

A STUDY OF THE "BLACK WIDOW" SPIDER
LATRODECTUS MACTANS, FABRICIUS.

by

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SUBMITTED IN PARTIAL
FULFILLMENT OF
THE REQUIREMENTS OF
THE COLLEGE OF WILLIAM AND MARY
for the degree of
MASTER OF ARTS
1934-1935

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INTRODUCTION

The "Black Widow" spider is the only spider found in the continental area of the United States that has been proved to be dangerously poisonous. This spider is even classed with rattlesnakes as to the poisonous effect. (Merriam, 1910.)

The first known case of Black Widow spider poisoning in this country was reported by Dr. Abner Hopton of Clintwood, N. C. in 1830. The first recorded death from arachnidism by this spider was that of an employee of John M. Dick in North Carolina in 1889. Since that time much experimental work has been done with spiders of the genus *Latrodectus*. Riley and Howard published one of the earliest American papers on this subject in 1889. In 1901, Rudolph Kobert, a German toxicologist, presented a detailed account of experiments with the Russian *Latrodectus* or Karakurt. Baerg published reports of the effects of a Black Widow spider bite upon himself in 1923 and three years later Bogen reported 150 cases of arachnidism in the United States during the preceding half of a century. A paper by Bogen in 1932 showed nearly 400 cases in this country.

The object of this study was a general consideration of the biology of the Black Widow spider, *Latrodectus mactans*, with particular emphasis upon the development and morphology of the poison glands, pre-

liminary to further study along medical lines, and a collection of data of the incidence of arachnidism in Virginia. Studies of the venom of this spider from a toxicological viewpoint and the effect of the toxin upon nerve tissues are contemplated.

The work was carried on at the College of William and Mary during 1934-1935, under the direction of Dr. E. D. Taylor, who suggested the problem to me and who has offered invaluable guidance. The writer is greatly indebted also to: Dr. D. W. Davis, Head of the Department of Biology, College of William and Mary, for his aid and interest; and Dr. E. C. L. Miller, Secretary of the Virginia Academy of Science, for his interest and help in collecting data on case reports.

SYNONYMY

The Black Widow spider has been known as Theridium verecundum, T. lineatum, T. carolinum, Latredectus perfidus, L. formidabilis, L. dotatus, L. zorilla, L. intersector, L. apicalis, L. variegatus, L. thoracicus. (Bogen, 1926.) The scientific name now used is Latredectus mactans, Fabricius. (Petrunkevitch, 1911.)

Common names of this spider are the Hour-glass spider, the shoe button spider, the T-bar spider, and the po-ko-moo.

Latredectus mactans is a web-spinning spider of the family Theridiidae. The females of this species are the largest in this family. These spiders are comb-footed, sedentary, spinning webs to catch prey and on which to place egg sacs.

They have four pair of lateral eyes, widely separated. There are three tarsal claws, with a comb on the tarsus of the fourth pair of legs, which is used for flinging silk from the silk glands opening on the spinnerets. (Comstock, 1913.)

DESCRIPTION

The female, which is the sex responsible for the cases of arachnidism, has a globose abdomen of about .95 centimeters in length, on the ventral surface of which there is the characteristic scarlet "hour-glass"

and on the dorsal surface slightly above the spinnerets, a similarly colored dot. The cephalothorax is approximately .32 centimeters in length and width. The abdomen and cephalothorax are glossy coal black, covered with very fine, short, black hairs and averaging about 1.3 centimeters in length. The spider may stretch her slender, shiny, black legs over a span of 5 centimeters. (Fig. 1.)

Immature females and males are much smaller and have more elaborate markings. Besides the ventral hour-glass mark, they have dorsally a series of white stripes on either side of a row of scarlet or orange dots. The males may be distinguished from the females by the bulbous palpi, which develop into copulatory organs. Newly-hatched spiders are light brown, gradually assuming the black color in a series of eight molts.

DISTRIBUTION

The genus *Latrodectus* is found in widely separated parts of the world. (Riley and Howard, 1889.) *L. mastans* is restricted to the United States and western South America. Other species, all of which are poisonous, *L. curaciensis*, *L. geometricus* have been identified in Cuba, *L. hasselti* or the "Katipo", in Australia, *L. menavodi*, on islands off South Africa, *L. lugobris* or the "Karakurt",

in Russia, L. tridecimguttatus, between Spain and Italy, and L. congoblatus, in Greece. (Bogen, 1926.)

The Black Widow is found more or less abundantly throughout the southern half of the United States and has been reported in most of the other states. In Virginia the spiders are found chiefly along the Coastal Plain, although cases of poisoning from this spider have been reported as far into higher country as Charlottesville and Bristol.

Some concept of the abundance of this spider in Williamsburg may be obtained from these instances. Fifty individuals of varying stages were found this spring among the stones of a rock-banked curbing covering about thirty-five feet by two feet, on the east side of Texas Avenue. Of the collection, fifteen were mature female spiders, twenty-three were immature females and twelve were immature males. Three months later, five mature females, one mature male and two immature females were collected from the same area. From the bases of a brick wall Black Widow spiders were found, one being found in about every six or eight inches.

HABITAT

The Black Widow spider is found in various situations. Her characteristic habitat is in damp, dimly

lighted places, where she may be undisturbed. In nature, these spiders usually live under stones, wood, around stumps and roots of trees. Specimens have even been taken under debris on beaches. At one time this spider was only noticed in rural districts, where it was found in outdoor privies and old buildings; now this pest shows up around urban homes and occasionally may be found under steps, in furniture, in old clothes, in garages, and in gardens.

HABITS

Food

The Black Widow spider is so named because she devours her mate, although she does not differ from many other species in this; she will not tolerate the presence of any other spider even of the same species. The females are especially antagonistic,

She feeds upon any insect, spider, or small animal which she may ensnare in her web. Although she is a vigorous attacker and fearless fighter, apparently she fights only when in search of food or when her domain is invaded. (Hall and Vogelsong, 1932.) Work with over five hundred of these spiders has shown only one apparently vicious spider. Fortunately, this spider generally is

not aggressive, only inserting her poison-injecting chelicerae when cornered.

The procedure in feeding is to bind the victim in silken threads which are pulled forth from the spinnerets by the hind legs, insert the chelicerae and poison the prey, string up the body in the web and finally to suck the body fluids. Later, the dried husk is cut from the web. Small insects such as flies are dropped from the web within a few hours; larger insects such as beetles are suspended in the web for a day or two.

It has been noted by Blair (1934) that the Black Widow does not feed immediately preceding, during, or following a molt.

That the spider is capable of surviving for some time without food is shown by the following records. Of thirty spiders, fifteen male and fifteen female, deprived of food for forty-two days in late spring, eleven males and one female survived. This also indicates that the male of this species has a higher survival potentiality with lack of food. It would seem probable that the differential in this case was due to the fact that the female spiders were preparing to lay eggs during this period, which should constitute a heavy drain upon the reserve food, and that, with no external source of food, the starvation was apparently

buted to differences in climate since Lawson's observations were made in Colorado and Blair's were made in Alabama. The following observations on the life history of the Black Widow spider have been made in Williamsburg.

The mature female usually constructs three egg cases each season, each sac containing from 239 to 603 eggs, the average being about 300 eggs. Lawson (1934) reports finding the majority of egg cases containing from 500 to 700 eggs. The eggs are white, translucent, with a shell-like covering over a semi-fluid content, spherical in shape and about .7mm. in diameter. They are easily broken and it is very difficult to handle them without crushing. The eggs contain a highly potent poison.

The eggs are laid at night from early spring to late fall. In the latter case the eggs do not usually hatch until the following spring, or if they hatch, the young spiderlings remain in the case until warm weather. Lawson (1934) gives an account of the construction of an egg case. The female spider spun a bell-shaped sac attached to the web, thrust her abdomen into the sac, laid her eggs, then closed up the case, and covered the whole case with additional strands of

silk. The whole procedure required two hours and thirty-three minutes.

The color of the sac varies from a near white to a yellowish tan. The case is balloon-shaped, about 12mm. in length and 9 mm. in width, spun of coarse viscous threads and placed in the upper denser part of the distinctively coarse, irregular web. The spider usually has a place of retreat in the ground at the end of the web; however, she rarely deserts the egg sacs.

Egg cases were made about every fourteen days under natural conditions in the field. (1) A web was located April 25, 1935. Egg cases were made May 1, 1935, May 17, 1935 and May 30, 1935. (2) A second web was found May 7, 1935. Egg sacs were made May 9, 1935, May 24, 1935 and June 7, 1935. No emergences were noted in the field as the cases were removed from the web and kept in the laboratory.

Egg cases were made at intervals of about twelve days in the laboratory. (1) This female was found in the field September 21, 1934 with no egg cases in her nest. She was watered and fed every other day in the laboratory and placed in a cage with two male spiders on September 28, 1934, which she soon devoured. Mating was not observed. She made egg cases on the following dates: October 9, 1934, June 18, 1935, June 25, 1935, July 3, 1935, July 12, 1935, and July 18, 1935. The first three cases hatched three weeks

after they were made. It should be noted that this spider laid fertile eggs in the spring with no opportunity of mating since the previous fall, which suggests that she is capable of storing sperm, as is the case with most spiders, and for an unusually long period. According to Savery, parthenogenesis rarely occurs in spiders. (2) This specimen was taken in the field December 7, 1934. She was not mated in the Laboratory. She laid eggs February 6, 1935, February 14, 1935, February 23, 1935 and March 2, 1935 and died April 3, 1935. The female usually died after completion of her egg sacs. The life span of a female spider is about one year. It is probable that under laboratory conditions these spiders were much better fed than they would have been in the field and therefore laid more egg cases and laid them at closer intervals.

The female spider feeds more and is much more aggressive during her egg-laying period. At this time she fights for food and to defend her egg sacs. When a living insect was placed in the container with a female spider, she immediately attacked the insect, stringing it up in her web and sucking the body fluids. If an attempt was made to remove the insect body before the spider had discarded it, she would cling to the body of her prey. The female spider always remained close to her egg sacs and could not be

pushed away with a stick in contrast to her usual retreat with such treatment.

Spiders emerge within three weeks after the egg sac is made, under summer conditions; during the winter, unless kept in a warm room, the spiders may stay in the case for two or three months. Blair(1934) found that spiderlings emerge within eleven days. Temperature seems to be the factor controlling emergence. Moisture is an important factor limiting the hatching of eggs. Egg sacs kept in a very dry place never hatched. A minute hole was made in the case through which the spiders emerged. The manner in which the hole is made has not been observed.

There is, apparently, no consistency in the size of spiders of each instar or the length of time between molts, but characteristic markings are definitely the same for each spider in the same instar. The size of the spider and the interval between molts seem to be dependent upon the food supply.

When hatched, the young spiderlings are transparent, reddish brown, with no ventral markings, and dorsally two white lateral stripes on each side of the median white stripe and a V-shaped white mark near the base of the abdomen. There is a black region on the cephalothorax around the ocelli and a dark brown area on the tip of the abdomen.

The first molt occurs within about five days after the spiders leave the egg case. Blair (1934) states that he has seen instances in which the first molt occurred within the case. Spiders of the second instar were darker, with the same dorsal markings, but more definite, and the additional ventral hour-glass faintly outlined in white.

The third instar shows black outlining the white dorsal abdominal stripes. An indistinct touch of scarlet appears at the tip of the abdomen and a slight suggestion of scarlet shows on the white hour-glass. The legs are darker except for a light area on the femora, base of the patellae and two light bands on the tibiae. Palpi are beginning to enlarge in the males.

The fourth instar showed more black between the white dorsal stripes and orange appeared on the median white line.

After the fourth molt, the male is easily discernible by the bulbous palpi which serve at maturity as copulatory organs. The male spiders retain the two white lateral stripes, dorsal orange stripe and hour-glass throughout development. The body and legs darken until they are coal black. The body of the female is almost entirely black, with indefinite white markings laterally and a clear orange median line, dorsally, and the hour-glass entirely scarlet, ventrally.

Through the fifth, sixth and seventh molts, the spiders gradually assume the entire black coat, losing the white ventral markings and retaining the dorsal stripe, reduced to a row of scarlet dots.

The last molt showed the mature spider, coal black, except for the ventral hourglass and spot on the tip of the abdomen near the spinnerets, which are scarlet. (For more detailed formal descriptions, see Lawson, 1934.)

Spiders hatching in the fall are mature the following spring, after a series of eight molts. Blair (1934) noted that maturity was reached after six molts, and Lawson (1934) observed that ~~there are winter instars.~~

Spiders were collected during the fall, winter, spring, and summer, in all different stages of development in each season, indicating that there is no regular time for the spiders to mature and that spiders may pass the winter in any stage of development in Williamsburg. It should be noted that the climate of Williamsburg is mild.

METHODS OF REARING

Since the Black Widow spider is cannibalistic, it is necessary to keep each living female specimen in an individual container; male spiders, however, may be kept together since, although the male does give a poisonous bite, he is not apparently cannibalistic.

In this study, a glass tumbler served as a suitable

container for the spiders. The bottom of the tumbler was covered with sand, upon which was placed a small wad of non-absorbent cotton. The top of the tumbler was secured by a piece of fine cheese-cloth and a rubber band. A small hole was cut in the cloth, into which a thistle tube was inserted for the introduction of feed and water. When not in use, the hole was plugged with cotton.

The spiders were fed upon any available insects, particularly Orthoptera and Coleoptera. During the winter months, fruitflies, reared upon a cornmeal and molasses mixture, and blowflies, reared upon meat, were a plentiful and convenient source of food. Adult and immature spiders were given a living insect every three days. Newly-hatched spiders live purely cannibalistically for the first week but then were separated and fed upon fruit-flies, which are especially suitable because of their size. The fruit-flies were transferred to the spider's container by inverting a thistle tube over the mouth of the bottle in which the flies were raised and covering the bottle to darken the interior. Since the fruit-flies are positively phototrophic, they moved into the thistle tube. The tube was then righted and the flies were shaken down through the stem into the spider's web. After the first week, about twenty-four spiders were left, about one-half of which were females. Lawson(1934) found that the survivors were

almost solely females due to the larger size of this sex. At this stage, the writer observed no differentiation in size and the sex of the spiders was determined only by watching further development.

POISON APPARATUS

Description

The poison apparatus of the Black Widow spider consists of a pair of chelicerae and two poison glands located in the anterior part of the cephalothorax. The chelicerae are composed of a fang and a larger basal portion. A small duct leads from the minute opening near the tip of the fang, through the center of the chelicera to the gland, the upper part of which lies inside of the chelicera. (Fig. 2.) The opening of the fang is so placed that that it is not closed by the pressure of the puncture, but permits the poison to flow freely into the wound. According to Savery (1928) and Riley and Johannesen (1932) the poison gland is surrounded by delicate muscles and it is probable that the injection of the venom is due to muscular contraction and that the act of puncturing does not in itself expel the poison.

The chelicerae were cleared for study by bleaching for one hour in a solution of a few crystals of potassium chlorate, three drops of concentrated hydrochloric acid

and 6 cc. of ethyl alcohol (60%).

Development

A study of the development of the poison apparatus shows a gradual increase in size with each instar. (Table p.22|Fig. 3). The poison gland of an adult female spider measured 1.44 mm. in length and .49 mm. in width. ~~It~~the greatest length and width. The gland of a newly-hatched spider was .24 mm. in length and .07 mm. in width, a reduction by nine times from that of the adult female spider. The chelicerae of the mature female spider were 2.08 mm. in ~~length~~ and .52 mm. in width. In the first instar, the chelicerae measured .28 mm. in length and .09 mm. in width, these of the adult female spider being seven times larger.

The poison gland of a mature male spider was found to be .98 mm. long and .28 mm. wide and the chelicerae measured .82 mm. in length and .42 mm. in width. The poison apparatus of the adult male spider is about the size of that of a female spider of the seventh instar. In proportion to the size of his body, the gland of the male is fully as large as that of a female of the same size. This is an interesting findigg since males of this species have been considered harmless by most writers.

Table Showing Size of Poison Gland and Chelicerae
at Each Instar.
(mean size from a sample of six spiders)

<u>Instar</u>	<u>Sex</u>	<u>Chelicera</u>		<u>Gland</u>		
		<u>Length</u>	<u>Width mm.</u>	<u>Length</u>	<u>Width mm.</u>	
Ninth	F	2.06	.52	1.44	.49	.0079 cc
Eighth	F	1.47	.42	1.26	.35	
Seventh	F	1.12	.30	1.09	.28	
Ninth	M	.82	.42	.98	.28	
Sixth	F	.80	.28	.91	.16	
Fifth	F	.63	.19	.77	.14	
Fourth	F	.56	.18	.63	.09	
Third	F	.44	.10	.50	.09	
Second	F	.31	.09	.30	.08	
First	F	.28	.09	.14	.07	(2)

Capacity

From fine measurements of cross-sections taken throughout a whole gland, a single poison gland of an adult female spider was determined to have an approximate capacity of .0079 cc. If both glands were completely emptied simultaneously, the amount of venom injected would be about .016 cc.

POISON

Very little study has been made of the nature and chemical constitution of the poison from Latredectus maotans, due chiefly to the difficulty in securing sufficient quantities of the venom for analysis.

The poison is an oily, translucent, almost white liquid. According to Kennedy (1921), the venom has an acid reaction, a hot bitter taste, gives the xanthoproteic reaction and is rendered harmless by heating to 90° C.

Kobert (1901) has carried out detailed experiments with Latredectus lugubris, the Russian "Karakurt". He has shown that poisons may be found in the body, in the eggs, and in the gland. Arachnelysin, from the body, was shown to dissolve the red blood corpuscles when introduced into blood taken from various birds and mammals. He therefore put arachnelysin in the class with the strongest kinds of blood poisons.

Kobert found that alcohol rendered the poison ineffective and that dry preservation over a period of fourteen years removed all traces of the poison. His attempts to clarify the poison by agents of albumin precipitation always showed attenuation of effect therefore no results were obtained. Kobert concludes that in its chemical nature the poison is neither an alkaleid nor a glycoside nor an acid, but a

toxalbumen, or poisonous enzyme, which is very similar to certain other animal poisons, notably that of the scorpion! (Riley and Johannesen, 1932)

EXPERIMENTAL STUDIES

The literature of experimental studies of poisoning from the Black Widow spider is very conflicting. Berdas reported bites by Latredectus tridecimguttatus with no evidence of poisoning. Baerg (1923) reported severe symptoms following a bite on the finger by Latredectus mactans. He also reported producing immunity in a rat by previous bites. Begen (1926) confirmed these reports by experiments with mice, which died from a few minutes to forty-eight hours after the bite.

In this study, spiders were prepared to bite mice by keeping them without feed for two days preceding the bite. The spider was held between the thumb and the first two fingers and gently rubbed over the surface of the hind leg of the mouse. A slight scratch could be felt when the spider inserted her chelicerae. The spider remained attached to the skin of the animal for about one and one-half minutes.

Definite symptoms were produced in mice by the bite of a Black Widow spider, as may be illustrated by the following typical case. ^{weighing 14.06 grams was bitten by an adult female spider} A female mouse, weighing .1767 grams, the site of the puncture being on the inside of the left hind leg. The mouse was very active

and excited after the bite. Within thirty minutes the back became arched and by six hours the mouse moved with a decided paralytic gait. The eyes were covered with a white mucous secretion by the twelfth hour and the animal died on the twenty-third hour. The mouse struggled violently for one half hour before death, coughing and gasping. The characteristic symptom was the white secretion of the eye. (See table, p. 26)

The rapidity of the appearance of symptoms and the time that elapses before death ensues are probably dependent upon individual susceptibility, the place and depth of the bite, and the amount of poison injected, which is largely a matter of chance as there is no way of regulating the quantity of poison. This very probably accounts for the recovery of the mouse in one case, after a bite by an adult female Black Widow spider. (Table, p. 26)

A bite by an immature female spider produced typical symptoms with recovery in twelve hours. (Table, p. 26)

It is much more difficult to cause a male spider to bite. The bite of a mature male spider produced definite symptoms but complete recovery occurred in from twelve to forty-eight hours.

That the mature female spider, immature female, and mature male spider of Latredectus mactans are all capable of producing effects, and the mature female, even

Table showing length of time for death or recovery
after bite of mouse by L. Mactans.

<u>Spider</u>	<u>Weight g.</u>	<u>Wt. mouse g.</u>	<u>Death</u>
mature female	.1767	14.03	24 hr.
mature female	.1380	22.95	38 hr.
mature female	.1503	18.00	recovery 72 hr.
mature female	.1656	15.006	32 hr.
mature female	.1493	17.69	22 hr.
mature female	.1574	16.50	28 hr.
immature female	.0867	22.99	recovery 12 hr.
mature male	.0500	27	recovery 48 hr.
mature male	.0634	24	no visible effects
mature male	.0362	25	recovery 12 hr.
mature male	.0400	23	recovery 24 hr.

Successive bites at one-hour intervals

mature female	.1234 g.	19	38 hr.
		18	recovery 72 hr.
		20.	no visible effect
		17	no visible effect

death, in mice, has been demonstrated.

To test whether the poison is exhausted by one bite, a series of four male mice, averaging 19 grams, was bitten at intervals of one hour by an adult female spider weighing .1234 grams. The first animal showed the usual reaction and died within thirty-eight hours. The second animal developed the characteristic white secretion on the eyes within six hours but recovered within seventy-two hours. Animals three and four showed no visible effects. This would seem to indicate that the poison is almost completely exhausted by the first bite and that some time is necessary for the replenishment of the poison glands.

Experiments with injections of glands or whole bodies by other experimenters showed no consistent results. Hall and Vegelsang (1932) macerated bodies of L. mactans and injected extracts from the bodies subcutaneously in white rats with negative findings. They suggested that some element in the body of the spider neutralized the toxin of the poison glands. Bogen (1932) reported no consistent effects obtained by injections of macerated extracts of spiders or glands in mice, rats, guinea pigs, rabbits, cats, and chickens. Coleman (1915) obtained positive results from injection of macerated glands in ten drops of distilled water into the abdomen of an eight months old cat.

No effects were produced by the writer from subcutaneous injection of macerated whole bodies, macerated

bodies without glands, or macerated glands alone, in mice. It was found, however, that the body of a pregnant female caused death within forty-five minutes after injection into a mouse. Since Latredectus eggs are lethal in small doses, a body containing about three hundred eggs not illogically could be expected to produce death. It is not improbable that this accounts for the discrepancy in results from injections of whole spiders bodies by various experimenters.

In this study, one difficulty in obtaining results from injections of whole glands seems to be a matter of finding a satisfactory solvent for the poison in the gland. This work is now in progress. It is desirable to study and analyze the poison from the glands, rather than the more easily obtained egg poison, since it is the poison from the glands that is injected when the spider bites.

There has been no question as to the poisonous properties of the eggs of the Black Widow spider. Coleman (1915) produced death in an eight months old cat in three minutes by injection of macerated eggs, intravenously.

In this study, from a series of subcutaneous injections of eggs in two cc. of distilled water, the average lethal dose for mice was determined to be between one and two eggs. (See Table p. 29).

Table Showing the Length of Time Before
Death or Recovery After Injection
of Eggs in 2 cc. distilled water.

<u>Number of Eggs</u>	<u>Time of Death</u>
50	45 min.
36	50 min.
20	60 min.
14	90 min.
7	5 hr.
* 3	48 hr.
* 2	4 days
* 1	no visible effects

* Average of three injections of same dose.

Mice suffering from the effects of injection of eggs did not show the same symptom of the white secretion of the eyes which was characteristic in poisoning from the bite by this spider. This suggests that the two poisons are not identical. In fact, Becker and D'Amour (1934) have shown by cross-immunization experiments that the poison from the eggs and glands are not identical. They have also established immunities in rats by the injection of sub-lethal doses of egg extract and of gland extract.

ARACHNIDISM BY LATROEECTUS MACTANS IN VIRGINIA

Dr. Emil Bogen (1926, 1932) has collected reports of three hundred and eighty cases of arachnidism by L. Mactans, in the United States from 1720 to Sept. 1932 that were serious enough to cause them to be recorded in medical literature. Certainly there have been many other cases not reported by physicians or not correctly diagnosed.

California leads in the number of cases of arachnidism, followed by Virginia and Florida. ^{Reports of} One hundred and eighteen authentic cases of "Black Widow" spider poisoning have been reported in this study from the state of Virginia. The majority of these cases were in Tidewater Virginia especially around Norfolk and Richmond, and on the Eastern Shore. Fifteen cases from Bristol show that

the range of the Black Widow extends into the mountains in this state. (Map p. 46)

A large proportion of these cases occurred since 1930. Most of the cases happened in the spring, summer, or fall, during the natural breeding season of the spider. This suggests that the spider is more aggressive during her breeding season than at other times. The spiders were located in privies in twenty-five instances, in a garden four times, in bed in three cases, on the ground in three instances, and once each in a stump, baseball glove, bathing suit, tobacco sticks, and on a perch. Most of the patients had seen the spider which they described as "black like a shoe-button with a red spot."

Due to the fact that just under the seat of the privy is so common a place for the Black Widow to be found, many of the reported cases of arachnidism in males occurred on the penis or scrotum. The bite occurred on the genitalia in twenty-two instances, the leg in seven cases, the hand six times, the arm thrice, the back in four cases, the buttocks twice and the neck and groin, once each.

Local symptoms were very seldom found. In one case a swelling like a blister formed immediately at the site of the bite. The skin was pricked and the liquid was withdrawn. The area was wiped with alcohol. The patient recovered with none of the usual effects. Assuming that the

spider injected enough poison to produce symptoms, it might be suggested that in this case the poison was injected only superficially and being removed immediately was not absorbed. The washing with alcohol would destroy any poison that might have been left in the wound, since alcohol is known to render the poison ineffective.

The age of the patients ranged from two to sixty-two. The largest number of cases were reported from adults between twenty and forty-five.

Three-fourths of the cases were in males, presumably because they are more often exposed to the haunts of this spider.

There has been only one recorded fatality from Black Widow spider poisoning in Virginia, that of a two year old boy in Charlottesville. The bite of the Black Widow is seldom fatal to adults. That young children are more often killed by spider poisoning is due, probably, to the larger amount of poison in proportion to body weight or volume of the one who is bitten.

Recovery required from forty hours to three months, with paralysis lasting indefinitely. The usual time for recovery was from a few days to two weeks.

Although fatalities occur only in about two per cent of cases reported in this country, arachnidism from this spider is nevertheless serious, since the victim usually suffers three days of virtually unrelieved agony.

A study of the cases reported in this state shows the following general symptoms and effects. The patients usually recall being stung. The first sensation resembles that of a pin prick followed by a slight burning effect, but there is no local rash,^{or} swelling. The first reaction appears in from ten minutes to several hours after the exceedingly minute wound is inflicted. There is pain, increasing in intensity, radiating from the site of the lesion, later localizing in the abdomen, back, and legs, and usually accompanied by nausea, vomiting, profuse perspiration, and urinary retention. The patient may complain of dizziness and throbbing of the head and give a picture of profound shock. The most striking physical characteristic is the extreme board-like rigidity of the abdomen. Excruciating abdominal pains persist for one or more days, gradually subsiding, unless terminating in death.

The treatment advised by Begen(1926) consists of the following three phases: sedation with morphine, codeine, or barbital compounds; stimulation with aromatic spirits of ammonia; and elimination by magnesium sulphate or citrate and enemas. Begen used a specific serum treatment, consisting of the injection intramuscularly of 20 cc. of bleed from a patient who has recovered from *Latreductus* poisoning. Results were good only when the serum was administered immediately after the venomous inoculation.

Reported Cases of Arachnidism in Virginia

PLACE	TIME	WHERE SPIDER WAS	SITE OF BITE	AGE	SEX	RECOVERY
Aacomac (Dr. J. L. DeCormid)	summer 1930	in house	arm	16	male	
Ashland (Dr. J. T. Vaughan)	summer 1930	privy	gluteal region	15	female	
Belle Haven (five cases) (Dr. W. Mear)						
Bristol (fifteen cases) (Dr. David Townsend)						
Buckingham County summer 1934 (Dr. J. R. Trent)		privy	genitalia	25	male	
Charlottesville (Dr. R. B. Burdinger) (Dr. C. B. Mostler)	Oct. 1930	garden	finger	2	male	death in 24 hr.
	Sept. 1931	privy	penis	29	male	several days
	Sept. 1931	privy	scrotum	21	male	two days
	Sept. 1931	privy	scrotum	55	male	40 hours
	Oct. 1931	privy	penis	31	male	
	Nov. 1931	privy	penis	18	male	
	Nov. 1931	rock pile	wrist	35	male	
Church Road New-Gilges Va. Hospital	May 1933	arm	arm	adult	male	two months
Clintwood (Dr. R. L. Phipps)	Aug. 1934	leg	leg	38	male	one week
(two cases)	summer before	elderberry field	hand	adult	female	
Eastville (Dr. J. G. Troner)	summer 1934	on watermelon	shoulder	10	male	
Farmville (four cases) (Dr. W. R. Brumfield)	summer 1927	privy	genitalia	adult	male	several days

(Note: Source of information given below name of place)

PLACE	TIME	WHERE SPIDER WAS	SITE OF BITE	AGE	SEX	RECOVERY
Fort Lee (Med. College Va. Hospital)	May 1933	privy	scrotum	44	male	one week
Hampton (Dr. L. E. Sample) (Va. Med. Mo)	Oct. 1867		hand	18	male	
	Sept. 1874		arm	22	female	
	Sept. 1875	rose bush	hand	13	female	one day
	July 1934	privy	genitalia	adult	male	one week
Highland Springs (Med. College Va. Hospital)	May 1935			18	male	two twosdays
Hopewell (Dr. W. S. Moody)	summer 1922	privy	penis	62	male	one week
Ivanhoe	summer 1925		leg	35	male	three weeks
La Crosse (six cases) (Dr. W. A. Plac Kerr)	summer since 1929	privy	genitalia			
Lee County (one case)						
Lee (Med. College Va. Hosp.)	May 1933	stump	shoulder	12	male	several days
Lynchburg (one case) (Dr. R. J. Holden)		in bed	leg	adult	female	
Mannboro (Dr. J. C. Hamner)		tobacco sticks	shoulder	adult	male	
		in grass	buttock			
		privy	genitalia	adult	male	
Mattoaca (Dr. H. C. Rucker)	July 1935	privy	genitalia	adult	male	
		privy	genitalia	adult	male	

PLACE	TIME	WHERE SPIDER WAS	SITE OF BITE	AGE	SEX	RECOVERY
Mattoax (3 cases) (Dr. H. C. Huxley)	summer 1934	privy				
(2 cases)	Summer 1933	privy				
Meadow (Med. College vs. Hospital)	Sept. 1932	privy	penis	24	male	two days
Nassawadox (one case) (Dr. M. C. Henderson)	June 1861	woods	groin	adult	male	
Newport News (Elizabeth Buxton Hosp) (3 cases)						
Norfolk (Dr. E. C. Savage)	May 1934	baseball glove	finger	11	female	one week
(Dr. C. C. Harrell)	summer 1934	in show	foot	adult	male	three days
(Z. Armstrong)	Nov. 1934	in bed	ankle	26	female	one week
North Halston (Dr. R. O. Campbell)	July 1934	privy	genitalia	adult	male	two weeks
Ocean View (Dr. Southgate Leigh, Jr.)	summer 1934	bathing suit	buttocks	adult	female	one week
	summer 1934					
Old Point (Dr. E. B. Sampson, Jr.)	Sept. 1853	privy	genitalia	adult	male	few days
Parkley (five cases) Dr. D. J. Fisher						
Petersburg (Petersburg Hosp)	Nov. 1934		back	24	female	
(three cases)		privy	penis		male	
(five cases)						
Pulaski (five cases) (L. E. Jordan)	1932-1935					
Richmond (Med. Coll. vs. Hosp)	June 1934	privy	genitalia	48	male	several days

PLACE	TIME	WHERE SPIDER WAS	SITE OF BITE	AGE	SEX	RECOVERY
Richmond (Med. Coll. Va. Hosp.)	Aug. 1931	privy	genitalia	29	male	two days
(Dr. Asa Shields)	May 1934	on porch	neck	adult	male	three months
(St. Luke's Hosp.)	May 1929	on ground	thumb	6	male	five days
(Med. Coll. Va. Hosp.)	July 1931	privy	penis	35	male	three days
(Med. Coll. Va. Hosp.)	1932		thigh	adult	male	one week
Saltville (Dr. R. D. Campbell)	May 1934		thigh	adult	female	one week
Suffolk (Liberian Hosp.)	June 1935			adult	female	one week
(two cases)	summer 1933	privy	genitalia	adult	male	
	summer 1930	privy				
Southampton County (Dr. W. A. Fletcher)				40	male	one week
Virginia Beach summer (Dr. R. W. Woodhouse)	1932-35			50	male	one week
Walkerton (Med. Coll. Va. Hosp.)	May 1935			10	male	several days
Williamsburg Dr. Bell	Fall 1934			10	male	several days
Valley of Virginia Dr. Asa Shields	April 1935	bed		32	male	three days
				40	male	several weeks
				adult	male	five weeks

CONTROL

The interest in this study has not been primarily that of control, but for completeness a brief summary of control methods will be given.

That the Black Widow spider has become a serious pest is shown by the number of cases of arachnidism reported yearly from this spider. The increase in the number of reported cases may not be due to the increase in the number of spiders but to the fact that most physicians now recognize arachnidism as a definite "clinical entity".

The most thorough method of combating this spider in the home is to have a regular "spring house cleaning" and inspection, taking care in handling objects from closets, cellars and dark corners. Spiders and egg cases should be crushed and burned. Effective insect sprays should be used in all closets and places likely to be infested. Retenene spray with ethylene dichloride has been suggested by the Dept. of Health, Los Angeles, Calif. This insecticide is toxic to L. mactans, yet harmless to birds and mammals eating it. The latest preparation, developed by the Los Angeles Dept. of Health, is a solution of Lethane, 5% or 6%, in light oil and is the best destructant of this spider. There is a thiocyanate compound used as a spray composition, non-toxic to animals but very toxic to the Black Widow.

Where this spider is found abundantly in open fields, burning after spraying with gasoline or kerosene has been successfully tried.

Cresote oil spray may be used around the yard since this material not only kills the spider but is a repellent. The chief objection to this chemical is that it destroys vegetation and damages paint.

SUMMARY OF THIS STUDY

1. The "Black Widow" spider in Virginia is found chiefly along the Coastal Plain with its range extending into the mountains.
2. The "Black Widow" spider is very abundant in Williamsburg, being found in numbers in gardens, in rock piles, and along fences.
3. The "Black Widow" spider is capable of surviving for some time without food. The male exhibits higher survival potentiality with lack of food.
4. An indication of the food of the "Black Widow" spider is given from a study of remains of animals left in webs.
5. A review of the breeding habits of the "Black Widow" spider as adapted to the climate of Williamsburg is presented.
6. Methods of rearing "Black Widow" spiders, which have been successfully used, are included in this paper.
7. With reference to the poison apparatus, ^{are presented.} description, study of development, and capacity. The poison apparatus shows a gradual increase with each instar. The capacity of a pair of poison glands is shown to be approximately .016 cc.
8. Definite symptoms were produced in mice by the bite of mature female, immature female and mature

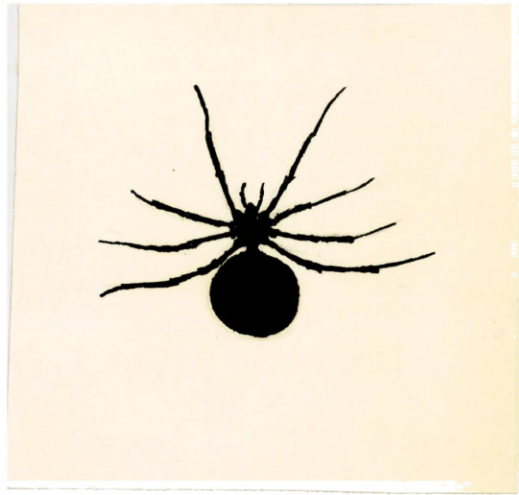
male "Black Widow" spiders. Death was caused in mice by the mature female spiders. That the gland is almost completely exhausted of poison by the first bite and some time is necessary for the replenishment of the gland was demonstrated.

9. Definite symptoms were produced in mice by subcutaneous injection of macerated spider eggs. No effects were observed from injection of macerated spiders or glands.

10. Data concerning one hundred eighteen cases of arachnidism by the "Black Widow" spider in Virginia has been collected and interpreted.



Mature Female
Ventral View



Mature Female
Dorsal View



Mature Male
Dorsal View



Immature Female
Dorsal View

Fig. 1.
Actual Size

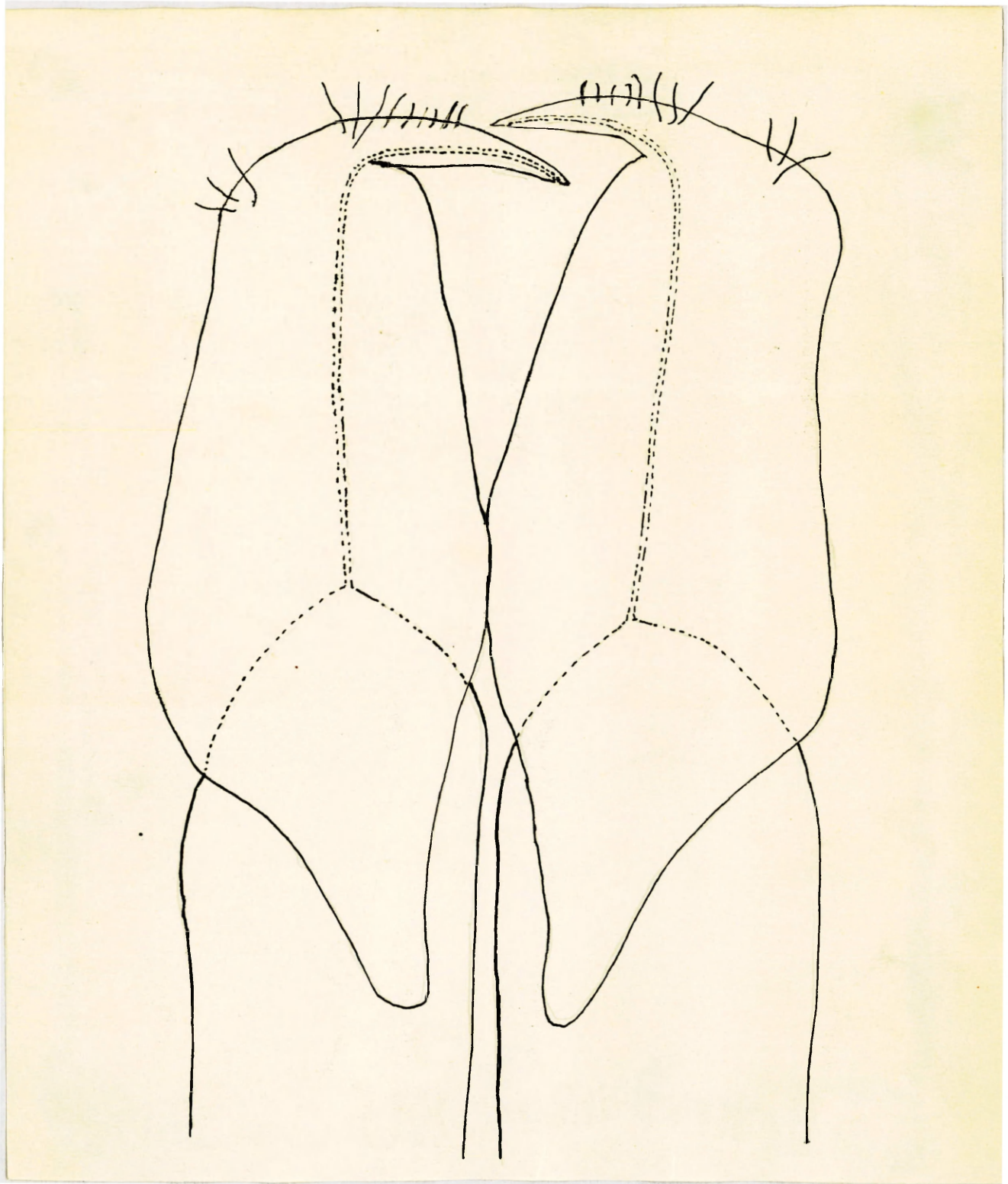


Fig. 2.

Chelicerae, showing duct

L. mactans, mature female

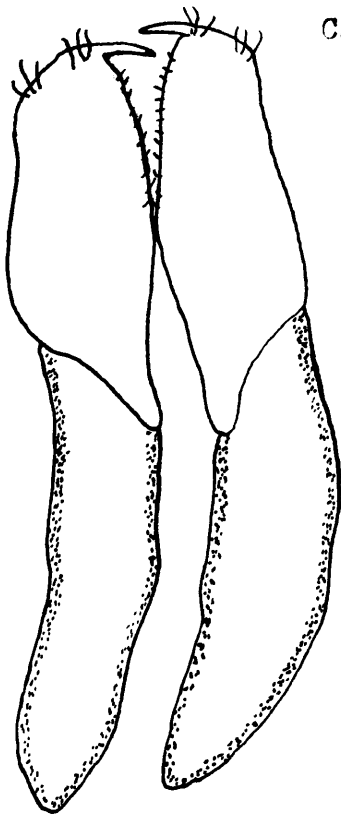
Camera Lucida Drawing

X 72

Fig. 3.

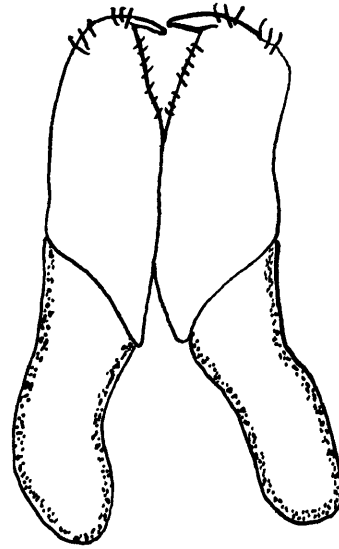
CHELISERAE AND POISON GLANDS
X32

Camera lucida



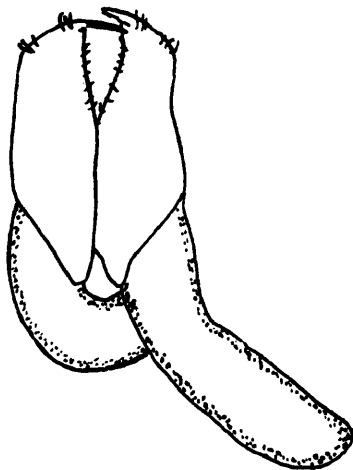
Female

Ninth Instar



Female

Eighth Instar



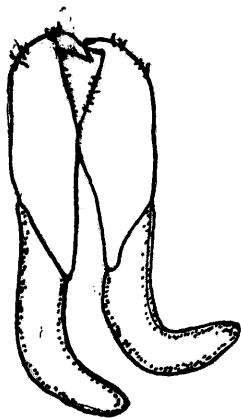
Female

Seventh Instar



Male

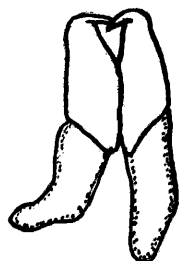
Ninth Instar



Female
Sixth Instar



Female
Fifth Instar



Female
Fourth Instar



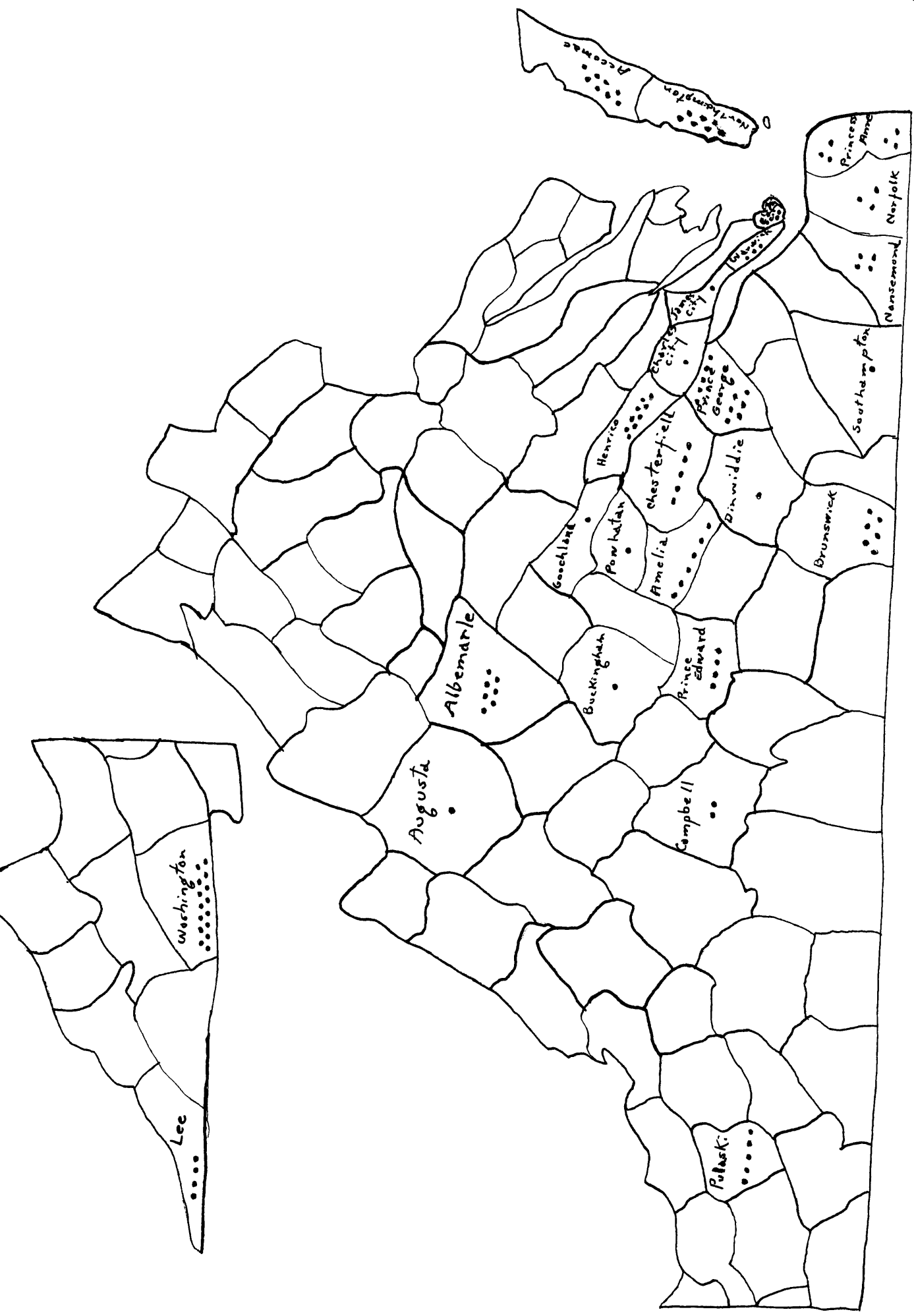
Female
Third Instar



Female
Second Instar



Female
First Instar



Virginia
 Distribution of Cases of Arachnidism

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