

**THE INSECT GALLS  
OF INDIANA; PP.  
801-871**

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## INSECT GALLS OF INDIANA.

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Some years ago I became interested in the study of gall insects and the structures produced by them. Having recently moved from the State I present this brief review of the subject, hoping that some one will be sufficiently interested to continue the work. I have also collected in the neighboring States of Illinois and Ohio, and from these States have a number of galls which I have not collected in Indiana, but which doubtless occur in the State.

Not only have a number of known species been overlooked, but there are also a great many undescribed species which will demand the attention of the student. The morphology and physiology is still an open field, but probably the most interesting field will be the rearing and studying the life history of these insects in the light of that masterly work by Dr. Hermann Adler on Alternating Generations.\*

However, the student who takes up this work must expect to meet with a great many difficulties. It will be necessary to make careful observations and experiments through several seasons, and the problem will be very much complicated by the presence of numerous parasites and inquillines which in many cases belong to the same families as the gall makers.

Abnormal growths on plants may result from any one of several causes; a severe mechanical injury, a repeated mechanical injury or a chemical stimulus due to the action of some insect, a fungous growth, the combined action of insect and fungus, character of soil or fertilizer, or from unknown causes. We wish at this time to speak especially of these structures produced on plants by insects.

\*Adler—"Ueber den Generations—wechsel der Eichen Gallwespen." Translation, "Alternating Generations, a Biological Study of Oak Galls and Gall Flies," by Charles R. Straton.

These abnormal growths have attracted the attention of the earliest writers. Redi,\* like all other vitalists of his time, believed in a soul in each plant and that this soul controlled the formation of the egg, the gall, and the insect and determined their specific character.

Malpighi, a physician to Innocent XII, professor of medicine at Bologna, and later at Messina, was the earliest systematic writer on galls. In 1686 he published his "De Gallis," which gave very accurate descriptions of the galls then known to Italy and Sicily. He believed that in the case of the Cynips at least the insect secreted a poison which excited a fermentation in the acid and this resulted in the formation of the gall.

Among the modern European writers Hartig, Ratzeburg, Lacaze-Duthiers, Girard, Schenck, Reinhard, Taschenburg, Schlechtendal, Wachtl, Förster, Lichtenstein, Adler, Kieffer, Rubsaamen, Beyerinck, Straton, Nalepa, Mayr, Cameron and Rothera have added to our knowledge of these growths.

In America the pioneers in this subject were Baron C. R. Osten-Sacken, Bassett, Walsh, Riley, Fitch, Shimer and Harris, who have done most of the work. Among the modern workers who have written on this subject are Ashmead, Beutenmüller, Pergande, Cockerell, Garman and Gillette.

Nearly all plants are subject to gall formations which are incited by insects representing six entirely different orders as follows: Arachnida (Eriophyidæ or Phytoptidæ), Hemiptera (Aphididæ, Psyllidæ and Coccidæ†), Diptera (Cecidomyidæ and Trypetidæ), Coleoptera (Bupestidæ), Lepidoptera (Gelechidæ), and Hymenoptera (Cynipidæ and Tenthredinidæ).

\* Born A. D. 1626.

† Up to the present time coccid galls have been reported only from Australia by W. W. Froggatt and C. Fuller.

The writer has recently found a coccid gall producer on the Anonae and figs in Cuba.

## BIOLOGY OF GALL PRODUCING INSECTS.

## ORDER—ARACHNIDA.

## FAMILY—ERIOPHYIDÆ (PHYTOPTIDÆ).

All the members of this family are plant feeders and many of them produce galls. The adult mite has four legs near the anterior part of the body, the two posterior pairs being lacking (Fig. 1). The early students of the mite galls were unable to see the mites and therefore supposed the galls to be fungi. The mites pass the winter within the buds or possibly under the bark. With the coming of spring they attack the young leaves and produce their characteristic galls and deposit their eggs. The new generation spreads over the plant and produces new galls upon the young

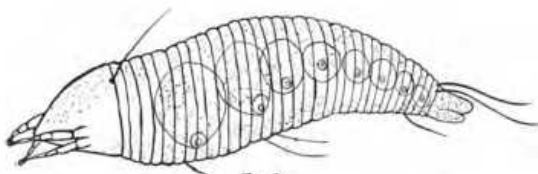


Fig. 1.

leaves and thus one generation follows another until the approach of winter makes it necessary for the adults to hibernate.

Certain species are very injurious to our cultivated plants. Among the most important is *Eriophyes pyri* Schenten, the pear leaf blister mite, which was introduced from Europe previous to 1870. Like many other introduced insects they are more injurious in this country than in their original home. It is widely distributed throughout the pear growing regions and probably exists in Indiana, although I have not collected it here.\* The mites pass the winter in the buds and in the spring attack the young leaves, forming red blister-like galls about one-fourth inch across, which become green and then turn brown.

\* Prof Slingerland in a Bulletin of the Cornell Experiment Station reports that it can be destroyed by the using a 5 to 7 per cent. kerosene emulsion applied with a spray early in the spring before the leaves appear. Aldrich in Bulletin No. 26 of the Idaho Agricultural Experiment Station reports that in Idaho it is necessary to use a 20 per cent. kerosene emulsion.

*Eriophyes oleivorus* Ashmead, attacks the oranges and lemons in California and Florida. It causes the leaves to curl, the orange fruit to become brown and the lemon fruit to become silvery. The oranges thus affected are said to ship better than unaffected fruit and although not so pleasing to the eye are said to be more juicy. They are frequently sold on the market under the name of russet oranges.

Another European Species is *Eriophyes phloeoptes* Nalepa (*Cecidoptes pruni* Amerling), which produces small subspherical galls at the base of the buds of plum trees.

#### ORDER—HEMIPTERA.

Two families of this order, *Aphididæ* and *Psyllidæ* produce galls which range in complexity from a simple leaf curl to a very high degree of complexity.

#### FAMILY—APHIDIDÆ.

This is the family of the plant lice (Fig. 2) which includes a number of gall makers. They are small, soft bodied insects which suck the juices of plants through a tubular mouth. There are a

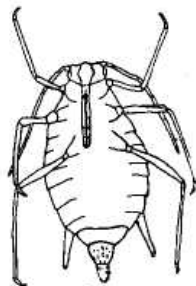


Fig. 2.

large number of species, and practically all kinds of vegetation are subject to their attacks.

The various species differ widely in their development and the following is intended merely for a general description. The first spring brood usually comes from winter eggs and is known as the



wingless agamic brood. This brood reproduces rapidly without males, but from time to time winged agamic individuals appear and fly to new plants and form new colonies. With the approach of winter a sexual generation is produced in which the males may or may not have wings but the females are always wingless. These females are impregnated and lay the winter eggs which produce the wingless agamic spring brood.

Among the most injurious is the grape Phylloxera, *Phylloxera vastatrix* Planchon (Figs. 46, 47). It is a native of the United States east of the Rocky Mountains, where it seldom does much damage. It was introduced into France previous to 1863 upon vines from America. In its new home it was soon recognized as a serious pest and in 1884 about 2,500,000 acres, or more than one-third of the vineyards of France, were affected, which resulted in great loss. It was afterwards introduced into California, probably on vines from France, and also possibly from the eastern United States, and has proved a serious pest. It has four well recognized stages: (1) the sexual form, consisting of a single fall generation; (2) the leaf gall stage, consisting of from one to five generations; (3) the root gall form, consisting of several generations; (4) the winged form, which is a single summer generation. The leaf gall form may be omitted.

*Schizoneura lanigera* Hansen, attacks the apples, producing scars on the branches (Fig. 3a), and also galls on the roots (Fig. 3b). It is very conspicuous because of the woolly excretions (Fig. 3c). I have not collected this gall in Indiana, but it occurs here.

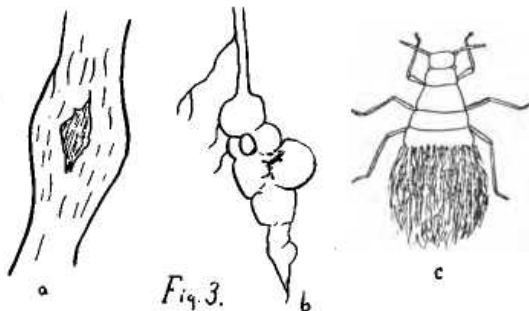


Fig. 3.

2—COOK SEPARATE.

Many of our forest and shade trees are subject to attacks from these insects, which seriously distort them and reduce their vitality.

FAMILY—PSYLLIDÆ.

The gall makers of this family are very similar to the Aphididæ, but are not so numerous. They are especially common on the hackberry (*Celtis occidentalis*), but are also found on some other plants.

ORDER—DIPTERA.

Two families of this order produce galls, the *Cecidomyidæ* and the *Trypetidæ*.

FAMILY—CECIDOMYIDÆ.

This is a family of very minute and delicate insects (Fig. 4) which are very numerous and which cause considerable loss of

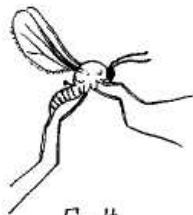


Fig. 4

crops. They are usually easily recognized by the larvæ usually being red or orange colored.

FAMILY—TRYPETIDÆ.

This is the family to which our common housefly belongs and is represented by a single species *Trypeta solidaginis* Fitch (Fig. 36), which produces a hard, spherical gall on our common golden-rods (*Solidago canadensis*).

ORDER—LEPIDOPTERA.

FAMILY—GELECHIIDÆ.

The only gall maker of this order that I have found in the State is *Gnorimoschema Gallæsolidaginis* Riley, which produces an elongated hollow gall on our common golden-rods (*Solidago canadensis*) (Fig. 48), but is of no economic importance. A few other species of this order produce galls.

## ORDER—COLEPTERA.

## FAMILY—BUPRESTIDÆ.

A very few species of this order produce galls. One species, *Agrilus ruficollis* Fabr., is very destructive to the raspberries and blackberries in certain parts of the United States. The eggs are deposited in the canes in July or August and soon hatch; the larvæ immediately bore into the sap wood and cause irregular elongated galls known as the raspberry gouty gall. The winter is passed in the gall and the adult insect emerges in June or July. It is frequently known as the "red-necked *Agrilus*" because of the copper colored thorax which is sharply contrasted with the black wing cover.

## ORDER—HYMENOPTERA.

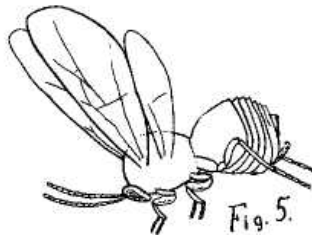
Two families of this order, the *Tenthredinidæ* and the *Cynipidæ* contain a large number of gall makers.

## FAMILY—TENTHREDINIDÆ.

Comparatively few species of this family produce galls and I have not collected any of them in Indiana, although I have collected them in Ohio. They are most abundant on the willows.

## FAMILY—CYNIPIDÆ.

The members of this family (Fig. 5) produce the most complex of all the insect galls. However, not all the insects of this family produce galls; many of them are not associated with galls,



while others are parasites or inquilines on galls produced by other members of this family. They are most abundant on the various species of the oaks, but are also found on the roses, blackberries and a few other plants.