened to show beveled cap or operculum.

made more serious by the hysteria engendered by these often exaggerated statements, especially if published in newspapers. In San Antonio, Tex., a few years ago the caterpillars became so abundant about some of the public schools, and the stings were so frequent, that the schools in question were ordered closed until all of the shade trees in the vicinity could be sprayed and this caterpillar brought under control. In Dallas and Fort Worth, Tex., and other cities the forestry departments were deluged with requests that something

be done to eliminate the pest, and the street trees were sprayed with arsenicals on an extensive scale.

It has been found that the long hairs on the caterpillars are harmless, but the shorter spines which are hidden among them are responsible for the ill effects. Most of the stings are caused by inadvertently pressing one of the caterpillars against an exposed part of the body. The severity of the sting seems to depend upon the tenderness of the place struck and also the amount of pressure applied. As has been stated, the severity of the reactions varies much with the person.

Almost immediately after any portion of the body comes in contact with one of these caterpillars an intense burning pain is felt, described by some as similar to a severe nettlesing. This usually becomes worse accompanied by itching for several minutes and persists from 1 to 12 hours and sometimes longer. Almost immediately after a sting the area touched by the caterpillar shows minute raised whitish spots or papules which soon become red, followed by spreading of the inflammatory area for several inches and often accompanied by general swelling of the portion of the body stung. Stings on the wrist have been followed by a swelling of the entire arm to almost double its normal size. A feeling of numbness which almost assumes the characteristics of paralysis accompanies the swelling. This is usually confined to the member attacked but may be generalized. Apparently stings on the neck are even worse, as the writer has one record of a man who was stung severely on the neck and completely incapacitated, being confined to the hospital for six days. These paralytic symptoms are often accompanied by nausea and sometimes by vomiting.

The stings are especially severe among young children, who often develop considerable fever and nervous symptoms. These sometimes last for a day or two and are accompanied by nausea, especially during the first few hours. Usually within two or three hours after a sting, the reddened pimple-like swellings at the site assume the appearance of small vesicles or blisters. These usually persist for a few hours and then apparently harden through absorption, leaving a roughened area. In some instances the discoloration of the skin surrounding the point of attack is rather marked, varying from a deep red to almost black. The paralytic symptoms usually subside with the pain, but the local lesions often persist for several days.

While it is certain that the spines are the direct cause of the nettling, it is rather difficult to explain the very severe symptoms,



FIG. 8.—Ventral view of pupa of puss caterpillar.

especially those of a generalized nature.³ It appears that when a caterpillar is pressed against the skin some of the spines, which are hollow, break off and others are pulled out. Beneath the clusters of spines apparently there are glands which secrete a poison which passes up within the spines, much as described by Packard in the related species *Lagoa crispata* Pack.⁴ The poison glands of the brown-tail moth have been studied by Kephart⁵ and investigations on the nature of the venom in that species have been carried out by Tyzzer.⁶

NATURAL CONTROL.

It is fortunate that, in Texas at least, some very effective natural control agencies are at hand. In fact it is difficult to rear larvæ to



FIG 9.—Cocoon of puss caterpillar with exuvium protruding after emergence of moth.

maturity on account of the high mortality among them due to a bacterial disease, usually manifesting itself among larvæ which are half grown or larger. They become sluggish and cease to feed. After a few days they die and become very soft, a typical result of bacterial infection. Specimens sent to Dr. G. F. White, of the Bureau of Entomology, were found to contain two distinct species of *Micrococcus*, but he could not state positively that they were responsible for the mortality among the larvæ. In many instances this disease

³ Since this paper was prepared Dr. N. C. Foot has published some results of experiments with *Megalopyge opercularis* (Jour. Exp. Med., v. 35, p. 737-753, May 1, 1922). He found that injections into rabbits and mice of an extract of ground caterpillar skins and spines produced marked symptoms and even death. He concludes that, "The poison appears to be of the nature of a venom, combined with protein vehicles, and may be itself a protein." It is rendered inert by boiling.

⁴ Packard, A. S. A study of the transformations and anatomy of *Lagoa crispata* Pack., a Bombycine moth. Proc. Amer. Phil. Soc., v. 32, p. 275-292, 7 pl., 1894.

⁵ Kephart, Cornelia F. The poison glands of the larva of the brown-tail moth, *Euproctis chrysorrhoea* Linn. Jour. Parasit., v. 1, p. 95-103, illus., December, 1914.

⁶ Tyzzer, E. E. The pathology of the brown-tail moth dermatitis. In 2d Ann. Rpt. Supt. for Suppressing the Gypsy and Brown-tail Moths, p. 154-168, Boston, 1907.

was directly responsible for the death of all the specimens under observation. It seemed to spread more rapidly when they were kept in close association, but also attacked them readily when they were scattered on the limbs of a tree.

Since 1913, when the severe stings inflicted on man by this pest came to the writer's attention, there has been a very noticeable variation in its abundance from year to year. It was very abundant in San Antonio in 1913 and 1914, apparently decreased during the next two years, and waves of unusual abundance have occurred since. At Dallas the caterpillars were fairly numerous in 1914, but less so for several years following. There was an unprecedented outbreak of them during 1920 in both Dallas and Fort Worth, and a very marked decrease in their number during 1921. This periodicity is no doubt rather closely correlated with the effectiveness of the natural control agencies.

In addition to the bacterial disease, and probably of even greater importance, are the tachinid parasites *Exorista flavirostris* v. d. W. (Fig. 11) and *Phorocera claripennis* Macq. (Fig. 12). The writer is indebted to Dr. J. M. Aldrich and H. J. Reinhard for the determination of the many lots of these flies submitted to them. At San Antonio, Tex., in 1914, *E. flavirostris* was most abundant. As many as eight flies emerged from a single cocoon, and fully 75 per cent of the larvae of the fall generation were parasitized by the two species. At Dallas, *P. claripennis* appears to predominate. Only a single specimen of this fly develops in a cocoon. Emergence usually begins earlier in spring than with the other species.

Both of these species have been observed to overwinter in the larva stage in the host within the cocoon. These flies usually emerged in March and April from cocoons spun in October and November, but some came out in the fall. The shortest period observed from spinning of the cocoon by the host to emergence of the flies was 11 days in summer and 22 days in fall. Two specimens of *E. flavirostris* were observed to leave the caterpillar and pupate August 22, and the adults emerged September 8.

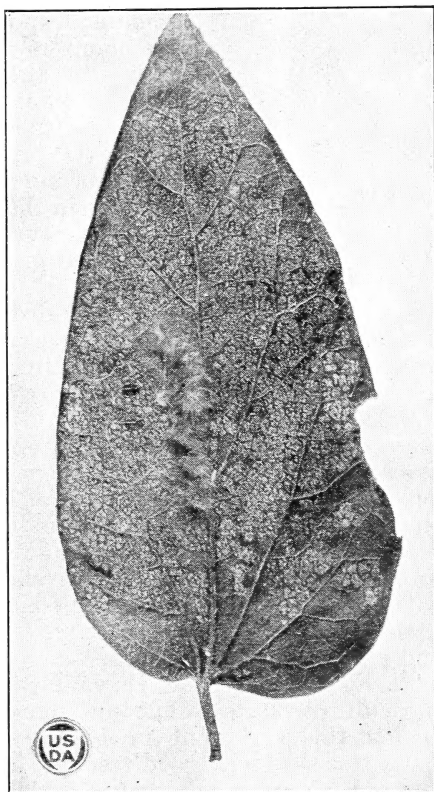


FIG. 10.—Leaf showing skeletonizing due to the feeding of young puss caterpillars.

Two specimens of the common hymenopterous parasite *Chalcis ovata* Say were bred from cocoons of this moth, and specimens of the ichneumonid (*Cryptus*) *Compsocryptus retentor* Brullé emerged in April from cocoons collected in November.

REMEDIAL MEASURES.

The logical procedure in a case of this kind is to prevent the occurrence of stings by early destruction of the caterpillars, but this is often not done. The pain from stings does not seem to be reduced materially by applications of ammonia, soda packs, or permanganate of potash, which might be expected to counteract it. The use of tincture of iodine on the lesions followed by cold applications apparently gives some relief. The need is apparent of determining precisely the toxic principle involved. This is especially true since the venom seems not to be an acid, as in the case of most insect stings.



FIG. 11.—*Erorista flavirostris*, a parasite of the puss caterpillar.

The spraying of shade trees with lead arsenate in the proportion of 7 pounds of powdered arsenate of lead to 150 gallons of water, with 4 pounds of dehydrated lime added, was found very satisfactory by Alfred MacDonald, formerly city forester in Dallas, Tex. In a few instances in which trees were sprayed with this mixture the writer checked up the results and found that where there were about 100 caterpillars on a medium-sized tree more than half of them were found dead on the ground four days after spraying and a few days later every live individual had disappeared. Weaker strengths did not appear to be satisfactory because of the slowness with which the caterpillars were killed and the increased danger of having them crawl about and possibly produce stings.

E. E. Scholl of the Texas Department of Agriculture states that in some spraying against this pest done in 1914 a combination contact and poison spray was used with good results. He used an emulsion of engine oil and soft soap—2 gallons to 50 gallons of water—with the addition of 2 pounds of powdered arsenate of lead.

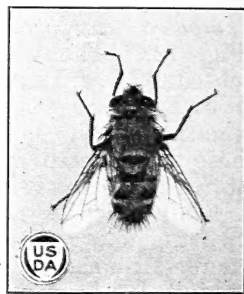


FIG. 12.—*Phorocera claripennis*, a parasite of the puss caterpillar.

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