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AN ECOLOGICAL STUDY OF HAMMOCK AND PINEY
WOODS INSECTS IN FLORIDA.*

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PART I.

PREFACE.

"No one can have been long engaged in collecting insects without having noticed the remarkable diversity in the products of different years, not only in quantity, but in kinds. Each summer seems to bring its own particular species to the front, so that if a person wishes to get a moderately correct idea of the insects of any locality, it is necessary for him not only to hunt diligently all the season, but every season for a considerable length of time; and if he has from any cause missed one, he

*A thesis (revised to date) presented to the faculty of the University of Florida in partial fulfillment of the requirement for the degree of Master of Science, June, 1917.

may be sure he has missed something which it may be years before he will again have an opportunity of securing, or securing in the same abundance." The causes of these variations are yet to a great extent an unsolved and puzzling mystery.

INTRODUCTION.

As there has been nothing published on the ecology of insects in Florida, the following study was undertaken. It is the first of its kind made in the State and to the knowledge of the writer in the Southern States.

Because of the close interrelation of insect with plant life it is essential that the investigator be acquainted with the plant life of the region studied. In this respect the writer has been greatly aided by Dr. Roland M. Harper's two interesting and instructive articles, "Florida Vegetation Types" and the "Geography and Vegetation of Northern Florida." These, although treating the flora from a purely floristic point of view and not from an ecological one, have been of much help and have been freely drawn upon.

Realizing the utter impossibility of completing a study of all the vegetation types in the time available, the writer has narrowed himself down to that of the hammocks and piney woods. The study of the hammocks has been as intensive as time allowed, while that of the piney woods has been only superficial. It is hoped that this paper may prove an incentive and an aid to some future student in a more comprehensive and complete faunal study of the region.

It represents the results of work running over a period of nearly two years (January 1, 1916, to June 1, 1917), although only half of each day during the academic year was spent on it. Observations were made and collecting done, however, during the summer.

Due to the interest of the writer in Coleoptera, collecting in this group have been more intensive than in the others.

The photographs are the original work of the author.

ACKNOWLEDGMENTS.

A study of this kind has entailed endless collecting and identifying of material.

I wish to acknowledge the assistance and supervision of Dr. H. S. Davis, under whose direction the work was done.

The help and advice of Prof. J. R. Watson, who is also carrying on ecological work, has been invaluable. He has also allowed the use of a few of his records, which are duly credited.

The bulk of the coleoptera determinations has been made by Mr. W. S. Fisher, of the U. S. National Museum, to whom I am especially indebted. Others who have determined material are as follows: W. T. Davis (Orthoptera, Cicadidæ and Odonata), Dr. Herbert Osborn (Homoptera and Tingidæ), A. A. Girault (Chalcidæ), Dr. L. O. Howard (Chalcidæ), J. J. Davis (Aphididæ and Lachnosterna), Z. P. Metcalf (Homoptera), W. S. Blatchey (Coleoptera), J. M. Aldrich (Diptera), C. T. Greene (Forest Diptera), Dr. C. H. T. Townsend (Diptera), Carl Heinrich (Micro-lepidoptera), Wm. Beutenmuller (Cynipidæ), Dr. E. P. Felt (Cecidomyidæ), Dr. A. D. Hopkins (Scolytidæ), A. B. Gahan (Hymenoptera), J. R. Watson (Thysanoptera and Macro-lepidoptera), Dr. H. T. Fernald (Sphecidæ), J. A. Hyslop (Elateridæ), Dr. E. A. Schwarz (Coleoptera), S. A. Rohwer (Hymenoptera), and Dr. Nathan A. Cobb (Nematodes).

DEFINITION AND DESCRIPTION OF HAMMOCK.

The term "hammock" is applied in Florida to the dense hardwood and cabbage-palmetto forests, as distinguished from the open pine lands and cypress swamps. The timber growth of the hammocks is most frequently deciduous or largely so, although the predominating growth may be evergreen.

The variable soil and drainage conditions give rise to a wide variation of vegetation types. The hammocks around Gainesville are of two types, high and low hammocks.

HIGH HAMMOCK.

The trees of the high hammocks are tall and straight. In some places the underbrush is sparse, but in others forms a dense entanglement. On the richest spots the trees are nearly all deciduous, the proportion of evergreens increasing with the sandiness of the soil.

The following is a list of the principal plants observed, giving both the scientific and common names. Those that are evergreens are indicated by heavy type, those that are only partially so by the specific name being in heavy type.

TREES.

Magnolia grandiflora	Magnolia.
Quercus laurifolia	Laurel oak.
Liquidambar styraciflua.....	Sweet gum.
Tilia pubescens.....	Linden or basswood.
Hicoria glabra.....	Hickory.
Cercis canadensis.....	Redbud.

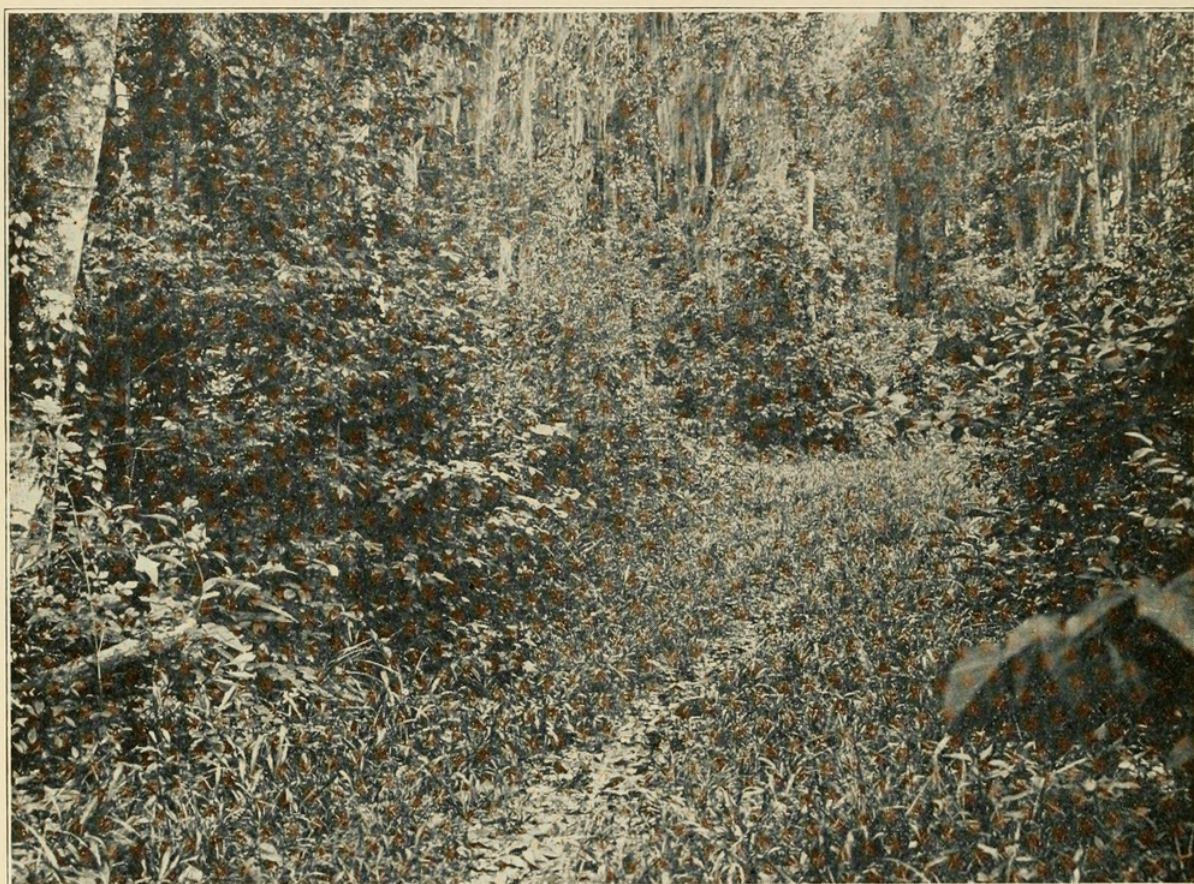


Fig. 1. View in a typical mesophytic magnolia hammock.

Ostrya virginiana.....	Hop hornbeam.
Quercus nigra	Water oak.
Quercus virginiana	Live oak.
Cornus florida.....	Dogwood.
Persia borbonia	Red bay.
Fraxinus americana.....	Ash.
Carpinus caroliniana.....	Ironwood.
Pinus taeda	Short-leaf pine.
Ilex opaca	Holly.
Quercus marylandica.....	Black-jack oak.
Prunus serotina.....	Wild cherry.
Prunus angustifolia.....	Wild plum.
Crataegus spp.....	Red haw.

VINES.

<i>Rhus radicans</i>	Poison ivy.
<i>Vitis rotundifolia</i>	Bullace or Muscadine.
<i>Gelsemium sempervirens</i>	Yellow jessamine.
<i>Rubus trivialis</i>	Dew berry.
<i>Bignonia crucigera</i>	Cross-vine.
<i>Smilax lanceolata</i>	Wild smilax.



Fig. 2. Hammock that has been partly cut over and burned, showing the saw palmetto dominant on the forest floor.

SHRUBS AND HERBS.

<i>Osmanthus americana</i>	Wild olive.
<i>Ilex vomitoria</i>	Yaupon.
<i>Serenoa serrulata</i>	Saw-palmetto.
<i>Tillandsia usneoides</i>	Spanish moss.
<i>Phoredendron flavescens</i>	Mistletoe.
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit.
<i>Arisaema dracontium</i>	Adder's tongue.
<i>Mitchella repens</i>	Partridge berry.
Mosses, violets, ferns and grasses.	

A large percentage of the vegetation is made up of evergreens. The rarity of fire is shown by the abundance of vines and underbrush.

High hammock soil is a very desirable one for trucking and general farming, but is very expensive to clear for cultivation.

LOW HAMMOCK.

Low hammocks are nearly always a little lower than the surrounding country, and damp, but hardly wet enough to be called swamps. In low spots in these hammocks the vegetation is often essentially the same as that of the swamps.

The trees are for the most part tall and straight, making a dense shade. Fires rarely ever occur as the humus probably never gets dry enough to burn.

The following is a list of the principal plants observed.

TREES.

<i>Acer rubrum</i>	Red maple.
<i>Quercus nigra</i>	Water oak.
<i>Liquidambar styraciflua</i>	Sweet gum.
<i>Magnolia grandiflora</i>	Magnolia.
<i>Taxodium distichum</i>	Cypress.
<i>Quercus virginiana</i>	Live oak.
<i>Persea pubescens</i>	Swamp red bay.
<i>Fraxinus caroliniana</i>	Ash.
<i>Ilex opaca</i>	Holly.
<i>Carpinus caroliniana</i>	Ironwood.
<i>Quercus michauxii</i>	Swamp Chestnut oak.
<i>Nyssa biflora</i>	Black gum.
<i>Morus rubra</i>	Mulberry.
<i>Magnolia glauca</i>	Sweet Bay.
<i>Hicoria</i> sp.....	Hickory.

VINES.

<i>Smilax lanceolata</i>	Wild smilax.
<i>Rhus radicans</i>	Poison Ivy.
<i>Vitis rotundifolia</i>	Bullace or Muscadine.
<i>Vitis aestivalis</i>	Wild grape.
<i>Bignonia crucigera</i>	Cross-vine.

SHRUBS AND HERBS.

<i>Ilex vomitoria</i>	Yaupon.
<i>Serenoa serrulata</i>	Saw-palmetto.
<i>Aralia spinosa</i>	Prickly ash.
<i>Tillandsia usneoides</i>	Spanish moss.

Violets, ferns and sedges.

The percentage of evergreens is very nearly the same as in the high hammocks. Vines and underbrush are also abundant.

DESCRIPTION OF PINEY WOODS.

There is a very small area covered by piney woods around the University in proportion to that covered by hammocks. The soil is mostly sand, with practically no humus, due to frequent fires and lack of shade. The vegetation consists mainly of long-leaf pine and the red and live oaks.

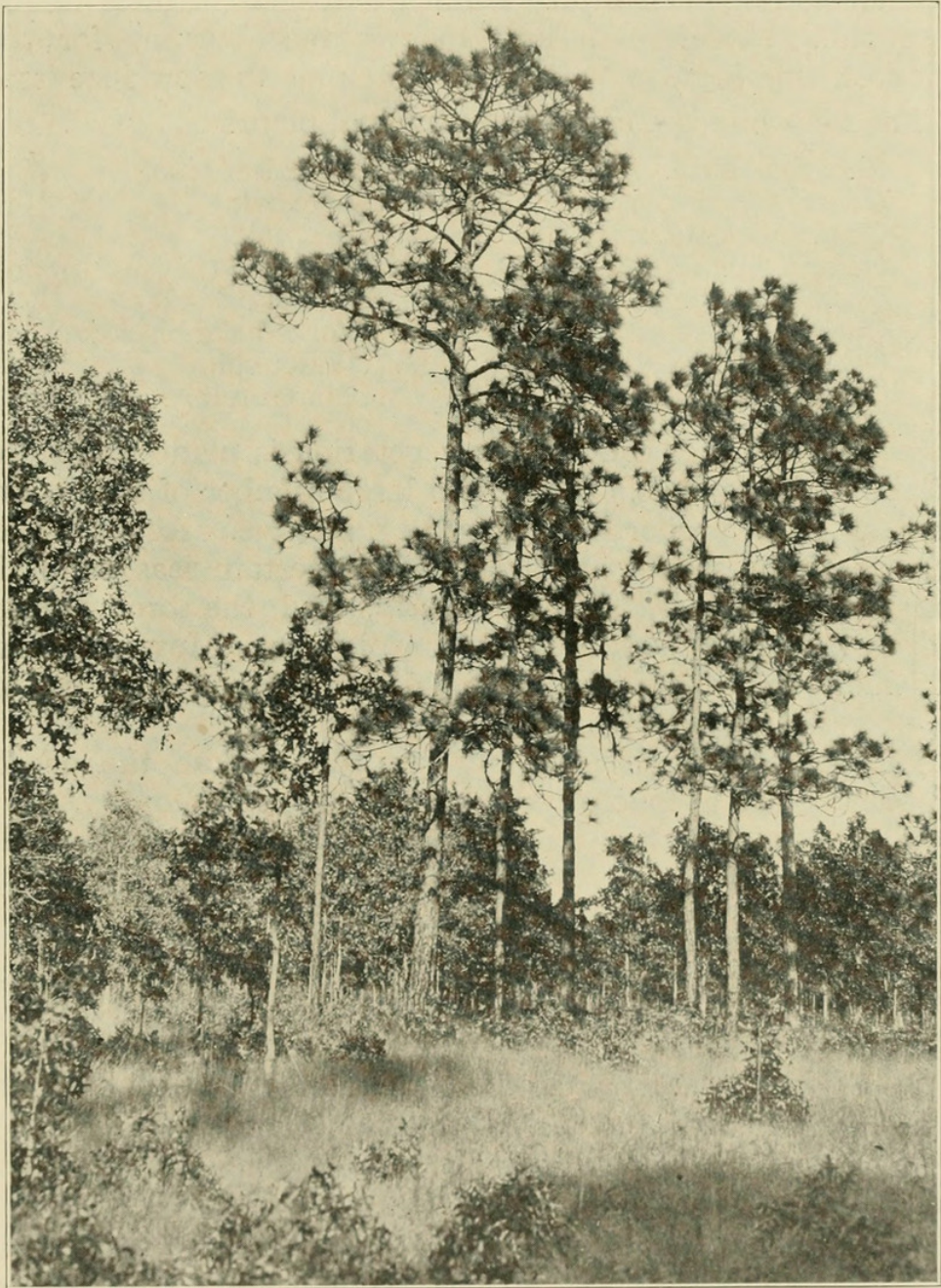


Fig. 3. Typical piney woods, showing long-leaf pine and the small scrub and red oaks.

Fire is a very important factor in the development of piney woods. Nearly every tree has its bark blackened at the base, and every prostrate log and stump is charred. The woods are fired at more or less regular intervals by man, principally for improving grazing and keeping down the underbrush. Many are set also through carelessness or by accident.

On account of its thick, fire-proof bark, the long-leaf pine does not suffer much injury from fire after it is three or four years old. Therefore, if any spot escapes burning for that period of time there is a chance for the pine to reproduce itself.

The following is a list of the principal plants observed.

<i>Pinus palustris</i>	Long-leaf pine.
<i>Quercus geminata</i>	Live oak.
<i>Quercus falcata</i>	Red oak.
<i>Hicoria alba</i> (?).....	Hickory.
<i>Quercus laurifolia</i>	Laurel oak.
<i>Quercus catesbaei</i>	Forked-leaf black-jack.
<i>Quercus nigra</i>	Water oak.
<i>Castanea alnifolia</i>	Chinquapin.

Seventy-five per cent of the vegetation is made up of pine and red and live oaks. There is a large number of shrubs and herbs, a large proportion being Leguminosæ. About fifteen per cent of the shrubs are Ericads. At certain seasons of the year the wire-grass, *Aristida stricta*, and the broom-sedge, *Andropogon virginicus*, are very conspicuous. Mosses, lichens, and woody vines are rare, being destroyed and kept out by fire.

The soil, although naturally less fertile than the nearby hammock land, is much easier to clear and to plow. A considerable part of what was once piney woods is now under cultivation.

LOCATION AND PHYSICAL CHARACTERISTICS.

GENERAL ACCOUNT OF THE GAINESVILLE REGION.

Gainesville is located in the peninsular portion of Florida about midway between the extremities of the State, lying in about latitude 29° 40' and longitude 82° 20'. It is located in what Harper ('14) terms the Middle Florida Hammock belt.

The soil of the region as a whole is a sandy loam, containing very little humus. There is more or less clay, ordinarily at

a depth of from six to ten feet. Clay or limestone underlies the region studied, with outcroppings of limestone frequently showing on the surface. Where the action of water has dissolved out the lime, numerous subterranean passages have been formed. These cave in, forming the so-called "sinks." Sinks often occur in long chains. In those sinks, which seldom go dry, there is an accumulation of muck and peat on the bottom, formed largely from the abundant aquatic vegetation. The

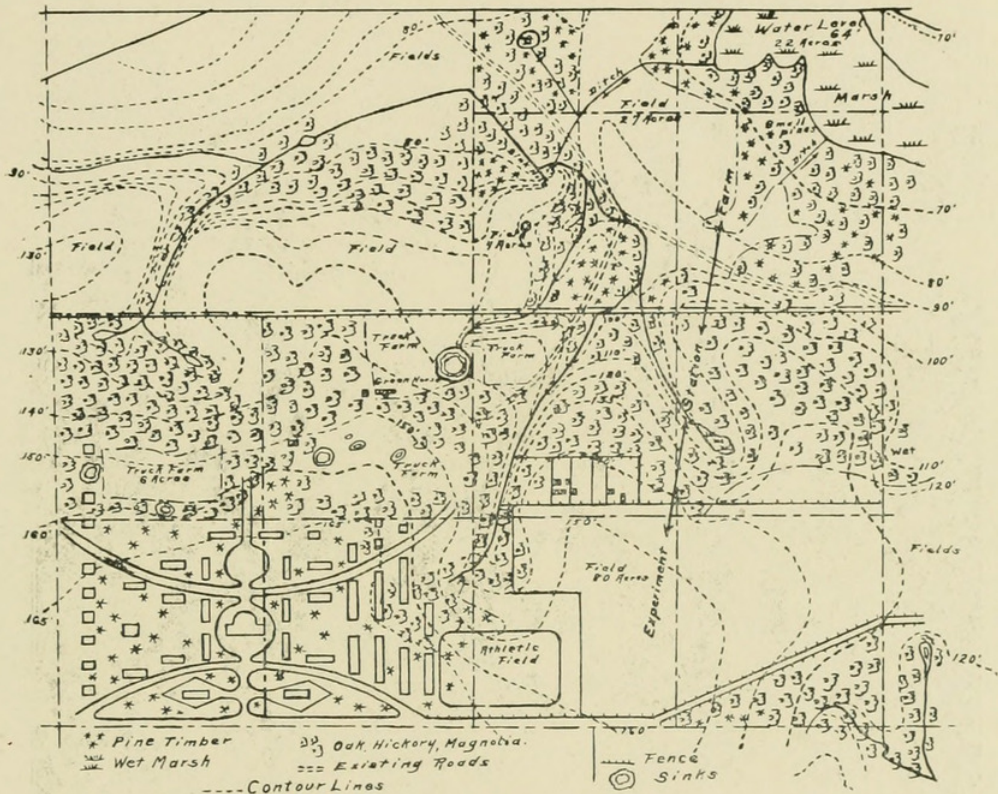


Fig. 4. Map of the University of Florida vicinity, showing the types of vegetation.

surface is not infrequently entirely covered with duckweed (*Lemna*). Not all of these depressions, however, contain water, many being dry the year round.

DESCRIPTION OF THE TERRITORY COVERED.

The University of Florida occupies a tract of six hundred and four acres, situated in the southwestern extremity of Gainesville. Ninety acres of this tract are devoted to the campus, drill grounds, and athletic fields. This was originally piney woods and scattered over the campus are still to be seen numbers of tall long-leaf pines.

Starting at the Experiment Station building and following the road south, we find on our left a small tract of piney woods just before we come to "Gator Sink." Continuing, we find

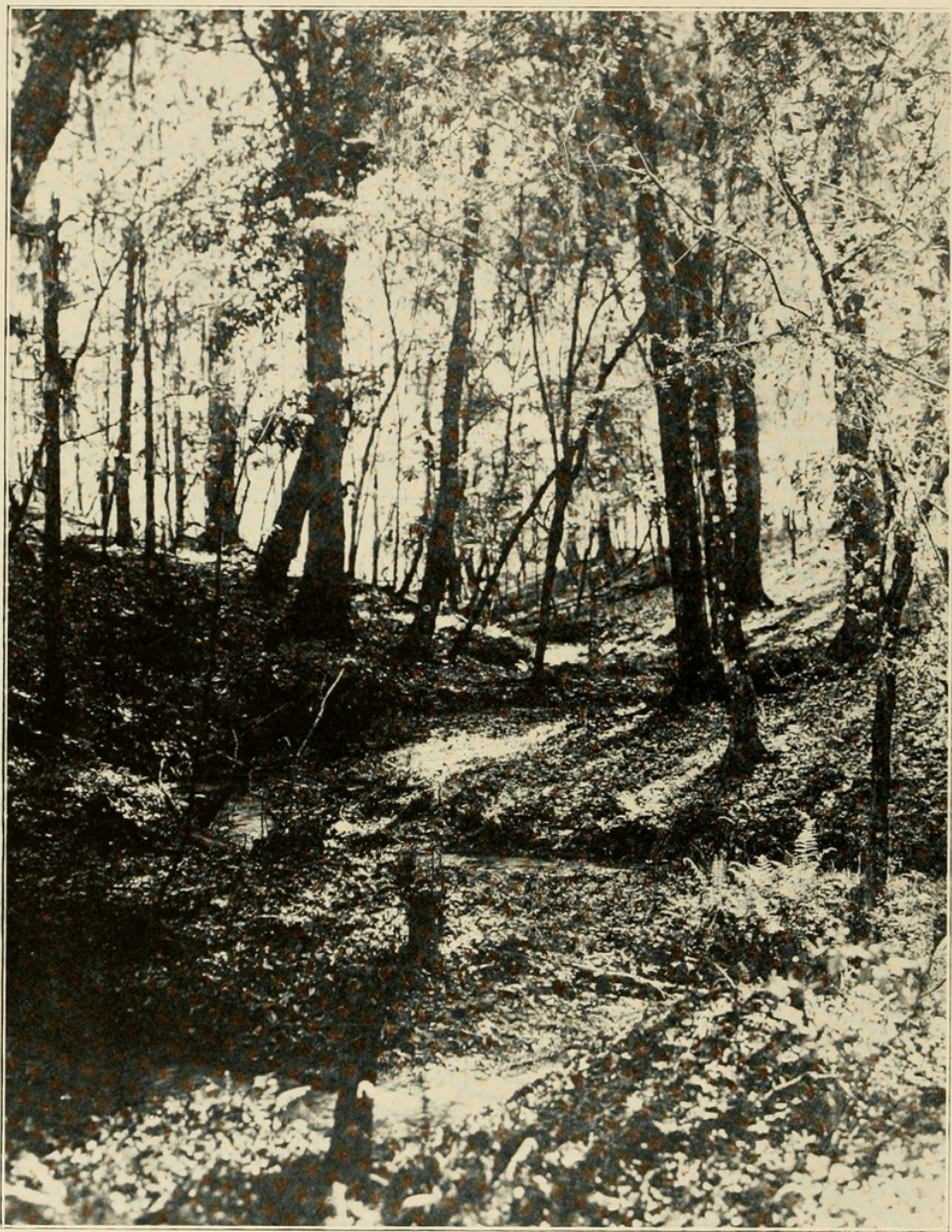


Fig. 5. A view of Catocala Glen.

back of the barn typical magnolia hammock, which extends to a lane leading westward. A similar hammock lies in the northwest corner of the Horticultural grounds. Continuing the lane westward (See map) is a clearing about 60 feet wide that

follows a telegraph line. This extends through the hammock to the wire fence marking the western boundary of the University property. Here it turns south, leading us to the edge of Lake Alice. This is a shallow lake during the rainy season only, being a marsh the rest of the year. Here we find bordering the lake low hammock, containing a lot of red maple and leading into black gum and cypress.

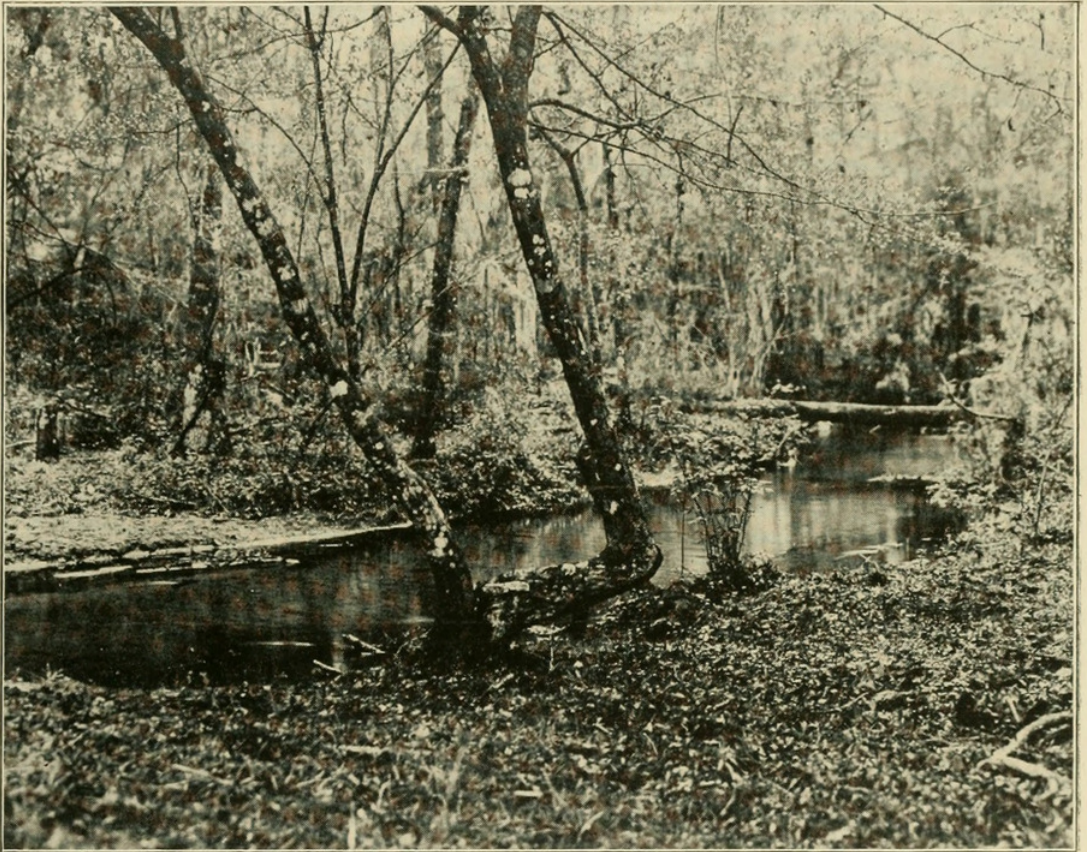


Fig. 6. Hogtown Creek, showing the character of the vegetation along its banks.

Originating back of the University Commons is a small stream which continues a winding passage through the hammocks in a ravine, known as Catocala Glen (Fig. 5), and crosses the road running south from the farm buildings and, uniting with another small stream, flows southward and comes to an end in a small sink in the ground near the target range. This stream has a very disagreeable odor, due to the sewage that empties into it.

Bounding the University property on the north is the Newberry Road. The Ocala Road bounds it on the east and south. Following the Ocala Road northward until we strike a branch of Hogtown Creek we find magnolia hammock. This branch of Hogtown Creek runs along in a winding course through hammock until it joins the east branch of Hogtown Creek. Hogtown Creek crosses the Newberry Road about a mile and a half from the University grounds. (Fig. 6).

Every year during the rainy season Hogtown Creek overflows, flooding the surrounding country and making an alluvial floodplain. Growth along its banks is at most places very rank. This is a favorite place for Geometridæ.

Just beyond the College Inn, on the right of the Newberry Road, is typical piney woods, which extends to the western boundary of the University property.

TEMPERATURE AND CLIMATE.

The following table shows the average temperature and rainfall at Gainesville, down to 1908.

Gainesville	Temperature			Growing Season	Rainfall		
	January	July	Annual		Annual	Percent June-Sep.	Percent May-Oct.
	54.9	81.4	69.3		51.34	54.1	66.5

The most salient features of the climate are the mild dry winters and wet summers. The rainy season begins in June and lasts until September. The copious summer rains seem to be largely responsible for the prevalence of poor sandy soils and evergreen trees in Florida, for the rain tends to leach out the clay, lime, potash, etc., leaving the plain sand. Evergreens (Harper '14) seem to be especially characteristic of soils poor in clay and potash.

There is a killing frost nearly every winter, the average date being December 11th, and occasionally a freeze. A temperature as low as 26° is common.

As a whole this is not a region of high winds. During cold weather and strong winds, insects find a haven of safety in the deep recesses of the hammocks.

ECOLOGICAL SUCCESSION.

All recent geological formations when first elevated above sea-level consist of sand dunes and hills, with swampy depressions or even lakes between them. A little east of Gainesville in what Harper ('15) calls the East Florida Flatwoods belt, we get a plant association that he calls scrub. This is the first association to take possession of the low hills.

There are two distinct ways in which hammocks originate. (1) Going from high pine land to hammock and (2) swamps and lakes to hammock.

Starting with High Pine Land we find it composed mostly of long-leaf pine with grasses and a few saw-palmettoes on the forest floor. There is very little shrubbery. After a little humus has gotten into the soil the black-jack, turkey, post and red oaks begin to come in.* This stage is known as Piney Woods.

Hickories and water oaks begin to come in and in dry situations we get the live oaks. This is the beginning of the Hammock. Now the oaks and hickories become more numerous, sweet gum enters, and the shrubbery thickens. In the last stage the magnolia becomes the dominant tree and the shrubbery becomes, in many instances, an almost impenetrable jungle.

Starting with the shallow lake, we have in the deeper water pond lilies (floating all around in the water are the recently introduced water hyacinthes). Coming near the shore we find saw-grass, rushes, and a little willow; the buttonbush is typical of such places. Cypress comes in, forming a cypress swamp. Tupelo is nearly always mixed in with the cypress. As sand is washed in and dead trees fill up the swamp, among the old cypress and tupelo and in dry situations, the red maple comes in. In turn follow the ash, water oaks, hornbeam, and sweet gums. Finally, when everything is filled up and well-drained, the magnolia and hickories begin to come in, giving us the climax magnolia-hickory-oak association.

*It is reasonably certain that if fires were kept out of a long-leaf pine forest long enough, hardwood trees of various kinds would come in and choke out the pine (which does not thrive in shade), and thus gradually convert the pine forest into a hammock. Hammock trees require humus and are sensitive to fire, and consequently they cannot invade the pine land very fast as long as fires prevail.

If all of these various types of vegetation were to be left undisturbed by the agencies of man, such as lumbering, fires and agricultural activities, the whole country would in the end go to the climax magnolia-hickory-oak association.

The rapidity with which the climax association takes possession of the country is dependent on the kind of soil present.

CLIMAX ASSOCIATION.

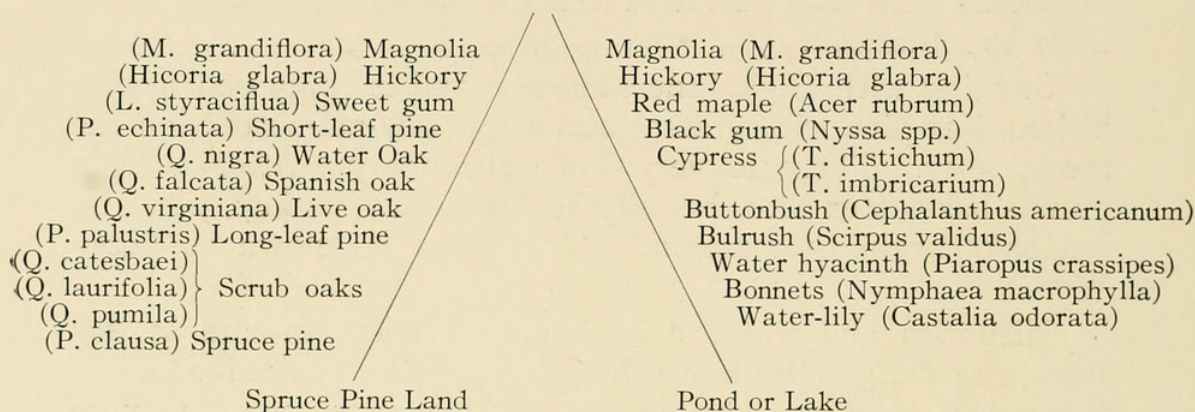


Fig. 7. Showing the convergence of two types of habitats to the climax association, the magnolia-hickory-oak hammock.

PART II.

RELATION OF HAMMOCK INSECTS TO THEIR ENVIRONMENT.

I. GROUND STRATUM.

Earthworms are abundant and beneath old logs and loose bark large numbers of millepedes and centipedes are to be found. A prettily-marked lampyrid larva was observed devouring one of these millipedes. Snails and sow-bugs are also plentiful.

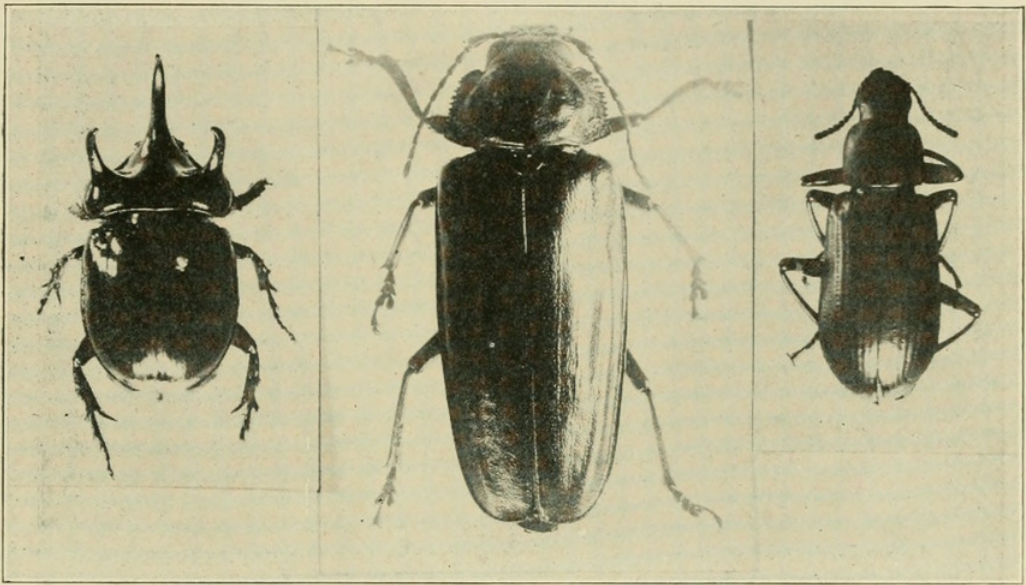


Fig. 8. *a*, *Strategus antaeus*, showing the long and formidable-looking horns which vary greatly in different individuals. Nat. size.
b, a wood-borer, *Mallodon mellanopus*. Nat. size.
c, *Nyctobates barbata* Knoch., which is found beneath the loose bark of decaying tree trunks. Twice nat. size.

The bark and wood of fallen trees offer a home to numerous insects (Fig. 8). When the bark has become loosened, we find practically all of the small invertebrates that are recorded from the ground. *Vespa carolina*, *Diaperis maculata* var. *floridana*, and often large colonies of the green stink-bug, *Nezara viridula*, hibernate beneath the loose bark. In the same habitat are also found the earwig, *Vostox brunneipennis*, and the large wood roach, *Eurycotis floridana*.

Beneath fallen logs, the tenebrionids, *Polypleurus nitidus*, *P. geminatus* and *Helops cisteloides*, occasionally *Strategus antaeus*, and various carabids are to be found in abundance.

The logs are inhabited by the large wood-borers *Prionus* (Fig. 9) and *Orthosoma brunneum*. The wood-eating beetle, *Passalus cornutus*, assisted by the rotten log caterpillar, *Scolecocampa liburna*, the large ant *Campanotus fallax* var. *decipiens*, and termites soon reduce the log to a mere paper shell. Numbers of wireworms and borers live beneath the bark. Larvæ of the elaterid, *Orthostethus infuscatus* (Fig. 10) are characteristic of

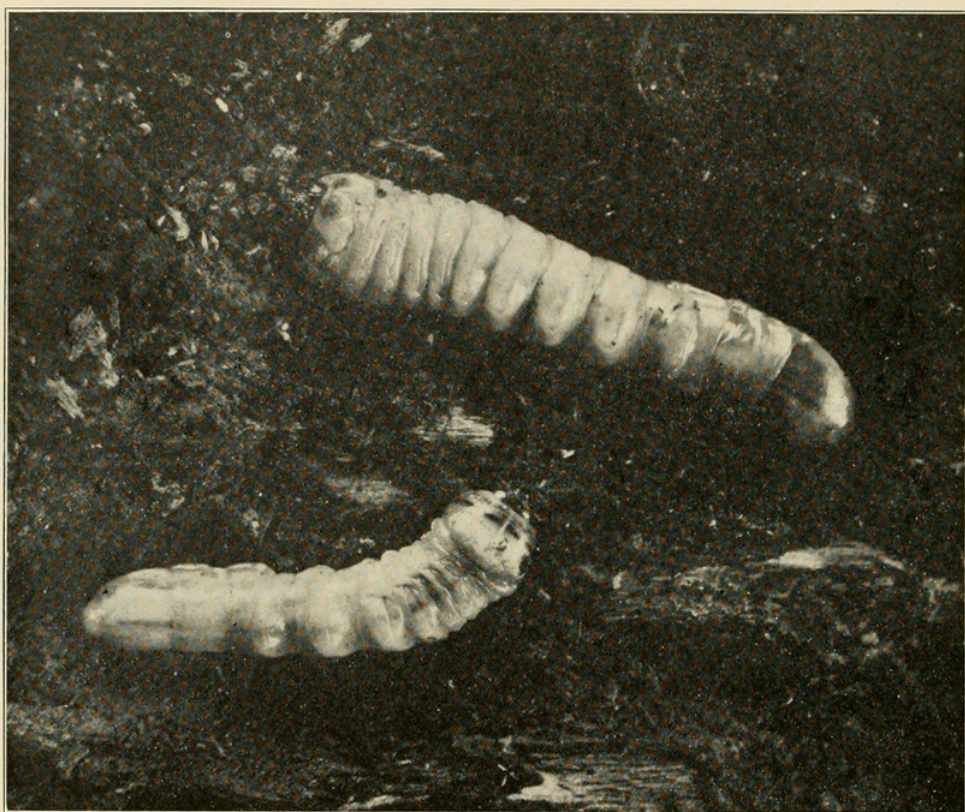


Fig. 9. Prionid larvæ in sweet gum log. Nat. size.

well-decayed logs. Numerous beetles, such as *Tritoma festiva*, *T. thoracica* and *Boletotherus bifurcus*, feed on fungi. A large slug is also common.

In dry protected spots beneath trees may be found the funnel-shaped pits of the ant-lions and occasionally one finds the burrows of a tiger-beetle.

Larvæ of *Lachnosterna* beetles, *Trichius piger* and *T. delta* inhabit old oak stumps. (Fig. 9).

II. FIELD AND SHRUB STRATUM.

The young trees go to make up a considerable portion of this stratum and together with the numerous shrubs and herbs support large numbers of insects. The tree- and leaf-hoppers are particularly abundant.

Lepidopterous larvæ are also very abundant, some tying and rolling leaves, others mining them. The larvæ of *Gelechia cercerisella*, a particularly interesting species, fold the leaves of young redbud. The leaves of the basswood are often made unsightly by the work of *Pantographa limnata*. (Fig. 11).

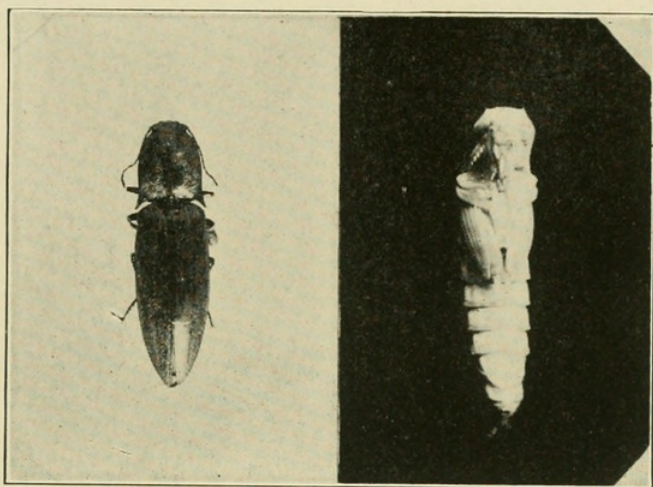


Fig. 10. The adult and pupa of the wireworm, *Orthostethus infuscatus*.
Nat. size.

The pretty and strikingly-colored syrphid, *Milesia virginensis*, is found buzzing around fallen logs and is taken occasionally at flowers. Many beetles, as *Coptocycla clavata* and members of the genus *Lema* are found feeding on the low herbage. (Fig. 12).

Grasshoppers are found in this stratum, but are not particularly numerous. The locustids greatly outnumber the acridiids. In low marshy places at the edge of hammocks are found the grouse-locusts, *Tettigidea lateralis lateralis* and *Neotettix coarctatus*.

The blue chrysomelid, *Porphyraspis cyanea*, (Fig. 13), is typical of the saw-palmetto upon which host alone it feeds. A small tineid, *Homaledra sabalella*, also feeds on the foliage of this plant.

On the wild morning-glory vine are found the tortoise beetles, *Coptocycla aurichalcea* and *C. purpurata*, and a small tineid makes a serpentine-like mine in the leaves of the *Smilax*.

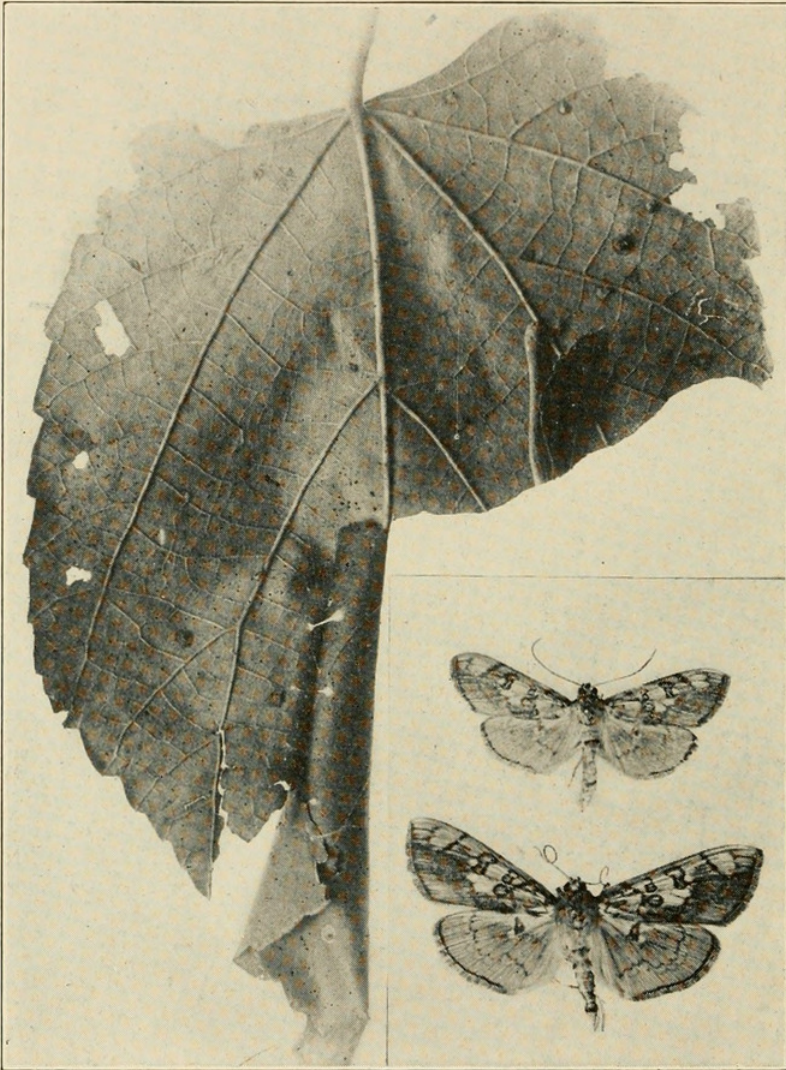


Fig. 11. The Basswood Leaf-roller, *Pantagrapha limnata* G. & R. Male and female moths and the work of the larvæ on a leaf of basswood.

III. TREE STRATUM.

In discussing the insects of the tree stratum, the most important or dominant trees will be taken up, giving a list of the insects associated with them, together with their relation to the host. Reference can be made to the annotated list for data on the different insects.

MAGNOLIA COMMUNITY.

The magnolia has very few enemies and this may account in a large degree for the long life of this tree.



Fig. 12. Work of the chrysomelid, *Octotoma plicatula*, on ash foliage.

Attacking the foliage: *Toumayella turgida*, *Coptocycla aurichalcea* and *Phyllocnistis magnoliella*.

At the flowers: *Thrips spinosus* and *Trichius piger*.

Parasitic: *Sympiesis* sp., and *Sagrammasoma multilineata*.

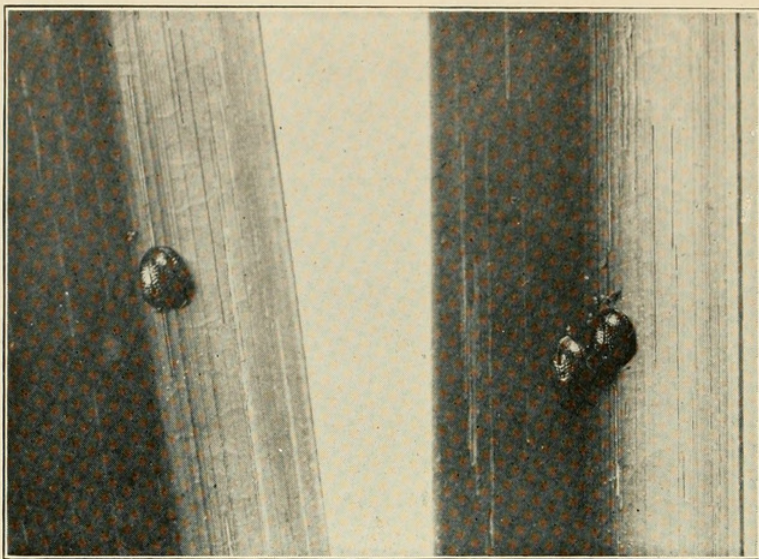


Fig. 13. *Porphyraspis cyanea* feeding on saw-palmetto.

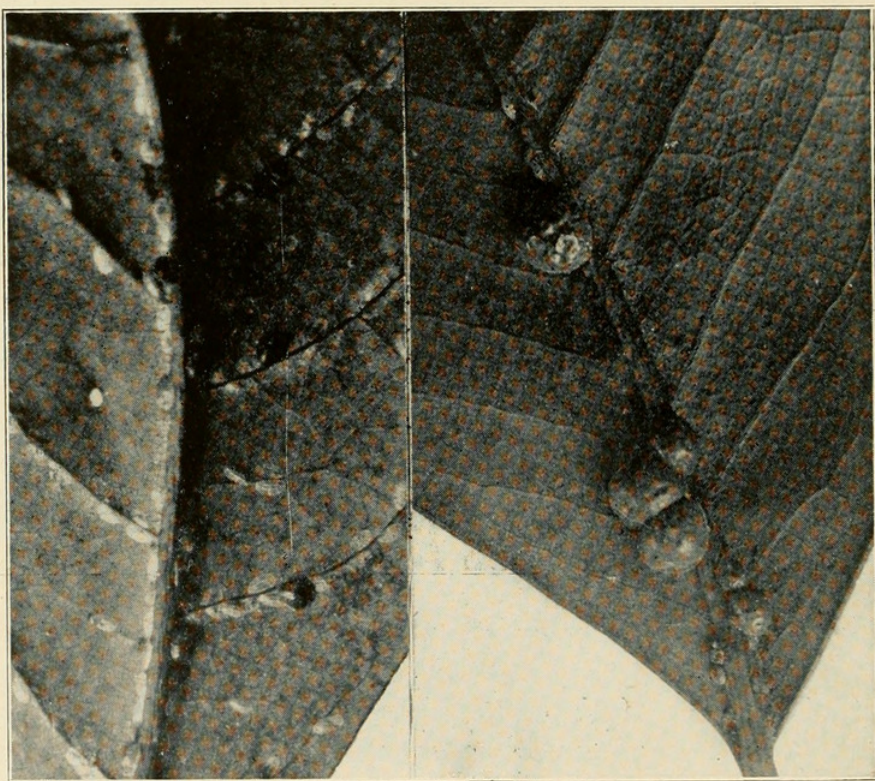


Fig. 14. The Magnolia Scale (*Toumayella turgida* Ckl.)
Enlarged twice.

HICKORY COMMUNITY.

Attacking the foliage: *Serica vespertina*, *Anthonomus saturalis*, *Craponius inaequalis*, *Stictocephala festina*, *Apatela impleta*, and *Liothrips caryæ* var. *floridensis*. Galls caused by various species of *Phylloxera* are abundant on the leaves.

Predaceous: *Hyperaspis proba*.

Merely accidental: *Mesostenus* sp., and *Notoxus calcaratus*.

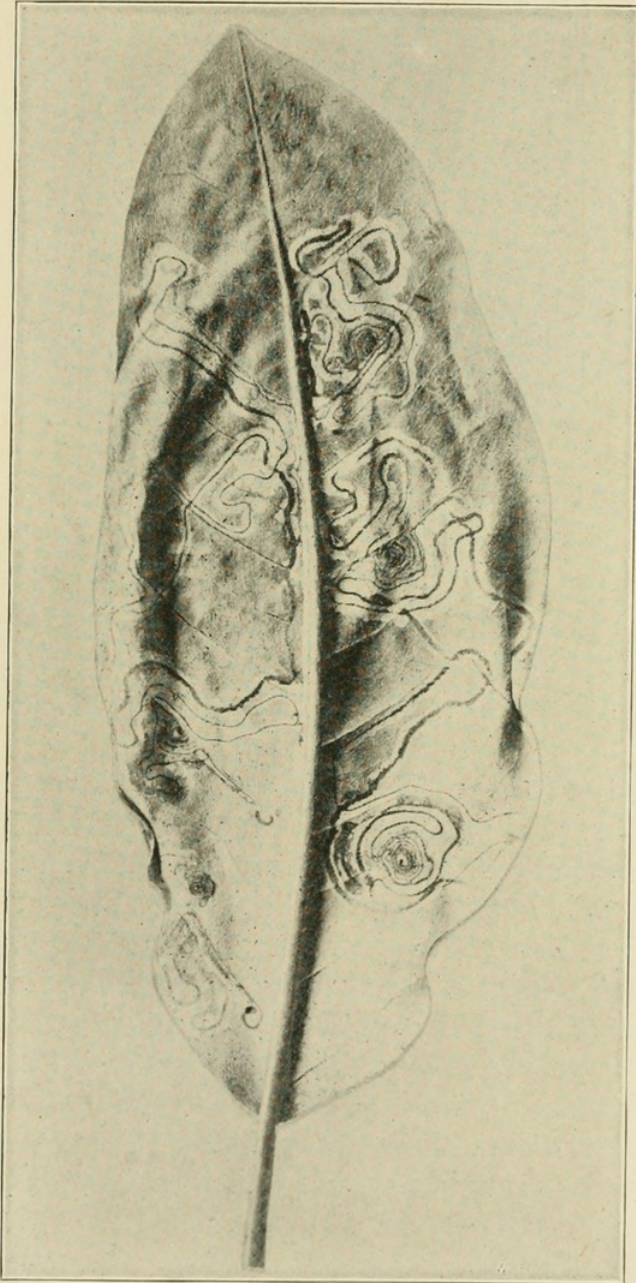


Fig. 15. Work of the Magnolia Leaf-miner (*Phyllocnistis magnoliella* Chamb.)

OAK COMMUNITY.

As a rule an insect that feeds upon one species of oak will be found to feed upon the other species. Therefore I shall list the oak feeding species under the one oak community. This rule does not hold good in every case, as many of the insects are limited to a single species of oak. The oak supports a larger number of insect species than does any one tree. ¹ And yet we find the giant oaks monarchs of the woods.

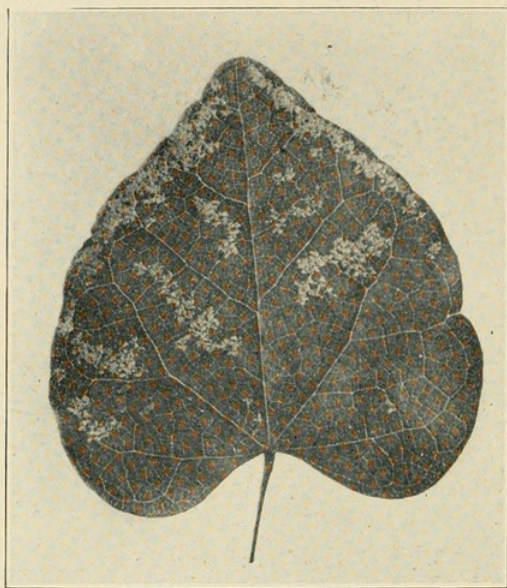


Fig. 16. Typical injury to the redbud by the leafhopper, *Erythroneura tricineta* Fitch.

Attacking the foliage: *Otiocerus degeerii*, *Stictocephala festina*, *Smilia camelus*, *Enchenopa binotata*, *Platycotis quadrivittata*, *Anthaxia cyanella*, *Brachys cuprescens*, *Diplotaxis languida*, *Lema brunnicollis*, *Lema conjuncta*, *Anomoea laticlavata*, *Coscinoptera dominicana*, *Bassareus conjestus*, *Cryptocephalus 4-maculatus* var. *flavipennis*, *Cryptocephalus guttulatus*, *Monachus auritus*, *Oedionychis fimbriata*, *Phyllotreta picta*, *Chalepus rubra*, *Metriona purpurata*, *Deloyala clavata*, *Attelabus analis*, *Pterocolus ovatus*, *Tachygonus lecontei*, *Pandeleteius hilaris*, *Prionomerus calceatus*, *Megalopyge opercularis*, *Stenoma humilis*, *Arogalea cristifaciella*, *Telea polyphemus*, *Amphibolips* sp., *Callirhytis batatoides*, *Holcaspis ficigera*, and *Andricus virens*.

Parasitic and predaceous: *Eupelmus auratus*, *Exochomus childreni*, *Brachyacantha dentipes*, *Enoclerus thoracicus*, and *Epitragus tomentosus*.

Occurring beneath bark: *Graphysurus fasciatus*, and *Adelina lecontei*.

Accidental: *Hymenorus obscurus*, *Tomoxia lineella*, *Notoxus calcaratus*, *Hypoprepia fucosa*, and *Hadena miseloides*.

BASSWOOD OR LINDEN COMMUNITY.

The basswood is met with throughout the hammocks and is a shade-enduring tree. It is attacked by numbers of insects and its blossoms furnish a rich collecting place. Among these is an undetermined leaf-tyer that renders the foliage unsightly.

Attacking the foliage: *Eriophyes abnormis*, *Gargaphia tiliæ*, *Gypona octolineata*, *Eutettix seminuda*, *Macrosiphum coryli*, *Cryocephalus badius*, *Chaetocnema confinis*, *Chalepus rubra*, *Pantographa limnata*, and *Phyllonorycter lucetiella*.

Accidental: *Celetes basalis*.

RELATION OF PINEY WOODS INSECTS TO THEIR ENVIRONMENT.

I. GROUND STRATUM.

Although less study was devoted to the piney woods insects, it is at once apparent that the insect life in this association is much less varied and plentiful than that of the hammocks.

The subterranean fauna, however, is very characteristic. In spring, especially, low mounds of sand a foot or two in diameter, made by the rodent, *Geomys tuza floridanus*, are conspicuous and typical of this habitat. This rodent is known in Florida by the name of "salamander," a name which gives an entirely erroneous conception of the animal. Another misleading name is that of "gopher," given to the turtle *Testudo* or *Gopherus polyphemus*. The insect fauna of its long burrows has been studied by Hubbard (Insect Life, Vol. VI, 1894). This "gopher," together with the "salamander" and other animals are continually moving and stirring up every particle of the upper foot or two of the soil every few years. Ant hills, the pits of the ant-lion or so-called "doodle-bug," and the holes of tiger beetles are occasionally found.

II. FIELD AND SHRUB STRATUM.

In the spring and summer grasshoppers and leafhoppers are to be found in the tall wire-grass and broomsedge, although

not in exceedingly abundant numbers. This stratum is characterized by being somewhat lifeless and its insect inhabitants small and inconspicuous.

III. TREE STRATUM.

Nearly all of the trees have their own particular kind of galls. Galls caused by the Cynipids *Andricus virens*, *Callirhytis batatoides* and *Holcaspis ficigera*, (Fig. 17), are extremely

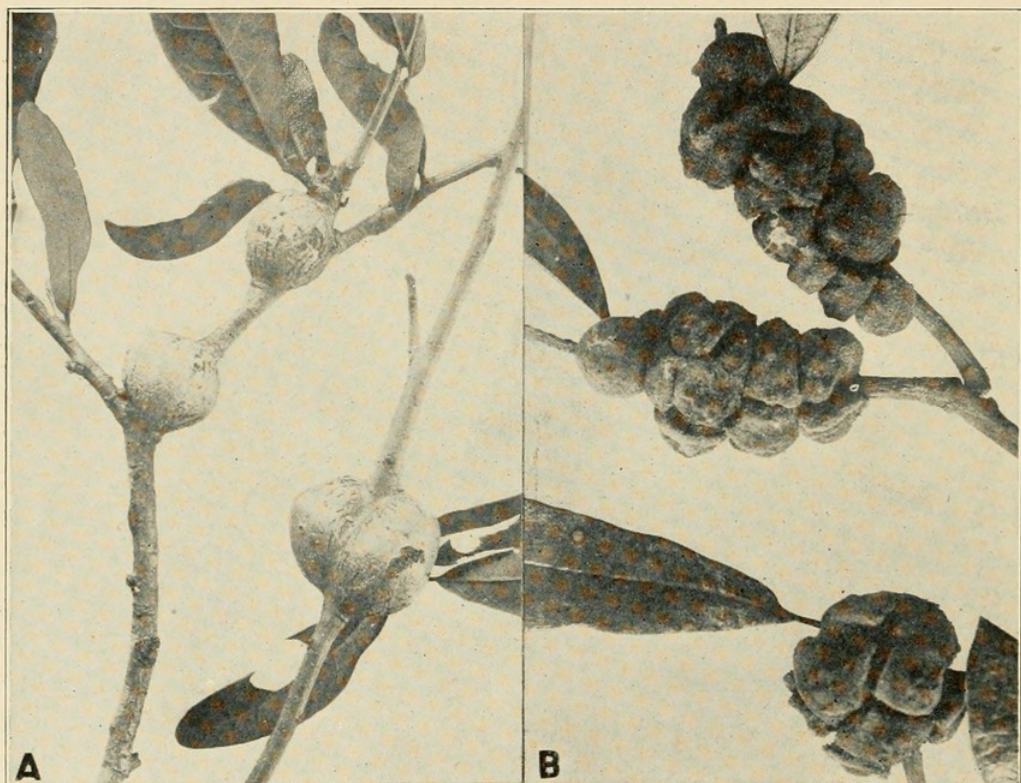


Fig. 17. A, Galls on *Quercus virginiana* caused by *Callirhytis batatoides* Ashm. B, Galls on same host caused by *Disholcaspis ficigera* Ashm.

abundant on the live oak, *Quercus virginiana*. The bases of the needles of pine are often enlarged to form galls by the Cecidomyid, *Cecidomyia brachynteroides*. (Fig. 18).

The scales, *Chionaspis pinifoliae* var. *heterophyllae* and *Lecanium parvicorne* (?) are found at certain seasons in large numbers on scattered individuals of the pine. These are heavily parasitized by chalcids. From *C. pinifoliae* var. *heterophyllae* were reared large numbers of *Aphelinus mytilaspidis* and *Prospaltella* sp. and from *L. parvicorne*, *Coccophagus immaculatus* and a species of *Aphycus*. The Florida wax scale, *Ceroplastes*

floridensis, was found infesting a branch of *Pinus palustris*, but this is of unusual occurrence. (Fig. 19).

Aphids are plentiful, together with their parasites and predators on the different trees and shrubs. To be particularly noted are the hickory *Phylloxera* galls and the large black pine aphid, *Lachnus pini*. The latter is parasitized by the hymenopteron, *Aphidius bifasciatus*. A clear and extremely interesting



Fig. 18. Galls of *Andricus virens* Ashm. on live oak, *Quercus virginiana*.

case of symbiosis exists between this aphid and its attendant ants.

Beneath and in the bark of the fallen pine are to be found the numerous galleries of the Scolytid bark beetle, *Ips calligraphus* (Fig. 20). Here are found many other insects, such as the buprestid borers, *Chalcophora* and *Buprestis*, and the wireworms, *Adelocera marmorata* and *Elatér hepaticus*.

PINE COMMUNITY.

The several species of pine are treated under the one community.

Attacking the foliage: *Anisomorpha buprestoides*, *Cryptothrips pini*, *Lachnus pini*, *Chionaspis pinifoliae* var. *heterophyllæ*, *Lecanium parvicorne* (?), *Ceroplastes floridensis*, *Lachnosterna prununculina*, *Polyphylla occidentalis*, *Polyphylla gracilis*, *Anomoea laticlavata*, *Cecidomyia brachynteroides*, and *Tolyte minta*.

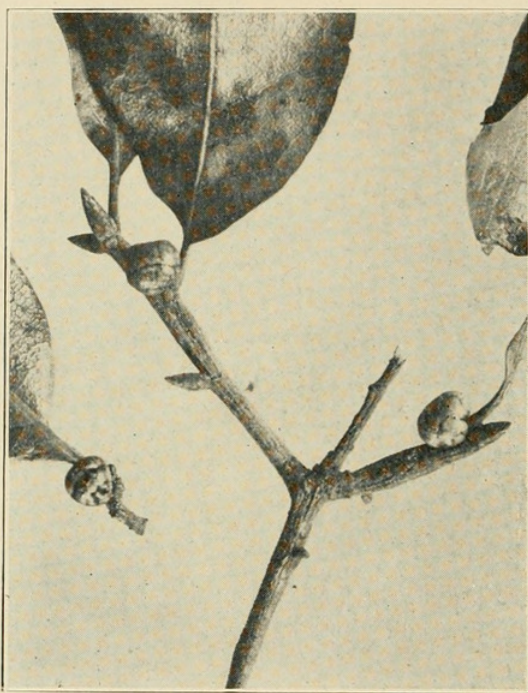


Fig. 19. Kermes scales that greatly resemble galls, on oak.

Bark and woodborers: *Ips calligraphus*, *Chalcophora virginensis*, *Chalcophora georgiana*, and *Monohammus titillator*.

Parasitic and predaceous: *Aphelinus mytilaspidis*, *Prospaltella* sp., *Coccophagus immaculatus*, *Phymata erosa* var. *guerini*, *Repipta taurus*, *Hippodamia convergens*, *Coccinella sanguinea*, and *Chilocorus bivulnerus*.

Accidental: *Thyreocoris pulicarius*, *Cicada sordidata*, *Polemimus limbatus*, *Photuris pennsylvannica*, *Bolbocerosoma farctum* var. *tumefactum*, *Callichroma splendidum*, *Typocerus zebratus*, and *Nezara viridula*.

CHINQUEPIN COMMUNITY.

The chinquepin is typically a piney woods form. While very few insects attack the foliage, the blooms of this tree form a rich and varied collecting ground. The blooming period

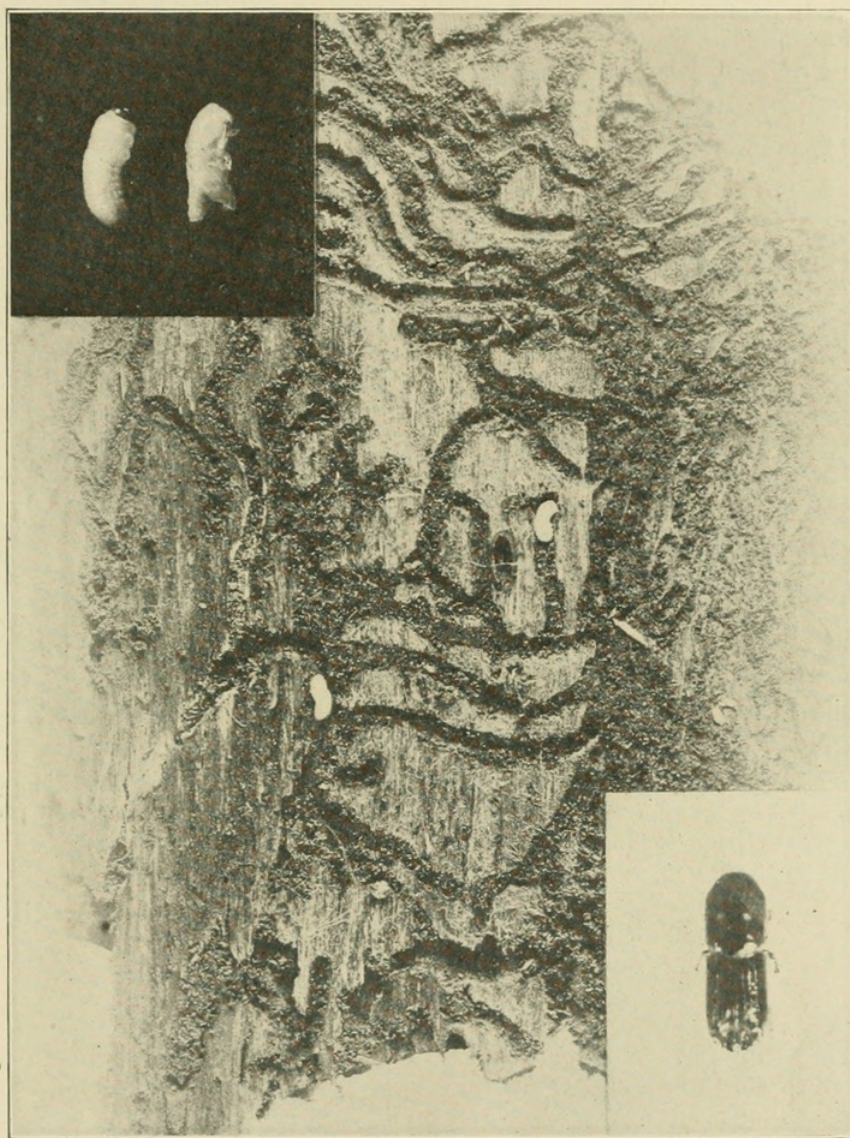


Fig. 20. Larvæ of *Ips calligraphus* Germ. and their galleries, natural size, in bark of pine tree. In the inserts, larva, pupa, and adult, enlarged.

lasts only two or three weeks, that for any one tree only a few days. The chinquepin begins blooming as early as April 26th and lasts some seasons as late as the first of June.

Attacking the foliage: *Diplotaxis bidentata* and *Diplotaxis frontalis*.

Predaceous: *Exochomus childreni* and *Chilocorus bivulnerus*.

At the flowers: *Pselliopus cinctus*, *Zelus cervicalis*, *Alydnus* sp., *Chauliognathus marginatus*, *Euphoria sepulchralis*, *Trichius delta*, *Trichius piger*, *Typocerus velutinus*, *Typocerus lunatus*, *Elaphidion mucronatum*, *Chlamys plicata*, *Oxacisthoracica*, *Rhipiphorus cruentus*, *Calandra oryzæ*, *Jurinea adjusta*, *Spallanzania hebes*, *Plagiprospherysa parvipalpis*, *Orthelia cornicina*, *Lucilia caesar*, *Tabanus mexicanus*, *Tabanus atratus*, *Elis subjens*, *Eumenes fraternus*, *Monobia quadridens*, *Polistes americanum*, *Chlorion caeruleum*, *Bembidula quadrifasciata*, *Bembex texana*, *Xylocopa virginica*, *Psithyrus laboriosus*, *Bombus pennsylvanicus*, *Apis mellifera*, *Dahana atripennis*, *Spragueia onagræ* and *Heliodenes* sp. (near or *H. bella*).

Accidental: *Macrophya formosa*.

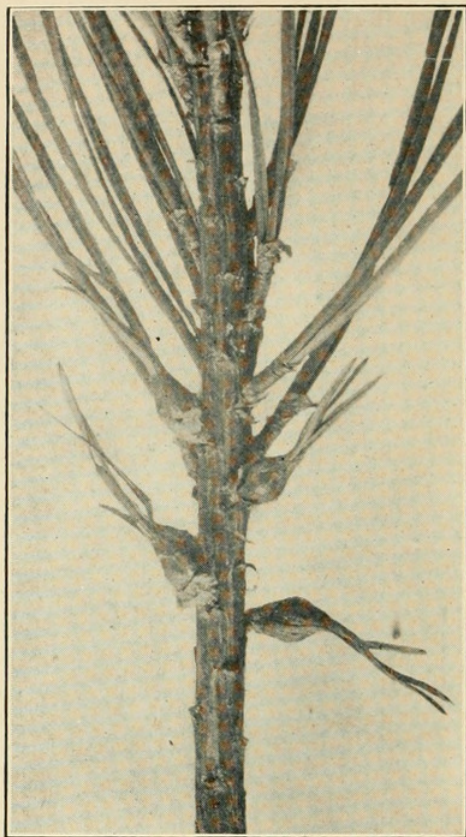


Fig. 21. Work of the midge, *Cecidomyia brachyteroides*, on pine.

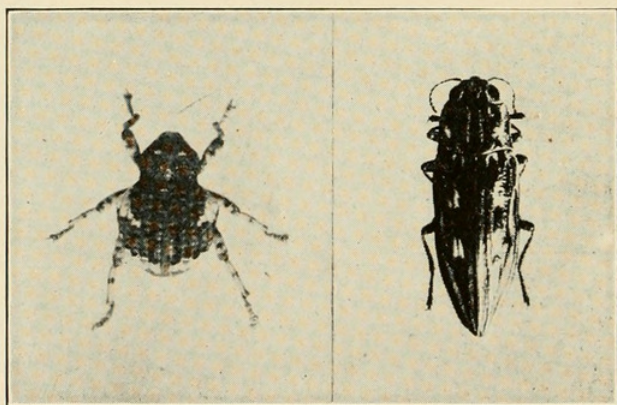


Fig. 22. a, The cactus-eating weevil, *Gerstaeckeria hubbardi* Le C., on *Opuntia vulgaris*, enlarged. b, A pine borer, *Chalcophora virginiensis* Drury, nat. size.

PART III.

ANNOTATED LIST OF INSECTS.

ACARINA.

Eriophyes abnormis. This species of mite produces countless numbers of small galls on the leaves of basswood.

Trombidium locustarum Say. The Locust Mite. Locusts are frequently taken with these small red mites attached to their bodies. They are parasitic upon both the adults and their eggs.

Trombidium spp. Red-bugs. The six-legged larvæ of a number of species are the "red-bugs" or "chiggers" so commonly met with in the woods that attach themselves to man and cause serious annoyance. They burrow beneath the skin and produce inflamed spots. The mature mite is not parasitic, but wanders about feeding on small insects.

Tetranychus telarius Linn. Common Red-spider. This species of red-spider is abundant everywhere on the small weeds and plants of the hammocks.

INSECTS.

PLATYPTERA.

TERMITIDÆ.

Termes flavipes Koll. White Ant or Termite. White ants or termites are found the year round working in stumps and logs in an early stage of decay. A large colony of workers and soldiers were found working in a fallen limb of cypress December 21st.

These insects feed mainly upon woody material and are active agents in hastening the decay and destruction of the dead wood of the forest floor. (See Snyder, '15 and '16).

NEUROPTERA.

Chrysopa oculata Say. Lace-wing Fly. Both adults and larvæ of this species of aphid-lion may be found during the majority of the year in the hammocks.

Brachynemurus carrizonus. This and a number of other unidentified species of ant-lions have been taken.

ODONATA.

AGRIONIDÆ.

Agrion maculatum Beauv. Black Damsel-fly. This species is quite common March-June 5. It prefers the smaller streams, seeking the cool, shady places where the vegetation is rankest. It was abundant at Hogtown Creek April 9th.

Hetaerina americana Fabr. This damselfly is an uncommon one here. A specimen was taken by Prof. Watson at Hogtown Creek, May 7.

AESCHNIDÆ.

Anax junius Drury. Taken in magnolia hammock near stream, March 5.

Coryphaeschna ingens Ramb. This is our largest species and a rather common one. It is a very strong flier. March 10–April 25.

Tachopteryx thoreyi Hagen. A specimen taken at edge of magnolia hammock, March 25.

LIBELLULIDÆ.

Micrathyrina berenice Drury. A very common although inconspicuous dragon-fly. Taken frequently at hammock edge. September 28–October 18.

Perithemia domitia Drury. This is a rather common species here and is frequently taken at hammock edge, although more abundant at wild flowers in open fields. There is a marked sexual dimorphism in the species. May 16.

Tramea carolina Linn. The Saddle-back Dragon-fly. This is one of our earliest and most abundant forms. It is typical of hammock and forest edge. February 26–April 25.

Erythemis simplicicollis Say. One of our most common species, occurring at hammock edge. Also taken in flatwoods. April 20–September 4.

Libellula auripennis Burm. Golden-winged Dragon-fly. A typical hammock and forest-edge insect. Has been taken only during May, but it is very abundant then. May 15–26.

Libellula axillena Westw. Several specimens taken by Prof. Watson at hammock edge May 17.

Libellula vibrans Fabr. A common insect about the stream at Hogtown Creek. April 5–June 11 (J. R. Watson).

Pachydiplax longipennis Burm. Abundant at Hogtown Creek, April 1–19.

ORTHOPTERA.

FORFICULIDÆ.

Vostox brunneipennis Serv. This pretty and striking ear-wig is found in large numbers beneath loose bark of old dead magnolia trees, together in association with *Eurycotis floridana*.

BLATTIDÆ.

Eurycotis floridana. The Large Wood Roach. This large wood roach inhabits decaying stumps, but is characteristically found beneath loose bark of decayed trees and frequently beneath corded wood.

I have found large numbers under bark pulled from trunk of a dead magnolia.

These roaches give off a very strong, quite distinctive, and very offensive odor, especially when handled.

Periplaneta americana Linn. The American Roach. Found occasionally in same habitats as the above species.

MANTIDÆ.

Stagmomantis carolina Johannsen. Praying Mantis or Devil's Horse. This is a forest margin insect and is rather scarce. The eggs are laid in masses and overlaid with a hard covering of silk; the top of the masses having the appearance of being braided. They are deposited on numerous kinds of vegetation. September 15–October 13.

Thesprotia graminis Sc. Smaller Praying Mantis. This is a forest-margin insect and is not very abundant.

PHASMIDÆ.

Anisomorpha buprestoides Stall. Lubberly Walking-stick. This species seems to be the commonest as well as the largest walking-stick found here. It is also sometimes known as the "Musk Mare." It has been taken on a variety of vegetation. A pair in copula on *Pinus taeda*, November 19.

The difference in size of the sexes is most striking. The female is twice the size of the male in length and much stouter in proportion. The females vary from 3 to 3¼ inches and the males from 1½ to 1¾ inches in length.

When disturbed, these insects throw off a volatile and acrid liquid with an odor that resembles that of peppermint somewhat. It is extremely penetrating, very much like ammonia, causing a similar smarting of the nostrils. This odor comes from the milkish fluid that is ejected from two pores on the prothorax and it clings to one's fingers and is still strong an hour afterwards. When the secretion is first ejected, the odor is distinct a couple of feet away.

Diapheromera femorata Say. Forest Walking-stick. This walking stick is distinctly a forest-inhabiting insect and occasionally becomes of economic importance. It is not a common insect in this region. Its life-history and habits have been studied by Riley ('78). August 15.

ACRIDIDÆ.

Schistocerca alutacea Harris. This seems to be the most abundant grasshopper here and is found in nearly all habitats the year round. Numbers of a dipterous parasite, *Sarcophaga opifera* Coq., were reared from adults.

Schistocerca americana Drury. Bird Grasshopper. Is more abundant than the above species during the winter and is found in the same habitats.

Dichromorpha viridis Sc. A green, short-winged form that inhabits grassy spots in hammock. September 30.

Arphia granulata Sauss. Yellow-winged Singer. This species has been taken by Prof. Watson as follows. Abundant in scrub oak woods March 29; Piney woods, September 27; Flatwoods, October 11-18.

Paroxya atlantica Sc. Taken occasionally at hammock-edge; also in flatwoods. August 27-October 18.

Stenacris vitreipennis Marsch. A specimen taken by Prof. Watson at border-line between low piney woods and hammock, November 30.

Neotettix coarctatus Hanc. Abundant in rushes and low herbage along banks of moist area at hammock edge near the target range, April 15.

Tettigidea lateralis lateralis Say. This is the most abundant grouse-locust here. Found in the same habitat as the above species.

LOCUSTIDÆ.

Belacephalus spp. The nymphs, especially of this genus are met with frequently under old logs and leaves in the hammocks.

Pyrgocorypha uncinata Harris. Found occasionally in hammocks in same habitats as the above species.

Microcentrum rhombifolium Sauss. This is a typical hammock insect, although not very abundant. Numbers of the egg-parasite of this species, *Eupelmus mirabilis* Walsh, have been reared.

GRYLLIDÆ.

Gryllotalpa borealis Burm. Common Mole-cricket. This species occurs in numbers along the moist banks of streams running along edge of hammock.

Gryllus. The home of this insect is beneath logs and rubbish along forest margin.

Orocharis saltator Uhler. A ♀ was taken hibernating in a decayed limb which was hanging in the branches of a tree in high hammock January 28. Prof. Watson took a ♂ around an injured tree in deep and low hammock, April 25. This is one of the most common tree-crickets found in the hammocks.

Hypithus agitator quadratus Sc. A ♀ was taken on iron weed (*Vernonia angustifolia*) along bank of Hogtown Creek, October 1.

THYSANOPTERA.

Thrips spinosus Morgan. The Magnolia Thrips. Is found in the blossoms of *Magnolia grandiflora* during May.

Frankliniella bispinosus projectus Watson. Florida Flower Thrips. This is our most abundant species of thrips and is found in blossoms of numerous plants the year round. It has been taken in blossoms of *Cercis canadensis* (March), *Aesculus pavia*, *Crategus aestavalis*, and numerous others. It was found breeding in numbers during March in the thimble-shaped rolls of the leaf-rolling beetle, *Attelabus analis*.

Heterothrips aesculi Watson. The Buckeye Thrips. Abundant in flowers of the wild buckeye, *Aesculus pavia*, in March. Taken also in the blooms of *Azalea nudiflora* at Hogtown Creek, March 9.

Cryptothrips pini Watson. The Pine Thrips. Prof. Watson has taken this species by beating pine from March-May.

Liothrips caryæ var. **floridensis** Watson. Hickory-gall Thrips. Taken in Phylloxera galls on leaves of hickory in April, May and June.

Anthothrips dozieri Watson. Collected by the writer by beating *Ostrya* in March.

HEMIPTERA.

CAPSIDÆ.

Halticus citri Ashm. Flea-hopper. The main food plant of this species is beggar weed. It has been taken by sweeping low growth in low hammock edge at Lake Alice. Breeds during the winter in green-houses and has been taken in the open from April through August.

REDUVIIDÆ.

Zelus bilobus Say. This predaceous bug is quite common in the hammocks. Nymphs abundant on *Ostrya*, March 26 and April 17.

Zelus cervicalis Stal. Taken at bloom of chinquepin, May 20.

Narvesus carolinensis Stal. Taken in hammock, June 26.

Pselliopus cinctus Fab. Common in hammocks. A visitor at chinquepin bloom May 12 (J. R. Watson). September 30.

Repipta taurus Fabr. Met with frequently in magnolia hammock and also on pine. July 30.

Sinea diadema Fabr. Rapacious Soldier-bug. A pair of this insect taken in copula between two oak leaves at edge of hammock, January 20. Nymphs abundant on *Ostrya*, March 26 and April 17. The little that is known of its life-history has been recorded by Ashmead ('95).

PHYMATIDÆ.

Phymata erosa var. **guerini** L. & S. A specimen of this species was taken on Long-leaf pine November 19. It is not uncommon here and is taken often at blooms of various flowers.

TINGIDIDÆ.

Gargaphia tilia Walsh. Basswood Lace-wing Bug. This tingid was very numerous on the under surfaces of the leaves of basswood throughout the hammocks April 2. Its work was decidedly noticeable, causing yellowish spots on the leaves. A few adults, the first of the season, were taken March 5.

Leptoypha sp. nov., close to **L. costata**. Wild Olive Tingid. This species occurs abundantly on the under surfaces of the leaves of *Osmanthus americanum*. Its work is also very noticeable, causing yellowish spots to show through on the upper surface. (See Osborn and Drake, '16). Work was noticeable and a dead nymph found March 5. Nymphs and adults abundant, August 13.

PYRRHOCORIDÆ.

Largus succinctus Linn. Taken on an old log in hammock, January 16.

Dysdercus suturellus Say. This species is taken occasionally.

DYSODIIDÆ.

Mezira granulata Say. A specimen was taken on foliage of shrub at edge of hammock, April 1.

COREIDÆ.

Euthoctha galeator Fab. Abundant at blossoms of wild cherry, March 7. Hammock, April 16.

Acanthocephala femorata Fab. Large-footed Plant Bug. This species is very abundant and is often taken at hammock edge. Its favorite host is the bull thistle. Pairs taken copulating, April 4.

Leptoglossus phyllopus Linn. Leaf-footed Plant Bug. Abundant nearly everywhere, especially at the blooms of thistles. Plant bugs begin to get abundant about the first of March and remain abundant nearly all season.

ALYDIDÆ.

Leptocoris tipuloides DeGeer. Abundant the year round on various grasses. January 28.

Alydnus sp. Abundant at blooms of chinquepin, May 20.

THYREOCORIDÆ.

Thyreocoris pulicarius Germ. A specimen taken on pine, April 17.

PENTATOMIDÆ.

Mormidea lugens Fab. Very abundant on weed at hammock edge, April 1.

Euschistus servus Say. Abundant at blossoms of wild cherry, March 7.

Euschistus variolarius Beauv. Not as abundant as the above species.

Thyanta custator Fab. Taken on haw bush, March 10.

Nezara viridula Linn. Green Pumpkin Bug. This insect is very abundant nearly everywhere and is of considerable economic importance. I have taken this species hibernating in large clusters beneath loose bark pulled from dead oak trees.

Euthrynychus floridanus Linn. Rather common and preys upon various insects. I found one sucking an adult lady-bird, *Chilocorus bivulnerus*, April 17.

SCUTELLERIDÆ.

Chelysoma guttatum H. Schf. Taken on foliage of the red haw, March 8.

CICADIDÆ.

Cicada sordidata Say. This is one of the commonest cicadas found here. It is heard singing in the tops of young pine seedlings, hiding away amid the foliage, during August and September.

Like all cicadas, the nymphs live underground, sucking the juices from the roots of trees. Upon reaching maturity, they come up to the surface and crawl up the trunk of some nearby shrub or tree where their shed nymphal skins are often found clinging to the trunks.

Cicadas first make their appearance at Gainesville about the middle of April.

Cicada hieroglyphica var. **Johannis** Walker. A specimen was taken at Hogtown Creek, June 28, by Prof. Watson.

Tibicen simularis S. & G. A dead specimen was found by Prof. Watson in a road leading through piney woods, August 20.

CERCOPIDÆ.

Monecphora bicincta Say. Taken in hammock, June 29, although not a typical hammock form.

MEMBRACIDÆ.

Acutalis tartarea var. **semicrema** Say. Abundant on *Eupatorium*(?) near the edge of Lake Alice, April 18.

Stictocephala festina Say. Taken on young hickory, March 3. On oak, April 3. *part S. lutea walk*

Smilia camelus Fabr. On oak at edge of hammock, April 10-13.

Smilia fasciatus M. & S. Taken in association with *S. camelus* on oak, March 16.

Archasia belfragei Stal. Not very common, occurring on oak at hammock edge, April 18.

Cyrtolobus vau Say. One of our most common treehoppers. Last instar nymphs and adults were found on *Quercus virginiana* at hammock edge, March 18-19. Both adults and nymphs greatly resemble leaf buds.

Ophiderma flavicephala Godg. A very common species on oak. March 18-April 18.

Ophiderma sp. nov. A single specimen of this blackish treehopper was taken hibernating in a decayed limb in hammock, January 28.

Entylia concisa Walk. Very abundant on young hickory shrubs in March and is also found on the wild buckeye, *Aesculus pavia*, and the thistle.

Enchenopa binotata Say. Abundant on oak, April 6.

CICADELLIDÆ.

Agallia 4-punctata Prov. A number taken on solanaceous weed near bank of Hogtown Creek, April 9.

Oncometopia undata Fabr. A specimen taken in magnolia hammock by Prof. Watson, July 30. This insect attacks citrus and roses and is of considerable economic importance.

Cicadella occatoria Say. This very pretty leafhopper is rather common here. It has been taken on blackberry and ragweed, July 8, on sweet bay, July 15, and by sweeping low herbage at hammock edge, April 18.

Kolla geometrica Sign. Taken on a weed at Hogtown Creek, April 11. On low herbage at edge of Lake Alice, April 18.

Tettigonella versuta Say. Taken on sweet bay and a number of weeds in abundance, July 8.

Gypona octolineata Say. One on basswood leaf, April 6.

Gypona grisea Spang. (?). A male of what is probably this species was taken on grass at hammock edge, July 16. Female only has been described.

Platymetopius frontalis Van D. Numbers on a species of mint (?) growing along road to Hogtown Creek, April 11. According to Osborn ('15, p. 113), it ordinarily occurs in grass-land and is frequently taken in adult form from oak trees.

Eutettix seminuda Say. Taken on basswood leaf, April 13. Rather common here.

Phlepsius excultus Uhl. Abundant. Taken in hammock, June 8.

Scaphoideus auronitens Prov. A specimen was taken on a solonaceous weed near bank of Hogtown Creek, April 9. One was taken on ash, May 5. According to Osborn ('15, p. 115), this species occurs only in shaded, wooded places.

FULGORIDÆ.

Otiocerus degeerii Kirby. A specimen was taken in hammock on an oak leaf, March 3.

Otiocerus abbotti Kirby. A rare species. A colony of eleven adults was taken on the undersides of ash leaves in magnolia hammock, March 30.

Ormenis septentrionalis Spin. Occurs on poke weed along the edge of hammock. July 8.

Ormenis pruinosa Say. Also an inhabitant of the hammocks.

APHIDIDÆ.

Drepanaphis monelli Davis. A winged female with a young colony of about eight on under surface of buckeye leaf, March 12.

Macrosiphum coryli Davis. A winged female with a young colony of eight on underside of basswood leaf, March 12.

Macrosiphum illinoisensis Shimer. Taken by A. C. Mason on wild grape, April 23–June 4. According to him, it is fairly abundant at this time of the year.

Pemphigus attenuatus Osb. A colony of this aphid was taken by A. C. Mason on smilax or green-briar, April 23. This was the only colony found, although a diligent search for others was made.

Lachnus pini Linn. This large species is common throughout the year on pine, but more abundant during the winter. It is parasitized by the hymenopterous parasite, *Aphidius bifasciatus* Ashm.

ALEYRODIDÆ.

Aleyrodes mori Quaint. This aleyrodid has been taken on a number of hosts in the hammocks. The under surface of nearly every leaf of a large holly tree was found covered with this species, December 2. They were heavily parasitized by an unknown chalcid.

COCCIDÆ.

Chionaspis pinifoliæ var. **heterophyllæ** Cooley. This scale is at times rather abundant on pine foliage. The writer has reared from this species the hymenopterous parasites, *Aphelinus mytilaspidis* and *Prospaltella* sp. in numbers. November 19–December 20.

Toumayella parvicorne Ckll. Also found on pine, but in sparing numbers, November 19. This parasite, *Coccophagus immaculatus*, and a species of *Aphycus* (?) were reared from this host.

Ceroplastes floridensis Comst. A branch of long-leaf pine was found infested with this scale, December 2.

Toumayella turgida Ckll. This scale is quite characteristic of the magnolia, being found on the underside of the leaves. Large numbers of the male scales were collected February 10. No females were to be found. From a small branch of six heavily infested leaves were reared nearly 500 males and 30 specimens of the parasite *Coccophagus immaculatus*. It is during this month that these scales are most abundant.

Aspidiotus hederæ Vall. This species is often met with on the leaves of swamp red bay, *Persea pubescens*, but is never abundant.

Coccus sp. The males of this species closely resemble those of *Toumayella turgida*, but are smaller in size. It is quite characteristic of red bay, *Persea borbonia* and is most abundant during February. A species of *Coccophagus* was reared in numbers.

COLEOPTERA.

CICINDELIDÆ.

Cicindela punctulata Fab. This is the most common species of tiger-beetle here. It is found along the sides of roads and in pathways running through open hammock.

Cicindela scutellaris var. **unicolor** Dej. Met with in the same habitats as the above species, but is not as abundant.

CARABIDÆ.

Omophron labiatum Fabr. This oval, convex carabid has been taken by the writer only beneath arc lights, but according to W. S. Blatchley, it occupies holes in the wet banks along the margin of streams, ponds, and sinks.

Pasimachus strenuus Lec. Met with occasionally beneath old logs. April 9–22.

Pasimachus subsulcatus Say. Occurs in the same habitats as the above species. April 4.

Morio monilicornis Latr. Plentiful beneath the bark of dead pine tree in hammocks, March 1.

Dicaelus alternans Dej. A single specimen taken beneath log, alluvial floodplain at Hogtown Creek, April 11.

Galerita janus Fabr. One of the common carabids. Found in abundance beneath old logs the year round.

Galerita lecontei Dej. Same habitat as the above species, but not as abundant.

Plochinous amandus New. A specimen was taken in caterpillar's old nest on wild olive (*Osmanthus americanum*), August 13.

Apenes sinuata Say. A single specimen was taken in leaf-tyer's (*Laverna sabellela*) nest on *Phoenix canariensis*, March 1.

Callida decora Fabr. Beneath bark of decayed oak stump, January 16. Several taken from under bark of small oak limbs in pile, in association with *Adelina lecontei*, February 4.

Brachynus stigycornis Say. Found beneath log at edge of hammock, May 1.

GYRINIDÆ.

Dineutes carolinus Lec. Abundant in the water of streams and sinks.

Members of the whirligig family of beetles, when handled give off a milky fluid which usually has a disagreeable odor. In certain species the odor is very pleasant and the name sweet-bugs is often applied to them.

COCCINELLIDÆ.

Megilla maculata DeG. This species has been taken several times, but is not abundant.

Hippodamia convergens Guer. A very common species. It is very abundant on the bull thistle in April.

Coccinella sanguinea Linn.

Found abundantly throughout most of the season.

Chilocorus bivulnerus Muls. This lady-bird is found the year round and is probably our most useful native coccinellid.

Exochomus childreni Muls. This small reddish coccinellid was abundant on oak foliage, April 16. On chinquapin leaf, April 29.

Brachyacantha dentipes Fabr. A single specimen was taken on oak foliage in piney woods, April 16. On oak foliage at hammock edge, April 3.

Brachyacantha querceti Sz. Taken on buckeye foliage at Hogtown Creek, March 9. Prof. Watson took a specimen in same locality March 5, in leaf-roller's nest, feeding on the remains of the inhabitant, which it had apparently killed.

Hyperaspis proba Say. One on hickory leaf, April 11.

Scymnus fraternus Lec. Very abundant during March in the blooms of *Crategus* and on the foliage of *Aesculus pavia*.

EROTYLIDÆ.

Megalodacne heros Say. Several of this handsome erotylid were taken hibernating beneath loose bark of a large magnolia log, January 25.

Tritoma festiva Lac. A number taken beneath bark of fallen oak, February 13.

Tritoma thoracica Say. One taken on ash leaf in hammock near stream, April 5.

HISTERIDÆ.

Platysoma carolinus Payk. Probably our most common species of Histerid. Taken beneath pine bark of decaying log, February 19.

Paromalus aequalis Say. This curious little beetle occurs abundantly beneath the bark of fallen oaks. February 7–March 6.

ELATERIDÆ.

Adelocera marmorata Fab. Has been taken from beneath bark pulled from decayed pine and oak trunks, but is a scarce species. March 1–9. The larvæ are probably predaceous.

Alaus oculatus Linn. Is found wintering in the adult stage in decayed stumps in plentiful numbers. A common, though interesting, species.

Alaus myops Fab. This species is found in the same habitats as the above species, but is not as abundant.

Cardiophorus sp. An unidentified member of this genus is very abundant on the foliage of various trees and shrubs in the hammocks. March 1.

Monocrepidius lividus Deg. Found abundantly on the foliage of various trees and shrubs. March 15–August 17.

Elater hepaticus Melsh. Six of this small brown elaterid were taken in decayed piece of limb suspended in small tree, January 28.

Orthostethus infuscatus Germ. This beetle passes the winter in the pupal stage, issuing the latter part of April. The larva is cylindrical, very highly chitinized, with a thimble-shaped 9th abdominal segment. It is a typical inhabitant of decaying oak and pine logs, where it may be found the year round. Adults, April 20–26.

Limonius pubicollis Lec. This species occurs on the foliage of *Ostrya* and shrubs in the hammocks in sparing numbers. March–April 11.

BUPRESTIDÆ.

Chalcophora virginiensis Drury. A common species here. The larvæ bore in pine.

Chalcophora georgiana Lec. Has the same host as the above species, but is not as abundant.

Dicerca obscura Fab. A specimen taken on pine log, January 3, by Prof. Watson.

Buprestis decora Fab. Two fallen specimens taken near pine trees; one contained a large number of eggs, March 29. This species evidently emerges about this time of the year.

Anthaxia cyarella Gory. This pretty bluish-green closely resembles an *Agrilus*. The adults have been taken on various oaks and only from March 27–April 15. They were abundant on young red oak bushes in open fields April 15.

Chrysobothris femorata var. Fab. Taken occasionally at flowers. At dogwood blossom, April 13.

Acmaeodera tubulus Fab. A common species at the blossoms of wild plum, dewberry and bull thistle. March 2–April 11.

Acmaeodera ornata Fab. Taken at blossoms occasionally. May 1.

Agrilus subcinctus Gory (?). Rather abundant, copulating on ash leaves April 4–5. A single specimen on linden leaf at hammock edge, March 24.

Agrilus dozieri Fisher. Numbers of what is a new species, closely resembling *A. ruficollis*, have been taken on the foliage of *Ostrya* at a number of places in the hammocks; only on this host. March 30–April 5.

Taphrocerus agriloides Cr. This species was rather abundant on nut grass and low herbage at hammock edge, April 1–3.

Brachys cuprescens Blatch. The adults appear the latter part of March and are present for only a few weeks. During this time they are very abundant, however. The larvæ are leaf-miners on oak which is also the food of the adults. March 24–April 16.

LAMPYRIDÆ.

Calopteron reticulatum Fab. This large handsome species is found on the foliage of various shrubs and trees, March 5–June 25.

Celetes basalis Lec. Taken on basswood leaf, April 2.

Photuris pennsylvanica DeG. Taken on *Pinus palustris* at night, June 9.

Chauliognathus marginatus Fab. Our most common species and abundant everywhere, especially at the blossoms of flowers. Taken nearly the whole year round.

Polemus limbatus Lec. Taken on long-leaf pine needles, December 4.

CLERIDÆ.

Enoclerus thoracicus Oliv. Beaten from oak foliage, April 18.

LUCANIDÆ.

Passalus cornutus Fab. An extremely abundant inhabitant of half decayed logs and stumps.

SCARABÆIDÆ.

Canthon depressipennis Lec. This little green or black dung beetle is very common from April to September.

Canthon laevis Drury. Our most abundant species of dung beetle and is met with along roads, rolling their balls of dung. April–September.

Choeridium lecontei Harold. Taken occasionally. May 27.

Copris carolina Linn. This species is most abundant during June.

Copris minutus Drury. A common species and is abundant nearly the year round. Very abundant at lights, February 5.

Phanaeus igneus MacL. A rather common species the year round, flying around dung in roads. While in flight, their buzzing closely resembles that of the bumble-bee. January 5–March 26.

Phanaeus carnifex Linn. Closely resembles the above species, but is not near so abundant.

Onthophagus hecate Panz. This very small beetle is found frequently in dung.

Bolbocerosoma farctum var. **tumefactum** Beauv. A specimen was taken from beneath bark of fallen pine, August 3. Prof. Watson took a specimen flying over grass-wet prairie July 30.

Trox suberosus Fabr. Taken at dead rat, June 28.

Diplotaxis languida Lec. Taken at night eating oak foliage, May 2. March 12–May 2.

Diplotaxis bidentata Lec. Numbers taken at night feeding on chinquepin foliage, April 24. Varies in color from brown to black.

Diplotaxis frontalis Lec. Taken at night feeding on chinquepin foliage, April 24. Several at lights, April 6.

Serica vespertina Gyll. A specimen taken eating foliage of young tender hickory, March 10.

Lachnosterna prununculina Burm. Several at lights, June 6. A swarm of hundreds was eating the foliage of *Pinus palustris* at night, June 8. I was attracted by the loud buzzing of them overhead.

Anomala semilivida Lec. A specimen taken on beggarweed, August 13.

Anomala marginata Fabr. One taken beneath log at Hogtown Creek, May 23. This species feeds on the foliage of wild grape and various trees.

Strigoderma pygmaea Fabr. Found abundantly on various weeds. April 20–August.

Dynastes tityrus Linn. The Rhinoceros Beetle or Betsy Bug. Found occasionally beneath old logs. It is said to live in the larval stage in old rotten wood. Found most abundantly beneath arc-lights in July.

Strategus antaeus Fabr. Found occasionally beneath old logs. July.

Stephanucha (Euphoria) areata Fabr. This species has been found only along sandy roads. January 16–February 19. Prof. Watson took one in road at Hogtown Creek, January 25. This is a rather rare species here.

Euphoria sepulchralis Fabr. An extremely abundant species, occurring at the blooms of chinquepin and especially at bull thistle. Abundant from March 25–August 16.

Euphoria inda Linn. Occurs at blossoms of various plants, but is an uncommon species here. October 9.

Trichius delta Forst. First made their appearance at chinquepin blooms, April 28. Taken at blooms of *Salvia*, Cherokee rose, and other flowers. These beetles were more or less abundant through June 5. An adult was taken on golden rod bloom August 9.

Adults were reared from larvæ in oak stump. They greatly resemble *Lachnosterna* larvæ, but are smaller in size and of a more creamish color.

Trichius viridulus Forst. A specimen taken in bloom of southern pawpaw along roadside to Hogtown Creek, May 23. This is a rare beetle here as elsewhere.

Trichius piger Fabr. Occurs on flowers of various kinds, including New Jersey tea and the magnolia. Is not as abundant as *T. delta* and apparently hasn't as long a season as that species. May-June.

Polyphylla occidentalis Linn. This species feeds on the foliage of pine and has been taken from April 25-June 6.

Polyphylla gracilis Horn. Also feeds on pine foliage, but is not very abundant. April 28-May 20.

CERAMBYCIDÆ.

Derobrachus brevicollis Serv. This is a very common visitor to porch lights during June. It is said to breed in old logs.

Chion cinctus Drury. A specimen taken on pine log by Prof. Watson, January 3. A very common species at lights, January-April 15.

Molorchus bimaculatus var. **semiustus** Newm. Rather common at blossoms of dogwood and *Crategus*, March 11-12.

Molorchus bimaculatus var. **corni** Hald. A single specimen of this variety taken at dogwood blossom, March 10.

Molorchus bimaculatus var. A single specimen of a black variety of *bimaculatus* taken at blossom of *Crategus*, March 12.

Rhopalophora longipes Say. A specimen of this slender bluish-black cerambycid was taken at dogwood blossom, March 11.

Callichroma splendidum Lec. One taken by O. Manecke in piney woods, flying from the bark of one pine tree to another, making a loud buzzing noise as it flew.

Neoclytus erythrocephalus Fab. A pair was collected in copula on fence at Hogtown Creek by Prof. Watson February 20. The larvæ breed in a large variety of trees.

Xylotrechus sagittatus Germ. A specimen taken by Prof. Watson on recently cut pine stump at Hogtown Creek, September 24.

Typocerus velutinus Oliv. Taken at chinquepin bloom by Prof. Watson, May 10.

Typocerus zebratus Fab. Taken on pine foliage in March. On small thistle in open field, April 20.

Typocerus lunatus Fab. A specimen taken at bloom of chinquepin by Prof. Watson, May 12.

Monohammus titillator Fab. This species is known as the Southern Wood-Sawyer and does a tremendous amount of damage to pine timber in the southern states. June 9–October 20.

Graphysurus fasciatus DeG. Several newly emerged adults and pupæ were taken beneath bark pulled from fallen oak trunk, February 7. A specimen was taken at lights September 25.

Oberea ocellata var. **plagiata** Casey. A single specimen was taken on weed at Hogtown Creek, May 23.

Elaphidion mucranatum Fab. A specimen taken by Prof. Watson at chinquelin bloom, May 10. Taken at lights, June 8.

CHRYSOMELIDÆ.

Lema solani Fab. Numerous at Hogtown Creek, April 9, eating the foliage of a solanaceous weed. March 14–April 9.

Lema brunnicollis Lac. A specimen was taken by Prof. Watson in live oak hammock, August 20. Abundant on low oak bushes and weeds in open field, April 11–15.

Lema conjuncta Lec. Taken in flight along road through hammock, May 1. A specimen was swept from oak foliage, April 1.

Anomoea laticlavata Forst. This species has been taken feeding on pine foliage June 8. Taken on a weed at Hogtown Creek, April 9.

Coscinoptera dominicana Fab. A specimen taken by umbrella-beating oak foliage, April 18.

Chlamys plicata Fab. Numbers of this queer-looking beetle were taken on chinquelin blooms, evidently eating the pollen, May 20.

Exema gibber Oliv. Taken in the hammocks, April 2.

Bassareus congestus Fab. Several have been taken on oak foliage. July 5–24.

Cryptocephalus 4-maculata var. **flavipennis** Hald. Beaten from wild cherry in bloom on road to Hogtown Creek, March 9. Taken also on oak and wild buckeye foliage. April 3–18.

Cryptocephalus guttulatus Oliv. Taken on weed at Hogtown Creek, April 9. On oak foliage, April 3.

Cryptocephalus badius Suffr. A number of specimens taken on basswood, July 12–14.

Monachus auritus Hald. A few on oak foliage in hammock, April 4.

Monachus thoracicus Cr. Large numbers of this little bronze chrysomelid were taken at wild plum blossoms, February 18–20. Abundant at cherry laurel blooms, March 1. At blooms of wild cherry in plentiful numbers, March 7–9.

Trirhabda brevicollis Lec. This beetle makes its appearance every year about the first of April, having only a single brood a year. Some years it completely defoliates all the prickly ash. The first larvæ of the season have been taken April 1. The pupal stage lasts only for a few days.

Galerucella notulata Fab. Taken on ragweed (Ambrosia), July 6.

Oedionychis 6-maculata Ill. Abundant on foliage of ash, together with *O. scalaris*, April 5. This beetle is astonishingly quick in its movements.

Oedionychis scalaris Melsh. Taken on ash, but not as abundant as the above species. April 5-6.

Oedionychis fimbriata Forst. Beaten from oak foliage, April 18.

Disonycha glabrata Fab. Abundant on bull thistle while in bloom, April 20. Large numbers riddling the foliage of pigweed (*Amaranthus*), May 15. A few were taken on corn plants, August 16.

Disonycha triangularis Say. Taken by sweeping low foliage; moist hammock edge at target range, April 15. Taken under old log hibernating, (C. Nieland).

Phyllotreta picta Say. Very abundant on young oak foliage, March 10-April 2.

Haltica chalybea Ill. This species winters over in the hammocks in Spanish moss. An adult was taken as early as February 18, at wild plum blossom and by the 27th large numbers were beginning work on the foliage of the wild grape. Hundreds were swarming everywhere, May 5.

Blepharida rhois Forst. Adults and larvæ of this "jumping sumac beetle" were very abundant on young sumac April 11-15. Larvæ were also abundant September 29, so that there must be a number of broods per year.

Chaetocnema confinis Cr. Occurs in abundant numbers in the hammocks on the foliage of basswood, wild cherry, buckeye, and various other trees and shrubs. March 3-April.

Octotoma plicatula Fab. The first of the season was taken on buck-eye leaf, March 6. The ash is their first choice as a food plant and by March 25 large numbers are at work on this plant. They are to be found for only a few weeks and as far as I have observed, have only a single brood a year.

Chalepus rubra Weber. Several have been taken between leaf-tyer's old nests in the hammock on oak from June 25-March 2. They begin to get abundant on the linden or basswood, the foliage of which they eat, by the middle of March. As with the above species, they are present in numbers for only a few weeks and then disappear. A single specimen was taken on oak, May 1. A pair of this species was taken on linden in copula, June 11.

Chalepus notatus Oliv. A few of this scarce beetle have been taken on blackberry, Ostrya, and oak. April 4-5.

Chalepus bicolor Oliv. Two specimens were taken by sweeping low foliage at hammock edge, April 1.

Metriona (Coptocycla) purpurata Boh. This species has been taken on buckeye, oak, and wild morning-glory vines. March 15-May 15. It is rather uncommon and its favorite food plant is *Ipomoea*.

Deloyala (Coptocycla) clavata Fab. A specimen of this rough-backed cassid was taken on a weed at Hogtown Creek, April 9. Several specimens were taken on oak foliage, December 2-3.

This is more of a northern insect, and this record extends the distribution of the species for a considerable distance south of its usual range.

Chirida (Coptocycla) guttata Oliv. This species occurs on wild sweet-potato vines and has been taken on wild mustard foliage. April 20-August 12.

Porphyraspis cyanea Say. Characteristic of saw-palmetto on which it only is found. January 1-October 28.

Chelymorpha argus Licht. A specimen taken hibernating in crevice of old log at hammock edge (C. Nieland), February 18.

TENEBRIONIDÆ.

Nyctobates barbata Koch. Found beneath loose bark of decaying tree trunks. It is typical of this habitat. October 20.

Epitragus tomentosus Lec. This is a very common species and is found especially on oak the year round. According to Prof. Watson this beetle is similar to the lady-birds in habits, feeding on various scales.

Polypleurus nitidus Lec. Very common under old logs and boards on the forest floor in both piney woods and hammock margin. January 14-February 3. Assimilates death when disturbed.

Polypleurus geminatus Sol. More uncommon than the above species, but typical of the same habitat. Found in association with *P. nitidus*. January 14-February 3.

Uloma impressa Melsh. Large numbers beneath bark of fallen pine log, November 19.

Uloma punctulata Lec. Abundant beneath pine bark in association with *U. impressa*, November 19.

Diaperis maculata var. **floridana** Blatch. This species is an uncommon one here, but is occasionally found beneath loose bark hibernating in the hammocks. It also hibernates beneath loose pine bark. April 27.

Boletotherus bifurcus Fab. Found occasionally on shelf fungi in the hammocks.

Adelina lecontei Horn. Numbers taken under bark of oak limbs in pile. Evidently not hibernating, but at work as larvæ, presumably of this species were found working with them. February 4.

Helops cisteloides Germ. Characteristic of rotten stumps and logs, both in piney woods and hammock, but is rather scarce. January 15-28.

CISTELIDÆ.

Hymenorus obscurus Say. One taken on oak foliage at night, May 2.

OEDEMERIDÆ.

Oxaxis thoracica Fab. This species is found very abundantly on chinquepin during its whole blooming period. April 27-May 24.

MORDELLIDÆ.

Tomoxia lineella Lec. A specimen taken by beating oak, April 18.

ANTHICIDÆ.

Notoxus calcaratus Horn. Met with frequently on the foliage of oak, hickory and other trees. April 29.

MELOIDÆ.

Nemognatha piezata Fab. Very numerous at blooms of the bull thistle, May 26.

Epicauta marginata Fab. Taken on wild *Gerardia* plant, August 31.

Epicauta strigosa Gyll. Numbers of this meloid at blooms of a composite. September 25.

RHIPIPHORIDÆ.

Rhipiphorus octomaculatus Gerst. A single specimen taken. Members of this genus greatly resemble the tumbling flower beetles and the adults are occasionally met with in the blossoms of various plants. August 7.

Rhipiphorus cruentus Germ. A specimen was taken at chinquepin bloom, April 26.

CURCULIONIDÆ.

Attelabus analis Ill. The adults of this little reddish weevil made their appearance about March 20. On this date they were few in number and their work was just beginning on oak. By March 27 the adults were very numerous and their work could be noticed everywhere.

The adult weevil rolls up the end of the leaf into a little thimble-shaped roll, depositing its egg in one end. The larvæ upon hatching, feed upon the substance of their nest. Rolls of what is probably the same species were observed in April on the leaves of chinquepin.

Pterocolus ovatus Fab. Several taken from oak foliage, April 13-15.

Tachygonus lecontei Gyll. This curious little weevil has been beaten from oak and prickly ash foliage. April 18.

Pandeleiteius hilaris Hbst. Abundant on oak foliage at hammock edge in April.

Anthonomus saturalis Lec. Numbers taken on hickory foliage, April 16. Also observed to be active at night running over the foliage.

Prionomerus calceatus Say. A specimen taken on oak foliage, April 5.

Centrinus albotectus Casey. An abundant species in blooms of dewberry and *Crategus* at hammock edge, March 1. Abundant on blooms of a composite in open fields, May 15.

Craponius inaequalis Say. Taken on hickory foliage, April 2; makes squeaking noise when handled.

Conotrachelus anaglypticus Say. A specimen was found on newly cut oak stump in hammock, March 8. Several beaten from buckeye at Hogtown Creek, March 5.

Calandra oryzae Linn. This weevil is very abundant at blooms of chinquepin. April 28-May 24.

SCOLYTIDÆ.

Ips calligraphus Germ. This scolytid was found in large numbers with its galleries in the bark of a felled long-leaf pine; the tree had died within the last three months, August 3. On this date the majority were just emerging from the pupal stage, but larger numbers of full grown larvæ and pupæ were present.

DIPTERA.

CECIDOMYIIDÆ.

Cecidomyia brachynteroides O. S. A number of galls were collected on *Pinus palustris* December 2. The bases of the leaves are enlarged to form galls.

Dr. Felt, in a letter, writes that "this is a rather common type of gall upon pines, which has gone in years past, under the name of *C. brachynteroides* O. S. or *C. pinirigidæ* Pack., the first being associated with deformations on *Pinus inops* and the second occurring on *P. rigida*. It happens that insects have been reared from neither of these, consequently we are uncertain as to the actual identity of the gall maker, though rearings from a similar gall on the Western *P. radiata* produced a species very different from what has been supposed to be the cause of these swellings in the Eastern states. It is possible that one or more species may be responsible for these galls in the Eastern states, and under the conditions a definite determination is out of the question."

CULICIDÆ.

Psorophora ciliata Fab. Giant Mosquito or Gallinipper. This is our largest species of mosquito and is known nearly everywhere in Florida as the "Gallinipper." Although frequently found in velvet-bean fields adjacent to hammocks, near moist or wet areas, it is typical of low hammock. It is very persistent, even in open daylight and its bite very painful.

The following mosquitoes have been taken at Gainesville by Mr. U. C. Loftin ('13): **Culex quinquefasciatus**, **Anopheles quadrimaculatus**, **Anopheles crucians**, **Stegomyia calopus**.

ASILIDÆ.

Mallophora orcina Wied. This robber-fly is taken occasionally in hammocks. August 13. Very little is known of the breeding habits of the American species of robber-flies. Hubbard ('80, p. 262) saw a female of this Florida species bury its abdomen in the ground, where it deposited five or six eggs at a depth of half to two-thirds of an inch. The eggs hatched in a week.

Deromyia bilineata Loew. This is the most abundant asilid in the region. It has been taken in piney woods and hammock margin and is abundant in velvet-bean fields adjacent to hammocks. August 6-September 27.

BOMBYLIIDÆ.

Sparnipolius fulvus. This species is taken at the blooms of golden-rod and other flowers and is particularly abundant in May. May 9–October 18.

Systoechus solitus Walk. Taken in association with the preceding species and in about the same numbers.

SYRPHIDÆ.

Milesia virginiensis Drury. Numbers are often seen buzzing around old logs in damp hammocks in April and May. This is the largest and most striking syrphid in the region. Taken at wild cherry blossom, March 7. Hogtown Creek, May 21.

Eristalis vinetorum Fab. Taken at the blossoms of various plants but is uncommon. A specimen was taken at window light, May 26.

The larvæ of the genus **Eristalis** are of the long-tailed, filth-inhabiting type of syrphidæ, which live normally in sewage and putrid or stagnant water, (Metcalf '16, p. 218).

TACHINIDÆ.

Jurinea adjusta V. d. Wulp. Numbers of this very large hairy tachinid were taken at *Crategus* blooms, March 25. Common at chinquepin blooms, May 3.

Spallanzania hebes Fall. A number of specimens were taken at chinquepin blooms, May 23.

Archytas lateralis Macq. This was the most abundant parasite reared from *Malacosoma americana*. These large flies issued from pupæ April 13–14.

Achaetoneura schizuræ Towns. Numbers were reared from *Malacosoma americana* larvæ, April 13.

Frontina aletia Riley. A few specimens were reared from larvæ of the same host, April 13.

Plagiprospherysa parvipalpis V. d. W. Several specimens taken at chinquepin blooms, May 20.

Trichopoda pennipes Fab. This is a very common visitor to various flowers, as golden-rod, etc. It has been reared at Gainesville in large numbers from the pentatomid, *Nezara viridula*, an insect that is found abundantly in the hammocks. February and August 25.

SARCOPHAGIDÆ.

Sarcophaga opifera Coq. This species was reared from one of the bird grasshoppers, **Schistocerca alutacea**, October 28th. The percentage of parasitization is small, only one individual being parasitized, this one producing seven adult flies, out of fifteen of the grasshoppers collected in the field.

Sarcophaga heliciis Towns. A large number of maggots emerged from a dead sphinx pupa, October 7. Pupated October 8, and the adults issued sometime later.

TABANIDÆ.

Chrysops vittatus var. **floridanus** Johnson. This fly is found in all hammocks, but is more abundant in piney woods. It occurs commonly from May to October, but is more abundant during the hot summer months.

As one walks into the shade of the woods, several of these flies will circle round one's head, frequently making sudden dashes at their victim. They are very persistent and annoying and their bite is painful.

Chrysops atropus O. S. A specimen taken flying around *Crategus* in bloom, March 8.

Tabanus mexicanus Linn. The males of this tabanid are found in plentiful numbers at chinquepin blooms, from April 30–June 1. Prof. Watson took a specimen in flatwoods, September 4.

Tabanus atratus Fab. This species is also found at chinquepin bloom, but is not as common there as the above species. It often attacks horses and cattle in the hammocks and is one of the most common forms here.

HYMENOPTERA.

TENTHREDINIDÆ.

Macrophya formosa Klug. A specimen taken at night on chinquepin leaf, April 24.

CYNIPIDÆ.

Amphibolips. This cynipid forms a small oak ball and is very abundant over the hammocks. Large numbers were issued June 25. From one of these balls issued a huge number of small hymenopterous parasites, *Tetrastichus* sp. June 25.

Callirhytis batatoides Ashm. More or less round swellings on twigs. Large numbers were collected fresh December 2. Most of the adults issued January 25–31.

Dis holcaspis ficigera Ashm. Large numbers of this gall were collected on twigs of live oak, **Q. virginiana**, January 1. A number of adult flies and parasites issued January 25–31.

Andricus virens Ashm. These galls were abundant on underside of *Q. virginiana* leaves at edge of hammock, December 2. The adults issued for the most part early in February. A single specimen of the parasite, *Eupelmus auratus*, issued March 1.

ICHNEUMONIDÆ.

Exetastes Sp. A single specimen of this pretty blue hymenopteron was taken on oak, June 11.

Campoplex gelechiæ Ashm. This is a very efficient parasite of *Gelechia cercerisella* Chamb. Issued in abundant numbers the latter part of July from pupæ.

Mesostenus sp. A beautiful hymenopteron taken occasionally in hammocks. May 15.

EULOPIDÆ.

Sympiesis sp. Numbers of this little metallic-blue chalcid have been reared from pupæ of the serpentine leaf miner, *Phyllocnistis magnoliella*, both on *Magnolia grandiflora* and *M. galauca*. August 1-4.

Zagramosoma multilineata Ashm. A number of this queer chalcid have been reared from *Phyllocnistis magnoliella*, August 1-4.

Aphelinus mytilaspidis LeB. Numbers of this small lemon-yellow parasite were reared from the scale, *Chionaspis pinifoliae* var. *heterophyllæ*. December 26.

Prospaltella sp. Reared from the same scale on pine in small numbers, December 26.

Coccophagus immaculatus Howard. Reared in numbers from *Toumayella parvicorne* Ckl. and *Toumayella turgida*. December 2-March 2.

ENCYRTIDÆ.

Eupelmus auratus Ashm. A specimen issued from a gall of *Andricus virens* on live oak, March 1.

Eupelmus mirabilis Walsh. Numbers have been reared from the eggs of the katydid, *Microcentrum rhombifolium*.

CHALCIDIDÆ.

Chalcis. A species that has been taken several times in the daytime asleep on the under surfaces of both *Magnolia grandiflora* and *Persea borbonia* leaves. December 10-24.

SCOLIIDÆ.

Elis subjens. Taken abundantly at chinquepin blooms during season.

EUMENIDÆ.

Eumenes fraternus Say. The adults are abundant at chinquepin blooms.

Monobia quadridens Linn. Very common at chinquepin blooms.

VESPIDÆ.

Polistes americanum Fab. This and many other *Polistes* are abundant at the blooms of flowers, especially the chinquepin.

Vespa carolina Dru. Three specimens were found hibernating under the loose bark of a large decayed oak in high hammock, January 25.

SPHECIDÆ.

Chlorion caeruleum Dru. This common dirt-dauber is abundant at chinquepin blooms, April 28-May 24. Taken April 29, with a very large spider in its clasp.

BEMBECIDÆ.

Bembidula quadrifasciata Say. Abundant at chinquepin blooms, April 28-May 24.

Bembex texana Cress. Also abundant at chinquepin blooms.

XYLOCOPIDÆ.

Xylocopa virginica Dru. This large carpenter bee is common at chinquepin and other flowers in May.

APIDÆ.

Psithyrus laboriosus Fab. Taken at chinquepin bloom, May 13.

Bombus pennsylvanicus DeG. Our largest species, although it varies considerable in size. Abundant on bull thistle plants at night and at flowers. March and April.

Apis mellifera Linn. This common honey bee is abundant everywhere at flowers at all seasons of the year.

LEPIDOPTERA.

NYMPHALIDÆ.

Anosia plexippus Linn. This species is not near so common here as in the more northern states. It is essentially an open field type, but is frequently taken along hammock edge and in open glades. Most abundant during November.

Pyrameis atalanta Linn. Another species that is scarce here, though abundant in the more northern states. Taken at hammock edge, March 5 and May 15.

Junonia coenia Hub. Rather common here, flying through the hammocks. A hymenopterous parasite was reared from a larva of this species April 19.

Basilarchia astyanax Fab. Seen occasionally flying in the hammocks. April.

Debis creola Skinner. This is an inhabitant of rather dense hammocks. April 14-29 and September 30.

Neonympha sosybius Fab. This is the most common wood nymph here and is very abundant in the hammocks from March to November.

Neonympha phocion Fab. This wood nymph is typical of flatwoods, but is found also in the hammocks. Hasn't as long a season as the above species.

LYCÆNIDÆ.

Feniseca tarquinius Fab. This is a very rare butterfly in this region. A specimen was taken in July flying along path in magnolia hammock. Another was taken by Prof. Watson in Catocala Glen, May 30. Larvæ are known to be predaceous on aphids.

PAPILIONIDÆ.

The following members of the genus **Papilio** are typical of hammock and are abundant usually from March to November: **P. cresphontes**, **troilus**, **palamedes**, **philenor**, **turnus** and **ajax**.

NYMPHALIDÆ.

Heliconius charitonius Linn. This is a representative of a large and conspicuous tropical family and is typical of hammock. Found most abundantly during August and September.

SATURNIDÆ.

Actias luna Linn. A freshly emerged moth was beaten from *Aesculus pavia* foliage towards evening in hammock, March 10. Numbers of fresh moths have been taken at lights during April. Prof. Watson took a moth which was not yet dry on a twig at Hogtown Creek, September 30. There is probably, therefore, at least two broods a year.

Telea polyphemus Cramer. Two larvæ of this species were taken, one nearly full grown and the other only an inch and a quarter in length, feeding on the foliage of white oak, December 3. Adult moths were taken at lights, January 22-28. Adult moths were rather common at lights during April and several young larvæ also observed on oak during the first part of April.

This would tend to show that there is an over-lapping of broods and there are at least two broods a year.

CERATOCAMPIDÆ.

Anisota rubicunda Fab. Full grown larvæ were present on maples on Station grounds, August 4. Larvæ were very abundant on the swamp maple at Lake Alice, October 1. Pupated October 7-8, and adults issued October 26-30.

AMATIDÆ (SYNTOMIDÆ).

Cosmosoma auge Linn. Taken at dusk at blooms of mint (?) species, hammock edge, August 13. A fresh specimen taken at lights, December 28.

Dahana atripennis Grote. Taken at chinquepin bloom, April 29. In magnolia hammock, May 18. April 29-November 14.

LITHOSIIDÆ.

Hypoprepia fucosa Hub. A specimen taken by beating oak foliage at edge of hammock, April 3. A rare moth here.

ARCTIIDÆ.

Estigmene congrua Walk. Abundant and just emerging in hammock undergrowth. March 10.

Ecpantheria deflorata var. **denudata** Slosson. Found a large pupa, together with cast skin beneath loose bark of a magnolia tree, March 2. A number of this, the largest of our woolly bears, were found in the hammocks during the first part of December; one was in a hollow tree trunk about middle way up when the trunk was broken into. One of the larvæ pupated about the first of December and the adult issued in the laboratory December 22.

The larva of this species when ready to pupate seems to crawl under any available shelter, such as Spanish moss, logs, beneath bark, etc. It is a typical hammock form.

NOCTUIDÆ.

Apatela impleta Walk. A cocoon was collected on hickory twig in hammock. The adult issued February 7. The larva feeds upon a great variety of deciduous trees and shrubs (Holland '05).

Apatela morula Grote (?). An adult issued February 26 from a cocoon taken from between loose bark of pine stump in hammock, February 19.

Hadena miseloides Guenee. A dirty-green larva was found inhabiting an old gall on oak, in the hammocks, December 5. The larva pupated during February, the adult issuing February 20. This is a rare moth here.

Autographa basigera Walk. A specimen taken near dusk at flower bloom, edge of hammock, August 13. An uncommon form here.

Autographa verruca Fab. Rather abundant at catnip blooms in burned piney woods, July 23 (Prof. Watson).

Scolecocampa liburna Geyer. Rotten-log Caterpillar. Larvæ of this species are common under the bark of fallen limbs and logs of many kinds in an early stage of decay. They honeycomb the sapwood, leaving the remainder hard though discolored. The excrement is quite characteristic, often indicating the approximate location of the larva. December–March.

After reaching maturity, they make loose cocoons composed of a few strands of silk, mixed with chips and the grass left in the burrow.

This is one of the species that invades the wood in the sapwood stage of decay and is often found associated with slugs, *Passalus cornutus*, and the ant, *Solenopsis* sp.

Spragueia onagrus Guenee. This pretty little moth is abundant at the blooms of chinquepin and various flowers from April 29–July 15.

The underwing moths make their appearance about the middle of May, but are most abundant during July. Catocala Glen is especially rich in these forms and a number have been taken at Hogtown Creek.

Catocala epione Drury. Taken by Prof. Watson in Catocala Glen, May 30.

Catocala sappho Strecker. Taken by Prof. Watson in Catocala Glen, May 30.

Catocala ultronia var. *celia* Edw. A specimen was taken in Catocala Glen as early as April 15th by Prof. Watson. One of our most common underwings.

Catocala lacrymosa Guenee. A specimen taken June 29.

Anticarsia gemmatilis Hub. The adults of this species have been taken occasionally in hammocks and also in flatwoods, October 29. The larvæ do very serious damage to velvet-bean plants every year.

NOTODONTIDÆ.

Melalopha inclusa Hub. This species is recorded as feeding on species of *Populus*. The larvæ were abundant in their webs on willow, October 29, at edge of cypress swamp; flatwoods east of town. Also abundant on willow at edge of stream by road crossing the University sewer. They pupated shortly afterwards and the first moths issued in the laboratory about February 15.

LASIOCAMPIDÆ.

Tolyte minta Dyar. A freshly emerged pair were taken on bark of *Pinus palustris* tree, February 10. There is a great difference in the size of the sexes. A large batch of closely scattered eggs covered with hairy material was deposited February 11. Eggs started hatching February 27; all hatched by March 3. There was a cocoon on the side of the tree also.

A slightly worn adult was taken on side of *Pinus palustris* tree in low hammock, December 4.

Malacosoma americana Fab. This species has only one brood a year in Florida and winters over in the egg stage.

Eggs began to hatch in the laboratory January 27; out of doors January 29. The larvæ began to spin their cocoons about March 23. The adult moths issued in about two weeks. They then mate and deposit their egg masses on the wild plum and wild cherry, their favorite food plants.

This insect is very heavily parasitized by a number of dipterous parasites, *Archytas lateralis*, *Achaetoneura schizuræ*, and *Frontina aletia* Riley having been reared.

GEOMETRIDÆ.

Dyspteris abortivaria H. & S. This little green moth is typically a hammock insect. Beaten from buckeye foliage March 9.

Euchlaena amoenaria Guenee. Is rather common in hammock, August 1–September 8.

Macaria praetomata Haw. Abundant at Hogtown Creek, March 4, (J. R. Watson).

Catopyrrha near **sphaeromacaria** Harv. These moth were abundant among grass and blackberry bushes near banks of Hogtown Creek, April 11.

PSYCHIDÆ.

Thyridopteryx ephemeraeformis Haw. This common bag-worm is found on the foliage of various trees and shrubs in the hammocks.

COCHLIDIIDÆ.

Sibine stimulea Clms. The Saddle-back. Feeds on the foliage of various trees. Has been taken feeding on *Ostrya virginica*, holly, and the red maple, December 2–4.

MEGALOPYGIDÆ.

Megalopyge opercularis A. & S. The larvæ of this species are seldom seen, but the cocoons are numerous on the twigs of oak, wild plum and other trees and shrubs.

PYRALIDÆ.

Melitera prodenialis Walk. Larvæ of this species were found eating prickly pear in piney woods at hammock edge, March 1.

Pantographa limnata G. & R. Basswood Leaf-roller. Numbers of these caterpillars were found on basswood in the hammock July 13. Some of the adults had emerged already on this date. A number of

rolled leaves were examined, the majority containing only a single larva, while others contained as many as three. The pupal stage averaged eleven days in length. A few larvæ were present on July 31. The larvæ first appear during early part of April.

Hymenopterous parasites of two species were reared in abundance from the larvæ. For notes on larvæ see Fernald ('84, p. 26-27).

TORTRICIDÆ.

Stenoma humilis Zell. Larvæ were found in abundance on oak foliage during June. An adult issued June 26. Several undetermined hymenopterous parasites have been reared.

Arogalea cristifaciella Chamb. A few larvæ of this leaf-tyer were collected on oak at hammock edge, April 13. Larvæ are very pretty and small and greenish, with purplish-black stripes across. One of these pupated April 24 and the adult issued May 3. The larvæ are not abundant.

GELECHIIDÆ.

Gelechia cercerisella Chamb. Red Bud Leaf-folder. The larvæ of this species begin their work early in April. They fold the two edges of the leaf together, holding it together with a few strands of silk. The larvæ live inside, eating out the epidermis; as many as six very young larvæ to a leaf, but usually only one. Larvæ were very abundant June 25, in all parts of the hammocks.

An efficient parasite of this leaf-folder is *Campoplex gelechiæ*, which issued in abundant numbers from pupæ during July.

TINEIDÆ.

Ornix geminatella Pack. This is not a very abundant insect here. The larvæ first make their appearance the latter part of February, making blotch mines in wild cherry leaves. A small parasite has been reared from this species. Adults have issued as early as March 3.

Heliodines sp. (Near or **H. bella** Wkm.) Several specimens of this pretty orange and black micro-lepidopteron were taken at chinquepin blooms May 21.

Phyllonorycter lucetiella Clem. A number of blotch mines containing pupæ were collected on linden, May 15. Small silverish moths issued sometime later.

Mompha eloisella Clem. A specimen taken resting on linden leaf, April 20.

Phyllocnistis vitifoliella Chamb. This is a serpentine miner in wild grape leaves. Mines were very plentiful July 16. From a pupa collected in July 16 issued a minute silverish moth July 18.

Phyllocnistis magnoliella Chamb. This is a serpentine miner on the leaves of the sweet bay, *Magnolia glauca*. Upon hatching, the larva begins making its mine circling around three or four times and then begins to wind its mine serpentine-like all over the leaf, finally ending at the edge of the leaf, drawing it up into a little pucker to form its pupal chamber; here the larva changes to a yellowish-brown pupa. These mines, on leaves containing a number, not infrequently cross each

other. The pupal chambers are not confined to the edges of the leaves, but are found to a much less extent in other parts. The leaves gradually draw up, wither, and die from the effect of this.

This insect was first observed by the writer at Gainesville on July 15. On this date nearly every leaf of the sweet bay examined contained one or more mines, and nearly all being in the pupal stage. Numbers of the adults issued from July 17-21. There are a number of broods which overlap each other. Fresh mines were abundant up until August 9 and from then on only a few fresh mines were observed. Several adults issued from material November 2-3. The insect in all probability passes the winter in the pupal stage in old leaves.

Numbers of the chalcid parasites, *Zagrammosoma multilineata* and *Sympiesis* sp., were reared.

The adults have been reared from mines on *Magnolia grandiflora* and sweet bay, *Magnolia glauca*. Mines of what is probably the same species have been observed in the red bay, *Persea borbonia*.

Homaledra sabaella Chamb. The writer has found larvæ of this species working on saw-palmetto (*Serenoa serrulata*), and the palms *Phoenix canariensis* and *Washingtonia robusta*. They can hardly be said to be leaf-miners, as they feed upon the upper surface of the leaf, destroying the skin as well as the fleshy part of the leaf. Their unsightly work is particularly noticeable from January to March.

An undetermined hymenopterous parasite was reared from a pupa February 19.

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